REPORT ON

THE FIRST MEETING OF IUCN/SSC SNAKE SPECIALIST GROUP

HELD AT MADRAS

BETWEEN 8-17 NOVEMBER 1982

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By
B.C.CHOUDHURY

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Participants in the first IUCN/SSC/SSG meeting.	

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The Snake Specialist Group(SSG) was conceived at the IUCN/SSC meeting in New Delhi in February 1981 with fifteen members from India,Bangla Desh,Sri Lanka,Malayasia,Japan,Zimbabwe,South Africa, Brazil,Japan,Checkoslovakia,Switherland and West Germany as well as U.K,U.S.A and Australia. The first chairman for the group is Mr. Romulus Whitaker from India. The first meeting of the SSG was held at Madras Crocodile Bank premises on the Mahabalipuram - Madras highway in India between 8th to 12th November followed by a field tour for the participants to Mudumalai Wild Life sanctuary,Tamil Nadu from 13th to 17th November 1982. During this meeting the members of SSG and other delegates discussed the status and conservation of Snakes in different part of the world and passed resolutions and action plans for future. Following are the report of the whole meeting which was attended by the undersigned delegatem . This report should be read in conjunction with the proceedings of the meeting being sent separately by the group chairman Mr Romulus Whitaker individually to each member , of which a copy will be submitted to the office .

PARTICIPATION:

The meeting was attended by delegates from U.K,U.S.A,Sri Lanka and India. Delegates from conservation/research agencies from India included officials from the Department of Environment,Government of India,State Forest Departments,Zoological Survey of India,Indian Council of Agricultural Research,WWF-India,Bombay Natural History Society and some other voluntary conservation agencies besides a representative from the IUCN Conservation Monitoring Centre. In all about 30 members participated in the meeting and presented papers and reported works carried out on snakes by their respective organisation.

PROGRAMME :

Papers were presented on 8th,9th and 11th November 1982 focusing attention on;

a)the status of Snakes in general in various parts of the World.

b)The snake skin trade and exploitation.

c)habitat loss

d)snake bite case statistics.
e)research on snake venom use.
f)traditional snake catchers and their trade.

On 12th November 1982 the participants met to pass resolutions and to recommend conservation measures for snakes to various conservation agencies of different member nations and to decide on an conservation action plan.

FIELDTRIPS:

On 10th November 1982 a daylong fieldtrip was organised to see the traditional tribal snake capture methedology of the Irulas- the snakecatchers of Tamil Nadu.

The second longer fieldtrip (from 13th to 17th November 1982) to MUDUMALAI WILDLIFE SANCTUARY in Tamil Nadu was organised for release of four captive bred and reared Indian Pythons (Python molurus) into the wild for the firsttime in India.

THE MEETING

Twenty papers were presented and color slides of snakes from various parts of the world were shown during the meeting. A brief account of each paper(abstract) ~~of all papers~~ presented during the meeting is given below. (The chairman is sending the proceedings of the meeting from which details of each paper can be had).

Papers presented on 8.11.1982.

1. Introduction ,aims and objectives of the group(SSG)- Romulus Whitaker.

The chairman gave a brief account of the function of the SSG the system of information gathering and analysis as well as other aspects Snakes and their conservation ,aspect initiated by the group was also discussed. Creating more awareness on snake conservation through publicity and research are one of the main objectives of the group.

2. ~~Studies and Conservation of the rare snakes of the Western Ghats~~

- T.S.N.Murty,Zoological Survey of India.

Dr Murty reported that although 33 species Uropeltids(Shield snakes) have been reported from western ghats by Smith of which recent surveys have been able to find only 22 species. Emphasising the growing habitat destruction Dr. Murty also expressed the need for more co-ordinated fieldwork. He furteh suggested that fieldworkers should specify exact locations about collections rather than to give vague descriptions like 'Western Ghats'- as western ghat means a vast

3. Helminthic infections in Malayan Snakes - Stephen Ambu

(Presented by Rom Whitaker).

Several species of endoparasites were collected within one week of snakes being captured from the wild to compile a checklist of helminths occuring in wild snakes. Lack of information on ectoparasites felt.

4. The IUCN Red Data Book - Dr. Brian Groombridge .

Dr. Groombridge the compiler of the new edition of the Amphibia and Reptilia Red Data Book described the new format of the RDB and announced and exhibited the Volume I of the Reptilia Red Data Book covering the Crocodilia and Testudines.

5. Endangered Snakes of Sri Lanka - Anslem de Silva.

Dr. de Silva gave an historical account of settelment mfx shifting from Central Sri Lanka to North-east and North - west river valleys due to developmental projects. This agricultural developments in the newly created land by forest clearings brought exploitation and destruction of many common snakes and their habitats were also lost. No snake,however, is endangered in Sri Lanka due to skin trade and other kinds of exploitation.

Papers presented on 9.11.1982.

6. Function of IUCN Specialist Groups in the Conservation of Species.

- Edward Moll.

Dr. Edward Moll-the chairman of the fresh water turtle group summarised this paper with a brief account of all specialist group and their role played so far in species conservation. Demonstrating the recommendable work carried out by the Primate groups Dr. Moll hoped that a similar approach by the SSG may help in better success and fund raising for snake conservation.

7. Indian Snake skin Trade - Anne Joseph.

Ms Joseph had compiled statistics of snakeskin trade in India-particularly export,seizures of skins by conservation agencies and quoted that 60 million dollar worth of snake skins are still smuggled out of India annualy. Tamil Nadu and West Bengal tops the list on this count because of the skin tanning facilities available here and due to large number of proffessional snake cathers belong to these states. The Wildlife (Protection) Act of 1972 has drastically cut down the trade,but several illegal methods are now being adopted by smugglers to ship snake skins.

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8. Snakebite and its effects on the snake populations in Sri Lanka.

- Anslem de Silva

Dr. de Silva who is working in collaboration with the Snake Institute of Japan had compiled statistics of snakebites in Sri Lanka traditional methods of treatment of snake bite cases using herbs, charms and also reported treatment of cases in hospitals. Snakebite deaths due to improper treatment are rather high in Sri Lanka and this results in hatred of snakes and their destruction. The need for development of better snakebite treatment centres with proper storage of anti-venin argued.

9. India's protective legislation for Snakes - Wilson P.Dorairaj.

Mr. Dorairaj, the Assistant Director of the southern region Wild Life Preservation office of Ministry x Department of Environment of Government of India explained the salient features of the Wildlife (Protection) Act of 1972 and how effectively the Act can be used for providing conservation facilities to Indian Snakes. He also read out a list of snakes that are given total legal protection in India by this Act.

10. Endangered Snakes of Bangla Desh - Dr . Ali Reza Khan .

(Presented by Amy Lowchick)

Dr. Reza Khan of Dacca University - an eminent herpetologist whom the credit of relocating the Gharial in Bangladesh goes emphasised that the Reticulated Python, the common Indian Python and the King Cobra are now the endangered snakes of Bangla Desh. These priliminary observation followed by serious work may bring in to light several other threatened species of snakes in the country and their causes of decline.

11. Snakes under pressure in the Sunderbans - Bikash Kanti Saha

(Presented by Ms J.Vijaya)

Being the son of a doctor who has been treating many snakebite cases in the 24 Pragana district of West Bengal Bikash got his interest in Snakes from his early childhood. He has choosen the Sunderbans - one of the unique mangrove habitats in the world and have compiled a list of snakes that are threatened in this area due to habitat destruction and snakeskin trade.

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Papers presented on 11.11.1982.

12. Rodent damages and Biological management - Ranjan Advani.

Dr. Advani ,Rodent Ecologist of the Rodent Research and Control Centre at the Central Plantations Crops Research Institute presented the quantum of crops damaged by rodents in the fields of Rajasthan deserts(Jodhpur),on the cocca plants and crops in Kerala and on the coconut fruits of Kerala and Laccdives. Some additional data were presented by officers of the Pest Control (Pesticide company) Limited for the North-eastern India. Giving a food analysis data of various Rodent predators Dr. Advani concluded that Snakes constitute 20% of the rodent predators. With a proper research project on the role of snakes as a biological control of Rodents the utility value of snakes in the ecosystem can be better projected.

13. Irula Snake-catchers Co-operative Society - Revati Mukerjee.

Ms. Mukerjee,the acting vice president of this newly registered co-operative in Tamil Nadu explained the traditional methods of snake capture by the Irula tribals and their dependence on nature. With the ban on snake capture and thriving illegal snake business many Irulas have either changed to other means of livilihood or practice their snake capture techniques for illegal purposes in the sly. The co-operative with Irula tribes as members envisages to enlist and legalise the snake capture in a rational manner and to carryout snake-venom extraction for medical purposes under strict governmental supervision and control . The snakes captured from the wild for such purposes are to be released back to the wild after limited extraction.

14. Endangered Snakes of Australia (Presented by Rom Whitaker)

The chairman readout a paper sent by the group members from Australia with several slides on snakes of Australia as supplements. Particular reference was given to endangered snakes of Australia' mostly due to habitat loss a result of rapid industrialisation and urbanisation.

15. Ecology of South Indian Shieldtail Snakes - M.V.Rajendran.

Dr. Rajendran - an associate of Prof. Carl Gans of University of Michighan demonstrated many species of shieldtail snakes that he has collected from the Western and eastern ghats. He briefly mentioned their habitat preferences and habits and how their habitats are shrinking making them'rare' to see of late.

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16. Conservation of Snakes in North-east India - S.Biswas.

Dr. Biswas of Zoological Survey of India summarised on the snakes recorded in this area earlier and their recent regression . He particularly mentioned of areas like Manibhadra and Bhitar Kanika in Orissa as rich reservoirs of Python and King Cobra and their gradual disappearence from these areas. He emphasised the need for identification of such snake areas and declaration of these areas as protected areas and if need be to resort to captive breeding and releasing of snakes in such areas as a major snake conservation strategy.

17. Role of U.S.zoos in Conservation of Snakes - Peter Brazitis.

(Presented by Romulus Whitaker).

Dr. Brazitis of Bronx Zoo had sent a paper with illustrative color slides of snake exhibits in U.S.Zoos. The present educative role of zoos on snake biology and conservation through graphics and proper display - particularly the "Reptile Nursery" of Washington Zoowere noteworthy. Such displays he advocatedx palys a positive role on snake conservation. This is the only way to dispel the ignorance on snakes and their role in nature.

18. Captive Breeding of Snakes as a Conservation tool - Sekhar Dattatri.

Mr Datttri encouraged by the success he had with captive breeding of snakes in the Madras Snake Park enlisted the factors that are essential for snake breeding in captivity. This he advocates helps in minimising capture of wildsnakes and plays an active role on snake conservation. This paper is a must for all prganisation who display snakes as exhibits.

19. Role of Indian Zoos in Snake Conservation - Dr L.N.Acharjyo.

Dr Acharjyo - a veterinarian(zoo) for almost two decades explained on the popularity of reptiles in general and snakes in particular in Indian zoos quoting visitation figures from various Indian zoos. Poor display with no labelling plays negative role on snake conservation. Supporting the European and American zoos on display and popularisation of snakes(despite cost) he advocated for such attempts by Indian zoos. Paper on 12.11.1982.

20. Mr Romulus Whitaker and Dr Brian Groombridge readout various country and regional reports on snakes and their present conservation status available and needed from compilations of reports sent by group members.

FIELD TRIPS DURING THE MEETING

Snakecatching with the Irula tribes of Madras (10th November 1982).

Ms Mukerjee presenting her paper on the Irula snake catchers had generated much interest by delegates to actually witness the tricks of these tribals while catching snakes. With this interest almost all participants took part in this fieldtrip. As mentioned in her paper this trick of snake capture is slowly vanishing and only a few experienced hands are now left. One such Irula by name Chokalingam led the party to an area near Kelambakam on the Madras - Mahabalipuram Highway.

Taking participants into a scruby land with a rainfilled pond nearby he demonstrated how to look for saw scaled vipers hiding in low thorny bushes in the ground well camouflaged with the ground. Three saw scaled vipers were observed and photographed. Similarly two striped keel back(water snake) on the edge of water and grass patches were also seen. Both these required keen observation to beat the well camouflaged strtegy of these snakes.

However,the real trick of finding snakes from holes in the ground required the expertise of the Irulas. He took the participants to agricultural farms and orchards where we were told to encounter more of cobras and rat snakes. Surprisingly most of the farmowners refused permission for capture of snakes from their farm. The one which gave permission also insisted that all snakes captured should be put back in his farm .

The trick adopted by the Irula snake catcher was to examine all holes encountered in fields and partition bunds. On close examination he could say wether a snake has gone in or not from the spoor marks left by the snake at the mouth. From the spoor mark the species can also be known as each species move on land in a different pattern. On one such hole Chokalingam foretold the presence of a rat snake and on digging found a 1.5m rat snake resting in a rat hole.(see plates). Similarly a cobra was also caught in the afternoon as also a sandboa.

Scanning carefully two green whip snakes were caught from the foliages of the hedges and a russel's viper was caught from the grass as also a fast moving rat snake.

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Snakecatching with Irula tribes of Madras

1. After examining an entrance of a rathole on the partition bund of the fields the Irula tribal Chokalingam digs into the hole.

2. A ratsnake 1.5m in size is pulled out from the ratchamber underg ground.

3. A striped keelback (non-venomous) snake well camouflaged on the grass.

4. A russel's viper in typical defensive posture on the fields.

Photos : B.C.Choudhury.









From the marks left on the mouth of the holes the Irulas are good at identifying the species of rat that inhabits the hole. The Irulas also showed the defence strategyadopted by rats to avoid snake attacks on them whils in a rat hole. This included secondary openings to outside, false resting chambers underground etc. From such close observations carried out from early childhood an Irula develops and shurpens his snaketracking abilities. The whole days field excercise was very educative and convinced everyone why such a traditional art has to be preserved. What remains to be done is to devise modes to utilise this knowledge in snake management in the field and adoption of these techniques by researchers in the field. The Rodent Control Project at Kosargada,Kerala readily decided to employ some Irulas in their project to help capture rats and snakes for their studies.

During the day a total of fifteen snakes belonging to six different species (Cobra,Rat Snake,Green whip Snake,Russel's Viper,Saw scaled viper and Sand boa) were caught and released back.

Firstever release of captivebred Python (Python molurus molurus) in Mudumalai Wildlife Sanctuary, Tamil Nadu (13th November to 17th Nov1982).

Four Indian Pythons(Python molurus molurus) measuring 1.66m to 2.15m hatced in1979 from eggs laid by captive reared parents at Madras Snake Park,Trust were selected for release in the Python habitats occuring in the Mudumalai Wildlife Sanctuary of Tamil Nadu state.

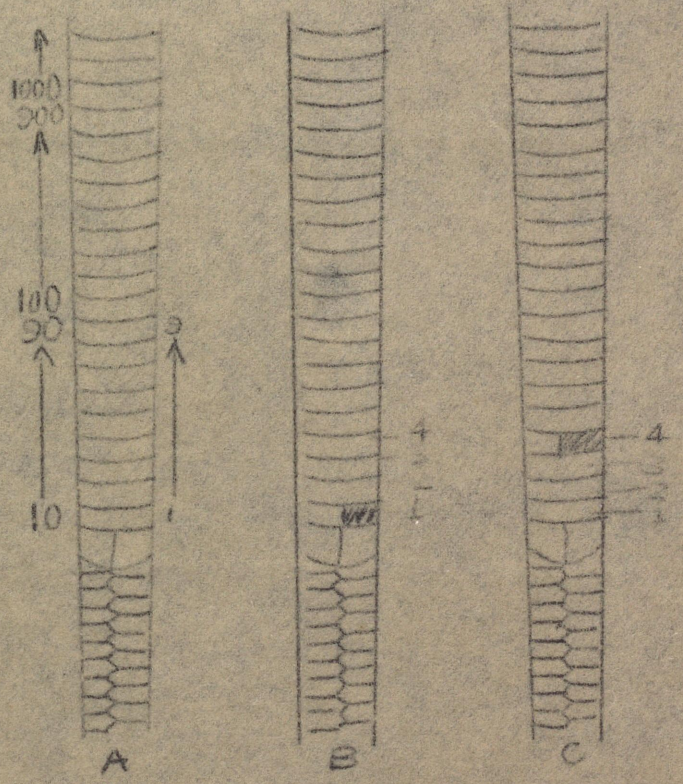
Prior to release each python was measured and identification marks of each individual noted. Miss Vijaya the research officer of the Madras Snake Park has found that the rosette marks on the dorsal side of each snake are different in pattern . From this she started counting the the marks starting from head towards the tail and noted peculiarities for idetification: For example the four released pythons had the following markings:

Python No.	Size	Sex	Identifying Marks
1.	1.90	Female	First rosette A rest spots.
2.	1.66	Female	Seventeenth rosette "W".
3.	2.15	Male	Second "Dot" & 23rd "W".
4.	1.75	Male	10th,11th,12th " YOU".

In addition to these each python released were marked individually

for future identification by ventral scale clipping following the method adopted by Parker and Brown in 1976 in U.S.A. By this method the ventral scales (not subcaudals) starting from the vent region and upwards are used. Single numericals 1 to 9 are assigned to the right side and 10 to 90 on the left side and if necessary even ~~in~~ 100 to 1000 can also be given as described in the figure below.

Figure 1



(Ventral scale clipping for marking snakes for release. Diagrams are ventral, posterior view. A. Enumeration of ventrals proceeding anteriorly from anal scute: 10's,100's and 1000's series on the observers left,single units series on right. B. Freshly marked individual number 1; a portion of the first ventral on the right side removed C. Freshly marked individual number 4; a portion of the fourth ventral on the right removed. Such markings remain even after five years after initial marking.)

Once clipped the scales hardly grow and this method has successfully been used by snake workers in the field in U.S.A. The actual clipping of the four to be released pythons was explained and exhibited to the delegates by Ms Amy Lowchick on the 11th November 1982.

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On 13th November 1982 each Python was packed in a separate snake bag(with provision for ventilation) and were hand carried by participants in a jeep on their way to Mudumalai. Attempts to keep them cool and still persisted all through the journey. All together six participants took part in the release programme other than the Tamil Nadu Forest Department Officials at Mudumalai. The members participated were:

1. Rom Whitaker,Chairman IUCN/SSC/SSG.
2. Brian Groombridge, Compiler,IUCN Red Data Book
3. B.C.Choudhury, Research Assistant, A.P.Forest Department.
4. Amy Lowchick , University of Michighan, U.S.A.
5. Sekhar Dattatri, Research Associate, MSPT,Madras.
6. Robert Studard, Manchester,U.K.

The Tamil Nadu Forest Department was represented by the Wild Life Warden of Mudumalai Wildlife Sanctuary Mr Mangalraj Johnson and other sanctuary staff.

Three different known python habitats in the sanctuary were surveyed to decide the release point and the choice fell on the area near to the Abhayaranya on the banks of the river Moyar. In this area,on a rocky patch a python had laid and successfully hatched over twenty eggs in June 1982. The nearness of water,plenty of hiding space on rock crevices and termite mounds and relative abundance of small mammals also favoured selections of this area.

On 15th November 1982 at 5 1700hrs all the four pythons were taken out of their bags and after allowing them to stretch for a while were released in two different localities - a pair in each place. All of them soon settelled on the rock and termite crevices. The sanctuary staff were requested to keep monitoring the pythons as best as they can and also requested to collect the moultings to find out their movement etc. Even from the moulting the snakes can be identified.

During the paper presentation there were discussions on fixing radio transmitters on released snakes and this proposal was considered to be attempted on future released as part of a full time research project when the other 27 growing pythons of MSPT ar e to be released,

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Python Release in Mudumalai Wildlife Sanctuary.

1. A 2.15m Python (Python molurus) being stretched before release. Note the rossette marks on the body of the snake. Theses marks are differenet in each individual snake.

2. One of the four Pythons being released on the rocky habitats on the banks of Moyar river in Mudumalai Wildlife sanctuary.

Photo : B.C.Choudhury.





Survey of pit viper habitat in Nilambur Forest (15 November 1982).

During the meeting Dr. T.S.N=.Murty of ZSI and Prof. Rajendram of Madurai presented papers on the endangered snakes of Western ghats with particular attention to Uropeltids.and Shrinking habitats in this region, particularly the hill streams which are dammed for irrigation or hydroelectroity purposes causes flooding of vast stretches of rain forests. This results in habitat destruction of both Uropeltids as well as pit vipers that inhabits the rock crevices and htreamside vmx vegetations. To analyse the rich herpetofauna of the rainforest - particularly on the forest floor and along the hill streams a sample plot of 6900 sq m was choosen in the Nilambur forests along the Calicut Kerala - Tamil Nadu border. The area choosen was one that the Kerala State Electricity Board is going to construct a dam on a hill stream.

The sample plot on the forest floor resulted in locating two species of pit viper ,two species of gecko,one species of agamid lizard and at least three different species of frogs.

The walk along the stream bed for over three hour resulted in locating and photographing 21 specimen of pit vipers belonging to four sub species.

This short expedition made us wonder about the rich herpetofauna of the rain forest which virtually remains obscure and thus the need for a well planned herpetological study by any conservation agency was felt by all concerned.

Our quick survey did not cover the vegetation nor the micro-habitats one finds in dead trees and rock crevices in a rain forest. Such a total expedition may result in finding many more endemic species of herpetofauna from this tropical rain forest.

The two fieldtours - one with the traditional snake catcers and the other to areas yet unexplored were quite paradoxical. Where remains ares yet to be explored and at the other hand a traditional art of reptile catching is fast vanishing dur to lack of patronage. Only a thoughtful planning can savethe both the rich herpetofauna and the people who earn a livlihood depending on them.

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8/12/82

RESOLUTIONS AND RECOMMENDATIONS(For India) 12.11.1982.

1. All participants agreed that the plight of snakes in India,their usefulness and myths etc. should be exposed to public through all available media. It was decided to appeal to all conservation agencies of central and state governments for publications of simple illustrated materials in vernacular languages to achieve this objective. The first such attempt was volunteered to be carried out by the SSG member from India Dr. T.S.N.Murty of Zoological Survey of India.

2. Two major research projects were proposed involving the Indian Python and the King Cobra. The draft project document covering proposals to study these snakes present distribution,status,causes of decline,their reproductive biology(in nature and captivity) and ecology is to be prepared by delegates Dr.L.N.Acharjyo,Dr S.Biswas,Mr B.C.Choudhury and Mr Sekhar Dattatri in collaboration with Mr Romulus Whitaker.

3. With the success of captive breeding and successful rearing of Indian Pythons at Madras Snake Park and Nandan Kanan Biological Park,Orissa a project on possibility of Python Farming is to be prepared by the Madras Snake Park Trust.

4. A project on the Role of Snakes on rodent control is to be initiated by the Rodent Research and Control centre at Central Plantation Crop Research Institute at Kasargad in collaboration with the CPPTI and MSPT.

5.It was also decided to appeal to Government of India to allot funds and to request state government and zoo authorities to develop better snake exhibits primarily for conservation and education.

6. It was also decided to make attempts to initiate a short-term training programme for zoo personnels on snake handling and keeping.

7. Preparation of an inventry of proffesional snakecatchers in the country and their present occupations so as to prepare a master plan to resettle them in their former proffession legally. All delegates were requested to cooperate in this .

8. Compilation of any/all kindsof information on snakes in their respective region and to passon the information to the IUCN/SSC/SSG Chairman.

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17/12/82



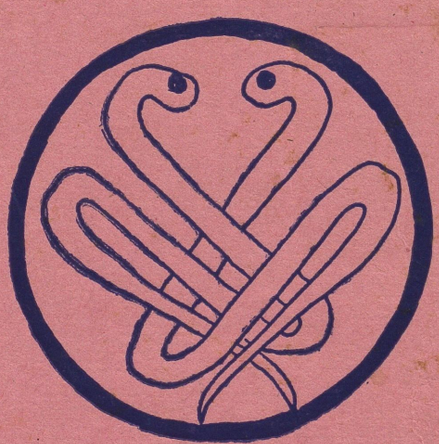
Participants of the First IUCN/SSC Snake Specialist Group Meeting held at Madras between 8th-17th November 1982.

Sitting (From left to right). Dr T.S.N.Murty,ZSI, Dr S.Biswas,ZSI Dr M.V.Rajendran,Ms Brenda Bhaskar,Dr Anslem de Silva,Sri Lanka, Ms Anne Joseph,WWF-India, Md J.Vijaya.
Standing(From left to right). Mr Wilson P.Durairaj,Assistant Director Wildlife Preservation, B.C.Choudhury,A.P.Forest Dept.,Dr Brian Groombridge IUCN Conservation Monitoring Centre, Amy Lowchick,Michighan University, Dr Edward Moll,Chairman Fresh Water Turtle Group, Mr K.Shanmuganathan, Chief Wild Life Warden,Tamil Nadu, Mr E.R.C.Davidar,Nilgiri Wildlife Society,Mr Romulus Whitaker,SSC Chairman,Dr Ranjan Advani,Rodent Control Research Project,KesavgadICAR,Dr L.N.Acharjyo Nandan Kanan Biological Park,Mr K.Jagan Mohan Rao,A.P.Forest Dept.,Mr Robert Studard,Manchester U.K,Mr Joseph Jogendernath,T.N.Forest Department.

Photo : B.C.Choudhury.

PROCEEDINGS OF THE IUCN/SSC SNAKE GROUP

22/12/82



First Meeting—8 November - 12 November 1982

LIST OF PARTICIPANTS

1. Rom Whitaker (Group Chairman)
2. Brian Groombridge
3. M.V. Rajendran
4. Edward O. Moll
5. T.S.N. Murthy
6. Amy Lowichik
7. E.R.C. Davidar
8. Wilson Dorairaj
9. Joseph Jogindranath
10. A.N.Jagannatha Rao
11. Revati Mukerjee
12. Ranjan Advani
13. Shekar Dattatri
14. J. Vijaya
15. L.N. Acharjyo
16. Anslem de Silva
17. R.E. Stuttard
18. Binod Choudhury
19. Jagan Mohan Rao
20. K. Shanmuganathan
21. S. Biswas

INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE
AND NATURAL RESOURCES (IUCN)
SPECIES SURVIVAL COMMISSION (SSC)
SNAKE SPECIALIST GROUP (SSG)

Programme of the First Meeting

Dates : November 8-12 1982
Place : Madras Crocodile Bank
Mahabalipuram Road
Madras, India

Monday 8th November
Chairman : J.C. Daniel

	10:00 AM	Registration of participants; tour of Crocodile Bank
		Introduction, aims and objectives of the Group - Rom Whitaker
		Studies and conservation of the rare snakes of the Western Ghats - T.S.N. Murthy
		Helminthic infections in Malaysian snakes - Stephen Ambu
	12:30-1:30 PM	Lunch Break
	1:30 PM	The IUCN Red Data Book - Brian Groombridge
		A cooperative for snake catchers - Revati Mukerjee
		Snakes of Sri Lanka: How they are endangered - Anslem de Silva
		Endangered snakes, their conservation in north western India - B.D. Sharma
	4:00 PM	Adjourn
Evening	8:30 PM	Slide talk at Temple Bay

* Each paper will be followed by a question and discussion period of 10-20 minutes.

Tuesday 9th November
Chairman : Ed Moll

10:00 AM	The role of the IUCN/SSC Specialist Groups in species conservation - Ed Moll
	Indian snake skin trade - Anne Joseph
12:30-1:30 PM	Lunch break
1:30 PM	Snakebites and its effect on the snake population in Sri Lanka - Anslem de Silva
	India's protective legislation for snakes - Wilson P. Durairaj
	On the endangered snakes of Bangladesh - M.A. Reza Khan
	Snakes under pressure in the Sunderbans - Bikash Kanti Saha
4:00 PM	Adjourn
Evening 8:30 PM	Slide talk at Temple Bay

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Wednesday 10th November

7:00 AM	Field trip with Irula snake catchers
3:00 PM	Return to Snake Park

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Thursday 11th November

Chairman : Wilson Dorairaj

10:00 AM	Rodent damage and biological management - Ranjan Advani
	The potentially endangered snakes of Australia - H.G. Cogger
	Methods of conservation of Uropeltids - M.V. Rajendran
12:30-1:30 PM	Lunch break
1:30 PM	Problems of conservation on snakes of India - S. Biswas

The role snakes play in education, in United States zoos - Peter Brazaitis

Captive propagation of endangered snakes as a conservation tool - Shekar Dattatri

Role of Indian zoos in snake conservation - L.N. Acharjyo

4:00 PM Adjourn

Evening 8:30 PM Slide talk at Temple Bay

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Friday 12th November

Chairman : Brian Groombridge

10:00 AM Country and regional reports - Rom Whitaker

Threatened snakes in Europe-Abstract Brian Groombridge

12:30-1:30 PM Lunch break

1:30 PM Meeting summary, resolutions, representations, project proposals

4:00 PM Adjourn

6:00 PM Barbecue

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Saturday 13th November - 17th November

Field trip to Mudumalai Wildlife Sanctuary for python release and collection in rain forest.

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INTRODUCTION, AIMS AND OBJECTIVES OF THE SNAKE SPECIALIST GROUP

BY

Romulus Whitaker, Director
Madras Snake Park

First let me welcome you, ladies and gentlemen, to the inaugural meeting of the IUCN/SSC Snake Specialist Group. It is appropriate that we gather in Madras for the protection of snakes, one tannery here used to process three to five thousand snake skins, think of it, per day. But that was prior to India's ban on the export of snake skins finally fully implemented in 1979. But it cannot be overlooked that several million registered skins are stockpiled with dealers, and that there is a quiet, but steady stream of smuggled skins. A glance at snake skin article production and sale statistics from Japan, England, Spain, Germany, Italy and France is illuminating.

Personally and candidly, I have little fear for the future of the heavily exploited cobra and rat snake, they are fecund, adaptable species with great flexibility and endemic throughout most of India. With a bit more emphasis on practical application instead of mere academic effort from our zoological institutions we could probably even safely allow a controlled harvest of these species. What is really worrisome is the plight of the python, king cobra and other hillforest species. The personal interest of the Prime Minister the agencies set up to safeguard the forests, and the general boost in public awareness notwithstanding there is little let up to the removal of the remaining hill forests. The Palni Hills I grew up in during the early 1950's have changed beyond recognition. The sholas were my deepest joy. I only lived for the weekends when I could get away from hated school routine to roam the dark evergreen heavens in the valleys of these ancient, worn mountains. The memories of mysterious caves we explored, the first pit vipers, the feathory tree ferns along the streams that put my young mind back into the Jurassic. These sholas are mostly gone, the patches that remain give the visitor some idea of the diverse plant and animal life they support, but you have to look long and hard for a Nilgiri langur, a tahr or a king cobra for that matter.

New species of snake

But what perhaps sticks in the throat worst of all is that we are losing it all to Eucalyptus plantations andpotato gardens without even knowing what's going. Last September in the tattered remains of Tiger Shola, just below Kodai, our son aged three, was playing at "snake hunting" something he had watched his parents play many times. He had turned over a lot of small stones and suddenly yelled "come quick a snake, a snake". His proud father and slightly apprehensive mother rushed to him and sure enough he had uncovered a sleeping kukri snake, very unlike any Oligodon we knew. To make a long story short, it is a species new to science. And god only knows what else is waiting to be found in the sholas, if any survive.

Theme of meeting

In case there is any doubt as to the theme and message of this meeting, while snakes being directly exploited for skins need the law enforcement agencies, most endangered snakes in the world need their habitat intact. Lacking the data, and the wherewithal to obtain data, (a condition very typical of the countries that really have the problems) shouldn't prevent the opportunistic ophiologist from getting his bid in to help out a preserved species. The greatly debated Silent Valley in Kerala is king cobra, Malabar pit viper and shield-tail snake habitat in our view and we will do anything to help save it.

The pet trade

In India we have no experience of the "snake fever" that grips a certain segment of the people in North America and the Western European countries. These people, numbering in the 10's of thousands perhaps, keep snakes as pets and this demand has created a huge and lucrative trade in live snakes from all over the world. Often this trade is harmless and develops interest in amateurs but sometimes it concentrates so heavily on a particularly desirable species that the snake is locally exterminated. Prices for the exotic or rarely available species are enough to tempt the unscrupulous. The effect of India's clampdown on snake exports is being felt in Switzerland where earlier

this year prices for spectacled cobras soared up to US$200 each and Indian pythons were offered at US$1000. The price of a pair of those snakes would finance a year of research on python population biology here!

The answer to the pet trade in snakes could be captive breeding. Many of the most popular species are being successfully held in captivity. Now that prices have shot up in the wake of species scarcity and strict law enforcement it becomes profitable for the more advanced form of animal trader to become breeder. Regulated, wild collection for commercial trade would be nice, but there is no precedent to demonstrate that we know enough about a snake population to entertain that yet.

Aims and objectives of the Snake Specialist Group

Conservation of wildlife is a steep uphill climb. Convincing people that the furred and feathered creatures should be protected is difficult enough but when it comes to the cold-blooded scaly ones the job becomes downright tough.

The Snake Specialist Group is one of seven Groups of the IUCN/SSC which looks after reptile conservation. The other reptile Groups are: Sea Turtle, Crocodile, Tortoise, Fresh-water Chelonian and Lizard. The functions of these Specialist Groups, as defined by Grenville Lucas, Chairman of the Species Survival Commission (SSC) are:

1. to ensure the survival and maintenance of genetic diversity of the endangered and vulnerable taxa concerned;
2. To determine and review on a continuing basis the status and needs of the taxa and the current research and management measures available and needed;
3. to make these known through published books, scientific and popular articles, films, newsletters, symposia and meeting proceedings;
4. to ensure the conservation of the taxa through the development and implementation of conservation strategies and specific projects;
5. to review for SSC, IUCN and WWF questions reports, documents and decisions bearing upon the group's area of expertise;

6. to have an input into the Conservation Monitoring Centre (CMC) at Cambridge and Kew, which amongst other tasks produces the Red Data Books.

The successful fulfilment of these functions depends largely on people around the world contributing information and following up projects on identified species and habitat problems.

Responses to requests for snake status have been gratifying from Europe and the United States, patchy for Africa and Australia and very lean from South America and Asia. This is predictable and of course related to the sheer number of professional and amateur herp people in the two former regions.

It is not surprising that we have little information on snake status for most tropical areas, when taxonomy and distribution is still so far from being established. The rate of forest disappearance makes studies in these countries all the more urgent. The Snake Specialist Group will not "neglect" the so-called developed countries but will emphasize initiating studies and conservation action in the tropical, southern countries where the need is greatest. A good start will be to compile a list of people, agencies and projects (anything from individual thesis work to Government level schemes) which could conveniently incorporate snake status study.

This paper was prepared for and presented at the 1st meeting of the IUCN/SSC Snake Specialist Group, November 8 - 12, 1982, at the

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Acknowledgement:

Before we proceed to the first paper of the morning I would like to thank the following people and organizations for support and helping organize the meeting:

1. The International Union for the Conservation of Nature, The Madras Snake Park Trust and Madras Crocodile Bank Trust for financial help.

2. Brenda Bhaskar, Anne Joseph and the Snake Park and Crocodile Bank staff for everything from typing to renting chairs.

STUDIES AND CONSERVATION OF THE RARE SNAKES OF THE WESTERN GHATS

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Ophiology of the Western Ghats

The Western Ghats of India are one of the most remarkable biomes in the world with a high degree of faunal endemicity, relict biota, and speciational proliferation. It is not surprising then that of late there has been an increased awareness of a major component - snakes of the area. Since the publication of the third and final volume in the Fauna of British India series by Smith (1943), contributions on the ophiology of these hills and forests of South India have not been many and even those published were of a general nature.

The uropeltids

Thanks to the pioneering investigations of Prof. Gans (1966, 1973) in collaboration with Prof. Rajendran (1977) much light has been shed on the obscure and little studied uropeltids (shield-tail snakes) peculiar to the Western Ghats. Indian herpetologistsaare forever indebted to Col Beddome who collected a large series of shield-tails, the majority of which were described as new to science by him. The recent studies on the group by Prof. Gans has provided us with some awareness of the status of these animals in the various hill ranges of South India. Prof. Gans has also infected others like Rajendran and the author with the same enthusiasm and zeal to carry out further studies on these snakes. But the lacunae persists. We know little of their feeding and breeding habits. The life history of even an abundantly available species is not completely known. A correct and final picture has not yet emerged on the exact number now found out of the recorded thirty-three species.

Other secretive species

While the uropeltid snakes have received some attention, the same is not true of the other earth snakes of the Western Ghats of the genera TYPHLOPS, RHABDOPS and XYLOPHIS. Barring a few stray records, these snakes have not even been collected adequately. Among the venomous snakes, our knowledge of the systematics, biology and other aspects of the coral snake (Callophis/Elapidae) is negligible and this highlights the urealized scope of ophiology in India. Probably because the coral snakes are small, secretive and pose no hazard to human lives, they are not seriously studied on par with their allies - the cobras and kraits.

The following measures are suggested for further studies and conservation of the lesser known species of snakes :

1. The distribution and status of the uropeltids and snakes of the genera Typhlops, Rhabdops, Xylophis and Callophis throughout their range requires detailed investigation.

2. Long term research on basic life history of some selected spe cies which may be under heavy pressure.

3. Most research on these animals should be done in or near the forests where they live.

4. Information on the holdings of these rare snakes in the research organisations, private scientific institutions, and universities should be pooled to arrive at accurate data on their past status.

5. The zoology departments of universities located near or around the Western Ghats should be involved in collaborative studies.

6. A popular handbook (thoroughly illustrated) on these obscure reptiles should be published.

7. The concerned forest departments should be made aware of the permanent damage to the habitat of these rare snakes caused by clearing the forests.

These small snakes may not receive equal conservation status afforded to a tiger or an elephant, but the fact that they are intrinsically fascinating animals and form an important component of the biota of our mountains should not be lost sight of.

INDIAN SNAKES UNDER HEAVY PRESSURE

BLIND SNAKES (Typhlopidae)

1. Ramphotyphlops oatesi
   Loc : Andamans. Recently collected in 1972

2. Ramphotyphlops tindalli
   Loc : Nilambur, Kerala. Known only from a few specimens

5. Ramphotyphlops andamanensis
   Loc : Andamans. No specimen now.

Shield-tails (Uropeltidae)

All the 33 species recorded from the Western Ghats are under heavy pressure. Of these, the following six species are slowly vanishing :

4. Melanophidium bilineatum

5. M. wynaudense
   Recorded from Mannanthoddy, Kerala and Coorg.

6. Plectrurus aureus
   Loc : Chambra Hill, Kerala

7. Uropeltis nitidus
   Loc : Anaimalais

8. Uropeltis dindigalensis
Loc : Sirumalais, Tamil Nadu

7. Rhinophis fergusonianus
Loc : Cardamom Hills

Wart Snakes (Acrochordidae)

8. Cherysdrys granulatus
Loc : Coasts of India

Family Colubridae

9. Ptyas mucosus
Throughout India

10. Spalerosophis diadema diadema
U.P., Punjab and Jammu & Kashmir

11. Liopeltis calamaria
Western Ghats, Tirunelveli Dist., Karnataka, U.P. and Bihar

11. Liopeltis nicobarensis
Loc : Nicobar. Only one specimen

12. Liopeltis rappi
Loc : Himalayas

13. Chrysopelea ornata
Loc : M.P., Orissa, Bihar, Tamil Nadu and Kerala

14. Dryocalamus gracilis
Loc : Anaimalais, Cuddapah Hills and Berhampore in Orissa

15. Dryocalamus nympha
Loc : Western Ghats, Orissa, Tamil Nadu

16. Sibynophis subpunctatus
Loc : South Western India, M.P. and Bengal

16. Sibynophis bistriatus
Loc : Nicobars

17. Rhabdops olivaceus
Loc : Mannanthoddy, Kerala

18. Boiga dighotoni
Loc : Kerala

19. Ahaetulla perroteti
Loc : Western Ghats

20. Ahaetulla dispar
Loc : Western Ghats

21. Ahaetulla nasuta

Family Elapidae

22. Callophis nigrescens
Loc : Western Ghats

23. Callophis beddomei
Loc : Western Ghats

24. Ophiophagus hannah
Loc : Assam, Sunderbans, Orissa, Bihar, Western Ghats (limited pockets) and Andamans

Family Viperidae

25. Vipera russelli
Loc : Throughout India

26. Vipera lebetina
Loc : Western Himalayas

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A SURVEY OF HELMINTHIC INFECTIONS OF SOME SNAKES IN NORTHERN PENINSULAR MALAYSIA

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Introduction

There are 137 species of Malaysian snakes (Grandison, 1978) and little is known about their parasite fauna. The helminths recovered from these snakes have been studied by various workers (Robinson 1934; Yeh 1956; Salleh & Ahmad, 1956; Schmidt & Kuntz 1966; Sprent, 1969; Pence 1970; Ishii 1973; Kagei 1973 and Tat 1980).

In the present study conducted at the IMR Snake Farm in the northern state of Perlis in Peninsular Malaysia, 531 snakes were examined for helminth infections. The Snake Farm houses different species of non-poisonous and poisonous snakes which are kept for display to public. Poisonous species such as King Cobras, Common Cobras, Malayan Pit Vipers and Kraits are also kept for venom extraction. An attempt was made to study the parasite fauna of these captive snakes to determine types of parasites found, their incidence and percentage infection on the different species of snakes.

Materials and Methods

Snakes housed at the Snake Farm are caught wild and supplied by dealers. A total of 531 snakes of 31 species which died in captivity were examined for helminth infections. The dead snakes were preserved in 70% alcohol before examination as were the specimens of helminths collected from them. Cestodes and trematodes were stained with paracarmine and mounted on permount.

Results

Of 531 snakes examined, 125 were found to be infected with helminths (Table 1). Seven species of nematodes, three species of pentastomids, one specie of Acanthocephalans, two species of cestodes and one specie of trematodes were found in the snakes (Table 2).

Poisonous snakes

Of the 531 snakes a total of 315 were poisonous. Examination of these for parasites showed that 88 (27.9%) were infected with helminths (Table 1). Pentastomid infections were found in also poisonous snakes except Trimeresurus purpureomaculatus, T. sumatranus and T. popeorum. All the poisonous snakes were negative for cestode and trematode infections. Nematode infections were found only in Agkistrodon rhodostoma, Ophiophagus hanna and Bungarus fasciatus. Out of all the poisonous snakes O. hanna and Naja naja kaouthia

were found to have a high infection rate, 100% and 71.42% respectively while the other poisonous snakes had less than 30% infection rate. A. rhodostoma had the lowest infection rate (4.9%). The only species of sea snake Hydrophis ornatus examined was negative for helminth infection.

Non Poisonous snakes

A total of 216 non poisonous snakes were examined and 38 (17.6%) found to be positive for helminth infections (Table 1). Only 4 species of snakes Chrysopelea paradisi, C. pelias, Zaocys carinatus and Python reticulatus were found to be infected with pentastomids (Table 1). Only 6 species of snakes were found to carry nematodes and only one Boiga cynodon was found to have trematode infection. Acanthocephala were found in 8 species of snakes. C. paradisi and P. reticulatus were both found to have 75% infection rate while other species had 50% and below.

Among all the snakes Sphaerechinorhynchus serpenticola was found in 14 species (10.6%) and Raillietiella orientalis in 6 species (6.4%; Table 2).

Discussion

Due to the increasing incidence of snake bites of the Malayan Pit viper (A. rhodostoma) and the common cobra (N. naja), snakes were kept in captivity for extraction of venom for antivenom production. Maintaining the different species of snakes became a problem as most snakes died after a week in captivity. Post mortem analysis of the dead snakes showed the different types of helminths present in them.

It has been observed that host/parasite relationship between different helminth parasites varies in different countries. Sprent (1969) suggests that distribution of Polydelphis anoura probably coincides with the distribution of the pythons. However in our present study we have found P. anoura in A. rhodostoma, B. fasciatus and B. cynodon but not in P. reticulatus and P. molurus. P. anoura has also been recorded in P. reticulatus (Robinson, 1934), and Balasingam (1963) recovered 13 specimens from a single P. reticulatus in Singapore.

O. filaria has been recovered from P. reticulatus in the north of the Peninsular (Robinson, 1934) . In our study they were recovered from O. hanna, B. fasciatus, P. reticulatus and Xenopeltis unicolor. A list of 25 species of the genus Ophidascaris has been recovered (Ash & Beaver, 1963) but only one specie of O. filaria occurs in snakes. It was first recorded in the Indian Python (Dujardin, 1845) and subsequently reported in other snakes (Stiles & Hassal, 1920). Baylis (1920) observed that O. filaria infection was restricted mainly to pythons but the present study shows otherwise.

Three different species of pentastomids were collected, of which Raillietiella orientalis was found in 6 different species (6.4%) and

Kiricephalus pattoni in 8 different species (1.5%). Armillifer moniliformis which is known to infect man was recovered from one P. reticulatus. The immature stages of A. moniliformis have been reported from a variety of mammals including man (Sambon, 1912 ; Lim & Krishnasamy, 1973; Prathap et al., 1968). Krishnasamy et al, (1981) examined 5,209 small mammals of 33 species and found 92 of them positive for nymphal stages of A. moniliformis. R. orientalis which was found in 34 snakes numbered 551 and had a higher female worm count (57,53%) as compared to male worms (43.46%). A total of 23 K. pattoni were recovered comprising of 12 male worms (52.17%) and 11 female worms (47.82%).

Kalicephalus edesoni had 1.5% infection rate in the snakes examined and a total of 41 worms (males 12 and females 29). The Spinicauda sp. has been identified only to the genus level and only 3 female worms were found in one A. rhodostoma. Two female worms of Capillaris sp. was also recovered from one A. rhodostoma. Only one female worm of Paraketertyphlum sp. was found in Dryophiops prasinus. From the present observation it can be noted that nematode infections among poisonous and non poisonous snakes differs. Some poisonous snakes carry multiple infections while some had no nematode infections at all. Among non poisonous snakes 6 species were found to have nematode infections but the infection rate was low and they were mostly single infections.

A total of 32 species of snakes were examined and 14 species were found to have Sphaerechinorhynchus serpenticola (10.6% infection rate) and 673 larval stage worms were recovered from the snakes. S. serpenticola was first described by Schmidt and Kuntz (1966) from the common cobra in Malaysia.

Two species of cestodes were found in 3 species of non poisonous snakes and their infection rate were very low (0.18%). Ophiotaenia kuantanensi was first reported by Yeh (1956) in the King Cobra in Malaya and in our present study only one worm was recovered from P. reticulatus. Raillietina sp. was found only in one D. prasinus and only one worm was recovered.

Only one trematode species Styphlodora persimilis was recovered from one Boiga dendrophilla. A total of 14 worms were collected.

The present survey on the types of helminth parasites found in the Malaysian species of snakes for the first time shows the distribution of parasite fauna. The percentage infection of the different species of helminths in the snakes examined is very low. The snakes were not examined for protozoal infections. The death of the snakes may be attributable to stress due to handling and transporting to the Snake Farm rather than helminth infection. It may however be possible that the helminth infection does affect the health of the snake when physiological stability is affected by stress (Frye 1973).

A very significant reduction in mortality has been achieved at the Snake Farm by adopting good sanitation in the snake pits, a well maintained undergrowth, well balanced diet and minimal handling

of snakes. From the above observations it can be said that under near natural conditions, helminth parasites may not effect the health of snakes. Recently mortality among snakes have been due to rich diets as healthy snakes which died suddenly have been found to have thick layers of fat in their abdomen (Frye, 1973).

Thus in order to keep snakes healthy and active in captivity, a balanced diet should be given and there should be minimal handling of them. Snakes infected with cestodes can be treated with niclosomide and nematodes with thiabendazole.

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TABLE 1 : HELMINTH INFECTIONS FOUND IN CAPTIVE SNAKES

Host	No. examined	Number & Percentage of snakes infected with														Total No. of infected snakes
		NEMATODES						PENTASTOMID				CESTONE		TREMATODE	ACANTHOCEPHAIA	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Agkistrodon rhodostoma	143	-	-	1 (0.70)	-	2 (1.40)	-	1 (0.70)	-	4 (2.80)	1 (0.70)	-	-	-	25 (17.5)	34
Trimeresurus wagleri	12	-	-	-	-	-	-	-	-	3 (25)	-	-	-	-	-	-
Trimeresurus sumatranus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimeresurus purpureomaculatus	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimeresurus popeiorum	7	-	-	-	-	-	-	-	-	-	-	-	-	-	2 (28.6)	2
Naja naja sputatrix	42	-	-	-	-	-	-	-	-	9 (21.4)	-	-	-	-	2 (25.5)	11
Naja naja kaouthia	21	-	-	-	-	-	-	-	-	15 (71.4)	-	-	-	-	-	15
Ophiophagus hannah	13	5 (35.5)	-	-	1 (7.7)	-	-	-	-	2 (15.3)	-	-	-	-	5 (38.5)	13
Bungarus fasciatus	74	-	2 (2.7)	-	1 (1.35)	3 (4.5)	-	-	-	1 (1.35)	1 (1.35)	-	-	-	2 (2.7)	10
Hydrophis ornatus	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Python reticulatus	4	-	-	-	1 (25)	-	-	-	1 (25)	-	-	-	1 (33.3)	-	-	3
Python curtus	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ahaetulla fasciolata	52	-	-	-	-	-	-	-	-	-	-	-	-	-	2 (3.8)	2

Host	No. examined	Number & Percentage of snakes infected with NEMATODES 1	2	3	4	5	PENTASTOMID 6	7	8	9	10	CESTONE 11	12	TREMATODE 13	ACANTHOCEPHALA 14	Total No. of infected snakes
Boiga cynodon	7	-	-	-	-	1 (14.3)	-	-	-	-	-	-	-	-	-	1
Boiga dendrophilla	7	-	-	-	-	-	-	-	-	-	-	-	-	1 (14.3)	1 (14.3)	2
Boiga jaspidea	8	-	1 (12.5)	-	-	-	-	-	-	-	-	-	-	-	-	1
Chrysipelea paradisi	3	-	-	-	-	-	-	-	-	-	1 (33.3)	-	-	-	1 (33.3)	2
Chrysopelea pelias	19	-	-	-	-	-	-	-	-	-	4 (21.5)	-	-	-	2 (10.52)	6
Cylindrophis rufus	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dryophiops rubescens	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dryophiops prasinus	51	2 (3.9)	-	-	-	-	1 (1.9)	-	-	-	-	1 (19.6)	-	-	10 (19.6)	14
Elaphe radiata	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gonyosoma oxycephalum	7	1 (14.3)	-	-	-	-	-	-	-	-	-	-	-	-	1 (14.3)	2
Lycodon subcinctus	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligodon octolineatus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psammodynastes pictus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xenopeltis unicolor	4	-	-	-	1 (25)	-	-	-	-	-	-	-	-	-	1 (25)	2
Zaocys carinatus	10	-	-	-	-	-	-	-	-	-	1 (10)	-	-	-	1 (10)	2

Host	No. examined	Number & Percentage of snakes infected with NEMATODES 1	2	3	4	5	6	7	PENTASTOMED 8	9	10	CESTONE 11	12	TREMATODE 13	ACANTHOCEPHAIA 14	Total No. of infected snakes
Zaocys fuscus	2	-	-	-	-	-	-	-	-	-	-	-	-	-	(1.50)	1
Acrochordus javanicus	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Enhydris plumbea	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	531	8 (1.50)	3 (0.56)	1 (0.19)	4 (0.75)	6 (1.13)	1 (0.19)	1 (0.19)	1 (0.19)	34 (6.40)	8 (1.50)	1 (0.19)	1 (0.19)	1 (0.19)	56 (10.55)	126

* 1 = Kalicephalus edesoni
2 = Spirura sp.
3 = Spinicauda sp.
4 = Ophidoscaris filaria
5 = Polydelphis anoura
6 = Paraheterotyphlum sp.
7 = Capillaria sp.
8 = Armillifer moniliformis
9 = Raillietiella orientalis
10 = Kiricephalus pattoni
11 = Raillietina sp.
12 = Ophiotaenia kuantanensis
13 = Styphlodora persimilis
14 = Sphaerechinorhynchus serpenticola

TABLE 2 : PERCENTAGE OF HELMINTHS FOUND IN DIFFERENT SPECIES OF SNAKES

Nematode	No. of infected species	No. of snakes infected	% infected
Kalicephalus edesoni	3	8	1.5
Spirura sp.	2	3	0.56
Spinicauda sp.	1	1	0.18
Ophidoscaris baylis	4	4	0.75
Polydelphis anoura	3	6	1.13
Parheterotyphlum sp.	1	1	0.18
Capillaria sp.	1	1	0.18
Pentastomid			
Raillietiella orientalis	6	34	6.4
Kiricephalus pattoni	8	8	1.5
Armillifer moniliformis	1	1	0.18
Acanthocephala			
Sphaerechiuorhynchus serpenticola	14	56	10.56
Cestode			
Raillietina sp.	1	1	0.18
Ophiotaenia kuantanensis	1	1	0.18
Trematode			
Styphlodora persinilis	1	1	0.18

THE RED DATA BOOK AND THE AMPHIBIA-REPTILIA VOLUMES

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Abstract

The Red Data Books, produced by IUCN (International Union for Conservation of Nature and Natural Resources), provide an authoritative compilation of data on animal and plant taxa considered to be at risk or actively threatened over all or a major part of their range. Their function is both to provide reliable data for researchers and wildlife or development personnel, and also to publicize generally the problems of threatened species. The first Red Data Book, on mammals, was published in 1966; further volumes, on birds, amphibians and reptiles, and fish, followed. Although the volumes were revised periodically, IUCN set up the Species Conservation Monitoring Unit (SCMU) in 1979 in Cambridge, U.K., in order to ensure that the need for accurate data on threatened animal species was adequately met. Meanwhile the first plant RDB had been produced by the Threatened Plants Committee at the Royal Botanic Gardens, Kew. SCMU is now part of a larger Conservation Monitoring Centre, whose central task is to establish a computerized data base incorporating information on animal (SCMU) and plant (TPC) status, wildlife trade (through the Wildlife Trade Monitoring Unit) and protected areas (through the Protected Areas Data Unit). All units have word-processing equipment and by the end of 1982 will have on-line data-processing links to the computer at Kew. The Amphibia-Reptilia RDB is being produced in three parts: part 1, dealing with threatened crocodilians and chelonians (and Sphenodon), has just been published; work is now starting on parts 2 and 3, on snakes and lizards, and on amphibians.

* *

The Red Data Books produced by the IUCN (Internation Union for Conservation of Nature and Natural Resources) list animal and plant taxa considered to be threatened over all or a major part of their range, and present relevant data on distribution, population, habitat, threats and conservation measures. For the higher vertebrates, in particular mammals and birds, it is intended in principle to collect data on all taxa known to be threatened; but among plants and invertebrate animals it is recognized that a complete inventory of all threatened taxa will probably never be possible, and a sampling approach has been adopted in treating these groups.

Of the six Commissions of IUCN, the Species Survival Commission (SSC) has been primarily concerned with compilation of the Red Data Books. A main aim of the SSC is promotion and coordination of action to maintain natural populations of wild species, and the Red Data Book performs a major role in this task by disseminating information on species of concern. While one function of the Red Data Books is to publicize generally the diversity of threatened species and the threats to their survival, they are also intended to provide a reliable and comprehensive source of data for a variety of persons. They may be used on the one hand by students requiring information for projects; or on the other hand by personnel associated with wildlife, parks, and aid or development organizations.

The first Red Data Book (RDB) was published in 1966, at the initiation of Sir Peter Scott (then Chairman of the SSC), and dealt with threatened Mammals. The information provided represented material previously held on data cards by the SSC. Volume 1 of the RDB series was followed by volume 2 dealing with birds, volume 3 dealing with amphibians and reptiles (first edition in 1968), and volume 4 dealing with fish. This first series was published in loose-leaf format, with the pages for each species colour coded according to the status category assigned to it.

Although the Red Data Books were revised at intervals, the threats to species, the numbers of species recognized as threatened and the need for full and reliable data on such species were all increasing too rapidly for the books to be as complete and accurate as desirable. In recognition of this situation IUCN set up the Species Conservation Monitoring Unit (SCMU) in 1979 in Cambridge, U.K. This office houses full-time compilers for the mammal, amphibian and reptile, and fish Red Data Books, all previously prepared on a part-time basis. It was joined in 1980 by the headquarters of the International Council for Bird Preservation (ICBP), responsible for compilation of the bird RDB. Besides employing full-time compilers. with appropriate support and secretarial assistance, SCMU also uses modern methods of data storage and processing. With word-processing equipment, draft data accounts can be updated. corrected or otherwise edited with great ease.

SCMU is now one component of a major IUCN operation, the Conservation Monitoring Centre (CMC). In addition to SCMU, the Centre includes the Wildlife Trade Monitoring Unit (WTMU) (formerly known as TRAFFIC), also based in Cambridge, the Threatened Plants Committee (TPC), responsible for the Plant Red Data Book, and the Protected Areas Data Unit (PADU). TPC and PADU are based at the Royal Botanic Gardens, Kew, U.K.

The primary aim of CMC is to establish a comprehensive data base, held in the computer installed for the purpose at Kew, incorporating information on animal and plant status, wildlife trade and protected areas. At present, while all units of CMC utilize word-processing equipment, only the Kew-based units have ready access to the computer. Once SCMU and WTMU have on-line data-processing equipment installed by mid-1983, major progress should be made in building the data base.

The data base is currently divided into four main files corresponding to the four units making up CMC. The types of data stored are as follows. For animals (SCMU) - taxon name, data on taxonomic position, common name(s), RDB category, habitat(s), threat(s), exploitation type(s), distribution data (including not only country/region names but data on RDB status, local endangered species list status, legal status, presence in protected areas in each country/region in which the taxon occurs). Plants (TPC) - taxon name, data on taxonomic position, RDB category, distribution data (including RDB status in individual regions and countries). Protected Areas (PADU) - protected area name, size, date established, country, area classification in Udvardy scheme, IUCN protected area category. Trade (WTMU) - data on trade reported by CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). parties, giving taxon name, importing and exporting countries, country of origin, type, numbers of item being traded, purpose for trade.

The data base will also include: information on projects of conservation importance (allowing duplication of effort, projects and resources to be minimised); names and addresses of individuals and organizations concerned with conservation; a bibliography containing details of publications relevant to conservation.

An animal taxonomy tree is being developed to store and manage taxonomic information on all animal taxa (from phylum down to population level). This tree will allow for various taxonomic differences of opinion to be stored so that outputs may be produced using various different taxonomic classifications (thus different applications e.g. RDB users, CITES statistics, are free to use different taxonomic classifications). A plant taxonomy scheme has been developed in conjunction with the Herbarium at Kew.

Work is in progress to integrate the various areas of the data base so that reports can be produced pulling together all information relevant to conservation in a given geographic region or for a given taxonomic group. The Centre has already produced reports on threatened mammals, amphibians and reptiles, and plants in the European Economic Community (EEC) area, to aid in design of EEC conservation legislation, and has contributed to and coordinated a review of the environment and biota o f Saudi Arabia, for the Meteorology and Environmental Protection Agency of that country.

The CMC word-processing facility and the appointment of a full-time compiler for the Amphibia-Reptilia Red Data Book has allowed a very significant increase in the effort that can be devoted to gathering and updating information on each included taxon. It has been the intention to exploit this in providing a fairly full, but still concise, profile of relevant aspects of the biology of each taxon treated. In common with the other new RDBs the format and subheadings have been modified to improve the organization of the data. At the same time an attempt has been made to be as comprehensive as possible within each subheading. It is hoped that the new material presented under the 'Habitat and Ecology' section in particular will give greater meaning to the primary data on survival status, threats and conservation measures. Where an adequate volume of data is available, each taxon account has been treated in some respects as a scientific paper in its own right; all major facts, interpretations and opinions are referenced and a 'Summary' provides an overview of the material presented.

Contact with herpetological colleagues and other zoologists demonstrates that awareness of IUCN, the Amphibia-Reptilia Red Data Book, and concepts relating to threatened species, is more restricted than might be wished. Thus, one major aim of the expanded treatment of taxa in the Amphibia-Reptilia RDB is to reach and influence readers outside the conservationist and environmentalist world who may be attracted initially by the basic zoological data. Such data are difficult to find for many of the species, or not available from a single source.

This approach does, however, require that publication of material on threatened amphibians and reptiles is staggered, so that information remains adequately up-to-date at the time of publication. A taxonomic approach is followed by most workers who have provided data, and by the IUCN/SSC Specialist Groups themselves, and this has been adopted in partitioning the Amphibia-Reptilia RDB into manageable sections. It was decided to begin the revision with chelonians, crocodilians and the Tuatara because of the volume of data available, and to some extent because of the wider interest in these species. Taxaon accounts for these groups are now published as part 1 of the new Amphibia-Reptilia RDB. Further parts, dealing with snakes and lizards, and with amphibians, will follow. Although the volume of data available on most of these species is relatively small, the number of species to be treated is very large and relevant information is difficult to obtain. Thus it is not

possible at this time to state when these further volumes will appear, although we would like to have both parts ready for publication by late 1984.

The species (and subspecies) accounts forming the main text of the Amphibia-Reptilia RDB (in common with those for other groups) are based on compilation, selection and editing of published and unpublished written information, sometimes verbal information, from a variety of sources.

The Species Survival Commission (SSC) of IUCN now has Specialist Groups for all taxa treated in Part 1 (except the unique Tuatara Sphenodon punctatus); specifically, for Crocodiles, Marine Turtles, Freshwater Turtles and Tortoises. These last two Specialist Groups are relatively new, while those for Crocodiles and Marine Turtles are of much longer standing. There is also now a Snake Group, but unfortunately not yet functional groups for Lizards or Amphibians. One of the many functions of the Chairmen of Specialist Groups is to promote supply of data for RDB purposes regarding which taxa covered by the Group are of particular concern, and on their conservation status, based on the research and experience of the Group members and correspondents. Contact with the Chairmen and members of the relevant SSC Specialist Groups has provided probably the major part of the information presented. A large proportion has also come from a variety of other persons not formally associated with IUCN, including field, museum and zoo herpetologists, various other field professionals associated with wildlife, parks, and aid organizations, and amateur naturalists. Data may be in the form of published literature, pre-publication manuscripts, unpublished research reports (e.g. relating to WWF-funded projects), letters or verbal communications. Basic data on aspects of the biology, distribution and taxonomy of a group have come mainly from the herpetological literature.

A preliminary draft data account is compiled from the information gathered. In some cases workers contacted have provided outline drafts, which can then be amplified or refined as necessary, using data on file. The preliminary draft is typically then circulated for comment, correction, and additional current data. Drafts are sent to as many authorities as possible; although quite frequently only one or two persons may be known to be competent (by virtue of their field experience) to review the material, in some instances many persons are involved. This latter case may pose the problem of resolving apparently conflicting statements and opinions; this is not always possible, in which event both viewpoints are presented. There may be one or several review phases, depending variously on the geographical spread of the animal concerned, on the number of authorities involved and on the direct limitations of time. Although the cut-off point for the 'final' taxon account is determined largely by publication schedules, there is actually no final version since the aim is to continually expand and update base. It is to be hoped that publication of the RDB will itself prompt comments and corrections on the information presented.

It must be recognized that the taxa treated in part 1 are those known or strongly suspected to be threatened; it is a minimum treatment in that many taxa in these groups (especially among freshwater and land chelonians) remain largely unknown, and there are degrees of 'suspicion' - several more taxa suspected to be threatened could have been listed if time were unlimited. Information will continue to be sought on all taxa of concern.

Decisions regarding inclusion of a particular taxon in the RDB, and assignment of an appropriate status category will be made with the assistance of as extensive specialist advice as possible; the list is flexible and modifications will be made whenever new evidence demands re-assessment.

Work is now commencing on parts 2 and 3 of the herp RDB, covering snakes and lizards in one volume and amphibians in another.

In many respects compilation of Red Data Books for these groups will be very much more difficult than for those groups covered in Part 1. The diversity of frogs, for example, in humid tropical forests is still not fully recognized. Many new taxa are described each year, some of which are immediately recognized as rare or actively threatened. In general, field workers dealing with amphibians have been more concerned with basic taxonomic work, with studies of breeding biology or other aspects of natural history, but have only rarely considered population status. For caecilians, while good progress has been made in investigating anatomy and reproductive biology, the distribution and abundance of caecilian species is generally very poorly known. The animals are simply too secretive, too infrequently seen and too little studied. Exactly the same problem applies to snakes, compounded by continuing systematic problems at species and especially higher taxonomic levels.

Another problem is regional bias in research. It is a relatively simple task to collect quite detailed information on subspecies, or sometimes even individual populations, of North American herps, while in other parts of the world entire regional herpetofaunas remain too poorly known.

To take just one of many possible examples many frog, toad, caecilian, lizard and snake species in the rainforest tracts of southwest India are known in museum collections by only a handful of specimens from a very few localities. In many cases these specimens were collected around the turn of the century. At the same time continuing loss and degradation of the original rainforest habitat must have affected populations of some of these species. The problem is that, despite important work by the Zoological Survey of India and others in recent years, the true distribution and population status of this diversity of species is just not known.

Similarly, among snakes the effects of massive exploitation by the skin trade is largely unknown. Largely anecdotal reports suggest that populations of Ptyas mucosus, for example, have declined locally, but in the apparent absence of any long-term data these suggestions can be countered by similarly anecdotal reports to the contrary. Again, the effects of truly enormous harvest by the skin trade in Asia of Acrochordus species and sea snakes appears to be unknown. It would be in everyone's interest to investigate what level of exploitation can be sustained by snake populations on a long-term basis.

It seems likely that many taxa will appear in Parts 2 and 3 of the herp Red Data Book with 'Rare' status, being known from few specimens from a restricted area, or with 'Insufficiently Known' or 'Indeterminate' status, being suspected to be threatened, or known to be threatened but without full supporting data. It may be necessary to produce accounts of key areas of threatened habitat, and of particular local herpetofaunas, whenever data are insufficient for the conventional single-species data account. This approach has already been adopted by the compilers of the forthcoming Invertebrate RDB.

I would like to close by making a request for any available information on rare and actively threatened amphibians and reptiles (particularly snakes and lizards, and amphibians) that may be of use in compiling parts 2 and 3. All information used will be fully acknowledged. Please bear in mind the definitions of the RDB categories as currently defined. It may be convenient to submit information in the format of the Inventory Report Form, or one of the new species accounts, both of which are to be found in part 1 of the herp RDB.

* *

RED DATA BOOK CATEGORIES

EXTINCT (Ex)

Species not definitely located in the wild during the past 50 years (criterion as used by CITES).

ENDANGERED (E)

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that are possibly already extinct but have definitely been seen in the wild in the past 50 years.

VLUNERABLE (V)

Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue operating.

Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

RARE (R)

Taxa with small world populations that are not at present 'Endangered' or 'Vulnerable', buy are at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

INDETERMINATE (I)

Taxa known to be 'Endangered', 'Vulnerable' or 'Rare' but where there is not enough information to say which of the three categories is appropriate.

OUT OF DANGER (O)

Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival has been removed.

INSUFFICIENTLY KNOWN (K)

Taxa that are suspected but not definitely known to belong to any of the above categories, because of lack of information.

N.B. In practice, 'Endangered' and 'Vulnerable' categories may include, temporarily, taxa whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category.

* *

SAMPLE DRAFT RARE

Loveridgelaps elapoides (Boulenger) 1890

Order OPHIDIA Family ELAPIDAE

SUMMARY A moderate size, secretive, crepuscular or nocturnal terrestrial elapid. Endemic to the Solomon Islands, recorded from five islands in the group. Mainly occurs in forest regions near streams. Reported extremely rare. Status and biology require investigation.

DISTRIBUTION Endemic to the Solomon Islands, in the Melanesian region of the West Pacific. Present on Gizo, Guadalcanal, Isabel, Malaita, Nggela. (1,3).

POPULATION Reported to be extremely rare (1,2). No further data.

HABITAT AND ECOLOGY Few data available. Average length about 80cm. Largely restricted to forest areas, usually near streams. Tends to be crepuscular or nocturnal, and secretive in behaviour, sheltering under leaf litter and fallen timber. Feeds on a variety of small lizards, worm snakes Typhlina spp., and probably frogs. (1,2).

THREATS TO SURVIVAL Unknown. Probably affected by habitat loss.

CONSERVATION MEASURES TAKEN None.

CONSERVATION MEASURES PROPOSED The status, distribution and ecology of this species should be further investigated.

CAPTIVE BREEDING None known.

REMARKS One of a diverse, zoologically interesting but poorly known group of elapid snakes in the Melanesian area (3).

A venomous but inoffensive species, the venom should be regarded as potentially dangerous to man (1).

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INDETERMINATE

Ogmodon vitianus Peters 1865

Order OPHIDIA Family ELAPIDAE

SUMMARY A moderate size, terrestrial elapid. Endemic to the Fiji Islands, recorded only from Viti Levu. Very poorly known, apparently a burrowing form, active on the surface only at night. Appears to be rare, suspected to be declining. Field research on status, distribution and biology urgently required.

DISTRIBUTION Endemic to the Fiji Islands, in the Melanesian area of the west Pacific. Recorded with certainty only from the main island, Viti Levu; possibly occurs on others in the group. (1,3).

POPULATION No details available; apparently rare, suspected to be declining (3). Very few specimens known (2), less than 20 museum specimens in total (2,3).

HABITAT AND ECOLOGY A rather small (under 50 cm length) terrestrial species. Habitat preference unknown. One specimen in the Fiji Museum was found in very wet soil in a taro garden in central Viti Levu (2). A recently discovered live specimen was found nearly 1.5 m below the surface in mudstone rubble in a gully in very wet mountain rainforest near Namosi, southern Viti Levu (2). This snake ate an earthworm in captivity (2). One partly-eaten dead specimen was found in grassland in 1974 (3). Graeffe, the ninete nth century discoverer of Ogmodon was informed by Fijians that the species occurs mainly in termite mounds (the Fijians frequently excavate for termites for use as fish bait or chicken feed) (2).

The recent captive specimen was very sensitive to light, burrowing when exposed to it. Quite probably the species is nocturnal and remains underground by day, this may afford some protection against mongooses (2).

THREATS TO SURVIVAL Reportedly threatened by mongooses, introduced to Fiji in 1883 (3).

CONSERVATION MEASURES TAKEN None.

CONSERVATION MEASURES PROPOSED A Fiji National Trust sponsored bill giving protection to all native terrestrial vertebrates (with provision for control of pest species) was recently proposed, but rejected in 1991 by the Cabinet (2).

Field research on status, biology and distribution is required.

CAPTIVE BREEDING None.

REMARKS One of a diverse, zoologically interesting but poorly known group of elapid snakes in the Melanesian area (4).

Venomous, but not believed dangerous to man (1).

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A COOPERATIVE FOR SNAKE CATCHERS

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Acting Vice President
Irula Snake Catchers
Industrial Cooperative
Madras Snake Park
Guindy, Madras.

INTRODUCTION

The Irulas, members of the Scheduled Castes and Tribes are found in various parts of South India and are basically a tribe of hunters. The word Irula means darkness or blackness and as E.Thurston remarked the name could have either described the colour of their skin or their preference for living in the dark jungles. Physically the typical Irula is dark skinned and platyrhine (nostrils wide apart), they are shortish and their hair is long and ragged or very curly. They speak a dialect of Tamil. The Irulas worship their tribal deity Kanniamma and Mari, the general goddess of epidemic disease.

IRULAS OF CHINGLEPUT

The Irulas that we are dealing with are from Chingleput District of Tamilnadu. They live in small family units generally located on the edge of villages. There are about 26,000 Irulas in the District.

By tradition and heredity they are hunter-gatherers. They were once known as Villiyans (bow men). With the disappearance of large game the Irula now concentrates his inherent skills and knowledge on trapping rodents, reptiles, termites and is also expert at recognizing and gathering medicinal herbs.

His snake catching skills are quite remarkable. When it comes to snakes the Irulas are fearless and young children of both sexes are taken on these snake catching expeditions. The equipment used by them is very basic: a crowbar and a sack. When hunting snakes they first decide which holes are likely to have snakes in them. They then examine the hole carefully for tracks, to determine the size and type of snake inside. Next they push a slender stick into the hole before they start digging with the crowbar. This stick is to help them locate the exact position of the snake so that they don't accidently damage it while digging. When the stick finally prods the snake, the shrugging of the snake causes the stick to jump back and the Irula knows how much further he has to go. The crowbar is also used to direct the suns rays into the hole to enable him to see better.

THE COOPERATIVE

Now with all the conservation laws under the Wildlife (Protection) Act of 1972 the Irulas are economically worse off than before. Since factory jobs and farming don't appeal to them, some use their unusual skills for the illegal trapping of snakes for the snake skin industry. Even their rodent trapping is not much in demand with all the pesticides and chemicals now being pushed on the market. It therefore seems logical that the specialised skills and knowledge of the Irulas should be recognized and organized in a productive

manner for their community. Which is how and why the IRULA SNAKE CATCHERS' INDUSTRIAL COOPERATIVE was formed in 1978, with a membership of 25 Irula families.

The Advisory Patrons are:

Zafar Futehally
Vice President, Worl Wildlife Fund

S.R.Sane
Animal trader

B.G. Verghese
Editor-in Chief, Indian Express

J.C. Daniel
Curator, Bombay Natural History Society

H.A. Reid
Liverpool School of Tropical Medicine

Salim Ali
President, Bombay Natural History Society

Carl Gans
Prof. Heretology, University of Michigan

Madhav Gadgil
Centre of Theoretical Studies, Indian Institute of Science.

A. Ayyappan
Anthropologist

OBJECTIVES

The objectives of the Cooperative are:

1. To provide a profitable produce outlet for Irula hunters and collectors.

2. To provide essential services such as health, education and saving/loan facilities in the specialized manner required by the Irulas. Emphasis will always be on self help with technical guidance only where needed (i.e. reducing danger of snakebite to catchers through revised capture techniques) and

3. To generate and undertake studies on sustained yield use of wildlife resources,

FEASIBLE PROJECTS FOR THE IRULA COOPERATIVE

1. Rodent Control : With the decline of the snake population, rodent control is becoming a problem. Chemical companies and pest control agencies are pushing various ineffective poisons on the market at exorbitant prices. These chemicals cannot really compete with the Irula's more effective direct capture methods, which are more economical and less dangerous.

Irula rat catching techniques vary according to the species and habitat. They include snaring, netting, digging out and smoking out. Their excellent knowledge of rodent natural history enables them to gauge infestation levels and optimum times for capture.

2. Termite Control : Irulas have had generations of appreciation of termite natural history. An experienced hunter can produce the queen termite within a short time which can effective kill the entire colony. Here again their methods would prove more economical and less hazardous than the widespread use of pesticides.

3. Herb Collection : The Irula's extensive knowledge in recognising and using medicinal herbs and plants in their natural habitat is at present being exploited by bio-supply dealers. The tribals need help in the fair marketing of these collections.

4. Biological Supply : This is a fairly large trade which involved at least 5 full time companies in Madras. It used to cater to the foreign preserved (and sometime live) animal market but with the recent controls it mainly supplies specimens to educational institutes. The Irulas are usually employed by these companies, for very little payment, to collect various species of frogs, birds, snakes, fish etc. The companies then re-sell these at a tremendous price mark up. Again the Cooperative hopes to control as far as possible the sale of these specimens and also see that a fair price is earned by the Irula.

5. Technical Field Assistance: With their love of the outdoors and their fund of knowledge and experience the Irulas can be successfully employed as field assistants to naturalists.

6. Snake Venom: One of the areas which was decided as financially and nationally beneficial was the extraction of snake venom. In India approximately 10,000 people die of snake bite annually because of the non availability and inadequate publicity and distribution of anti-venom serum. To start this project has taken several years of correspondence with the State and Central Government, which finally paid off this year with the Government issuing an Order permitting the capture of venomous snakes for the eventual production of anti-venom serum. The whole project will be conducted under the close supervision of the Forest Department.

Basically the project involves the catching of the snakes by the Irula Cooperative members - who will then bring them to a central point (at present the Madras Snake Park) where they will be paid for the snake depending on the type and size. The venom will then be collected, processed and despatched to various institutes for producing anti-venom serum. After 3-4 weeks of extraction the snakes will be released back into their natural habitat. Initially the money from the venom sales will be ploughed back into the project as independent space and equipment will have to be acquired. Eventually the money will be used for the benefit of the Irulas. In spite of low funds this project will start in November, 1982. Acknowledgement is due to the Madras Snake Park for making available space, facilities and manpower.

ADDITIONAL PROJECT PROPOSALS

Besides the various projects mentioned above there are several other areas which will be examined for further application by the Cooperative:

1. Deer ranching
2. Leopard farming
3. Frog farming
4. Fish farming
5. Butterfly and moth farming
6. Crocodile farming
7. Monitor lizard farming
8. Python farming
9. Sustained yield snake skin use
10. Honey collection
11. Horticultural supply
12. Pest control methods (biological)
13. Wildfowl farming
14. Wildlife tourism
15. Turtle farming (marine & freshwater)
16. Evaluation of tribal medicines.

It is envisaged once the initial venom supply project is underway and the financial situation of the Cooperative improves that the membership of the Cooperative will increase and along with it the various objectives fulfilled for the benefit of more Irula snake catchers.

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SNAKES OF SRI LANKA : HOW THEY ARE ENDANGERED

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Introduction:

Sri Lanka possesses one of the best snake faunas in the world. A total of 94 species and subspecies of snakes have been recorded to date (though the validity of a few subspecies are questionable).

There is evidence that many species of snakes are being over-killed, over-collected and smuggled out and also their habitats are being increasingly disturbed. This paper discusses the reason why snakes of Sri Lanka are endangered; they can be grouped as follows:

A. Natural:

Sri Lanka is fortunate as it does not have any volcanic eruptions, forest fires, freezing temperatures etc. However we do get floods in some parts of Sri Lanka more or less annually. During these floods it was observed (in Gampola, Central Sri Lanka) that uropeltids and other durrowers were effected. However, this can be considered neglegible as only a few specimens were observed dead.

B. Artifical:

The word 'artificial' used in this context is direct or indirect interference by humans whereby snakes are endangered.

B.1 Destruction of habitats:

Perhaps one of the most extensive and irreplaceable damages were done two centuries ago when the early British planters cleared vast areas of mountain rain forests for coffee and subsequently for tea. It appears that this had a tremendous effect on the snakes. It was observed that once the forests are cleared it not only effected the arboreal snakes but also the fossorial and subfossorial snakes who had made an ecological niche under these fallen leaves and in the humus. It was observed that the moisture content under these fallen leaves is an important feature for some endemic snakes like Cercaspis carinatus (Khul) and Haplocerus ceylonensis Gunther. In addition to this, vast areas of forest are now being cleared in the dry zone for agricultural purposes.

Another common episode observed in the Central Province of Sri Lanka was setting fire to grass fields during the drought by some people for "fun". I have observed that Hypnale hypnale, Boiga ceylonensis, Vipera russelli and Oligodon sublineatus are common in these habitats.

A recent visit to the sugarcane corporation in North East Sri Lanka I was informed that before they harvest the sugarcane, the dried leaves at the bottom and the undergrowth is set on fire. The intention of this is to get rid of the snakes. I was informed that in addition to other species of snakes pythons too get burnt.

B. 2 Encroachment into snake habitats:

Fishing in some localities of the sea could also be termed as an indirect encroachment into sea snake habitats. It was observed in certain areas that some species of sea snakes are regularly caught in the fishing nets and often killed.

B. 3 Miscellaneous:

Though no proper studies have been conducted on snakes that get run over by vehicles and die; it is estimated that more several thousand snakes are killed in this way annually.

B. 4 Killing snakes:

People kill snakes due to rational and irrational attitudes. Though no proper studies are done it can be assumed that many thousands of snakes are killed annually. Some of the common harmless victims are Lycodon aulicus and Boiga species.

B. 5 Smuggling:

Export of fauna is banned from Sri Lanka. However, several customs detections were made of tourists trying to smuggle out snakes. There is evidence that many snakes and other reptiles are smuggled out from the country as it is not practicable to check/the baggage of tourists. all I consider this to be an important area that should be looked into.

B. 6 Skin industry:

Fortunately in Sri Lanka this is not a problem like in India. The available evidence suggests that only about five python skins are tanned annually.

B.7 Snake flesh as food:

In Sri Lanka sea and fresh water turtles, land monitor and crocodile flesh are consumed. Fortunately snakes have not fallen into this category.

B. 8 Action of insecticides and other pesticides:

Sri Lanka uses a wide variety of insectidices and pesticides, most of which have been banned in Western countries. At present there is no sufficient data to establish that these chemicals have affected the snakes. However, I have observed that DDT spraying in some areas of the dry zone during malaria epidemics had affected the gecko populations. This could have also affected the gecko feeding snakes.

Conclusion:

In Sri Lanka the habitats of the fossorial and subfossorial snakes disturbed from the 19th century and still continues. This has not only affected uropeltids, but also snakes like Haplocercus ceylonensis and Cercaspis carinatus Destruction of the forests in the whole country could be regarded as one of the major threats to snakes of Sri Lanka. This not only alters the ecological needs of snakes but also over exposes them, and the snakes fall easy victims to humans. The other area that should be examined is smuggling of snakes.

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ENDANGERED SNAKES, THEIR CONSERVATION IN NORTH WESTERN INDIA

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Introduction

The Indian subcontinent is a vast area of Asia lying between 8°N and 37°N latitudes and 60°E and 95°E longitudes. The rich and varied snake-fauna of India is composed of about 250 species of which about 52 are poisonous. This, however, is in contrast to the world population of snakes which is composed of about 3,000 species of which about 200 are venomous.

The northwestern Indian region has its own ecological complex and diversity and has been explored for snakes and their conservation as documented from time to time (reference 1-9). It is dismaying to note that as utmost valuable elements of our ecosystem several species of snakes in India are facing extinction or being pushed fast towards it. Among the reptiles some attention has been paid on government level for the conservation of crocodiles, lizards, gharials and turtles but no comprehensive attempt for the snakes has been made which however, need maximum attention. In the absence of proper protection and extensive awareness in the masses about snakes they are being decimated indiscriminately in one form or the other.

Random killing of snakes for commercial exploitation has not only driven some of the important species towards an endangered status but has also considerably disturbed the ecological balance in the country-side. The following species of snakes found in various parts of northwestern India (all documented from Jammu & Kashmir State) are endangered forms or fast reaching endangered status:

1. Family: ELAPIDAE
    1. *Naja naja oxiana* Eichwald (Oxus cobra)
    2. *Naja naja naja* (Linn.,) (Common cobra)
    3. *Bungarus caeruleus* (Schneider) (common krait)

II. Family: VIPERIDAE

4. Agkistrodon himalayanus (Gunther) (Himalayan pit viper)
5. Vipera libetina (Linn.,) (Libetine viper)
6. Vipera russelli (Shaw) (Russel's viper)

III. Family: COLUBRIDAE

7. Dendrelaphis tristis (Daudin)
8. Elaphe hodgsonii (Hodgson's snake)
9. Sibynophis sagittarius (Cantor)(Cantor's black-headed snake)
10. Psammophis leithi (Gunther)
11. Ptyas mucosus (Linn.,) (Whip snake or rat snake)

IV. Family: BOIDAE

12. Python molurus molurus (Linn.,) (Indian python).
13. Eryx conicus (Schneider) (Common sand boa)

V. Family: TYPHLOPIDAE (Blind snakes)

14. Typhlops tenuicollis (Peters)
15. T.porrectus (Stolickzka)
16. T.braminus (Daudin)

FACTORS LEADING TO THE DECLINE

In the past two decades there has been a drastic decline in various valuable species of snakes and this can be traced to two main causes: (1) The prime factor is the degradation or destruction of habitat used by potentially useful and rare snakes. The encroachment of human habitation has disturbed many species of snakes and contributed to this decline. (2) . The ongoing commercial exploitation (for medicines, skin industries and scientific research) has encouraged ruthless and large scale destruction of many species of snakes. The demand for snake skins to make fancy articles unfortunately still exists. Till the mid-seventies over 3,000,000 skins were being exported annually from India. Unfortunately the illegal hunting of snakes is still going on in spite of various restrictions imposed in the form of wildlife regulations.

CONSERVATION

As precious and important elements of nature in our ecosystem, snakes deserve immediate attention for their conservation. In fact, they are the only voracious and successful predators of

rats and other small rodents controlling their population in nature to the extent of 80 percent even by invading their burrows. It is however, wrong to think of the snakes in terms of more foreign exchange because the loss of foodgrains by rodents is far more in value than the foreign exchange that the snakes fetch. Rats and other small rodents are best controlled by the biological means of snakes. A census taken when the population of snakes was higher reported a 20 to 25 percent loss of food grain due to rodents. Which means the loss now must be greater with the destruction of more and more snakes. Therefore stringent measures for the conservation of snakes must be taken by giving them blanket protection. This can be achieved as follows:

(1) By imposing a total ban on the use of snakes for the National and International market. The possession of snake skins, fats etc. should be strictly regarded as a cognizable offence.

(2) Maximum snake conservation centres, parks and schools for snake studies should be set up to propagate conservation and general awareness of the significance of snakes in our environment.

(3) Wide publicity through audio-visual aids, radio, television and ISRO programmes should be undertaken at Government level to highlight the significance of conservation.

By adopting these measures the wanton killing of snakes can be checked on a large scale and proper methods of conservation can be perpetuated with suitable ecological security for them. But if the present state of negligence continues, many of the endangered species will be wiped out by the turn of the century.

Consequently the extermination of the snake from our ecosystem will cause all sorts of ecological unbalance. Therefore, the conservation of snakes is highly significant to maintain this eco-balance.

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THE ROLE OF THE IUCN/SSC SPECIALIST GROUPS IN SPECIES CONSERVATION

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Background

To introduce specialist groups and their mode of operation within the framework of the Species Survival Commission (SSC) of the International Union for the Conservation of Nature and Natural Resources (IUCN), it is convenient to first present some background on these two higher administrative bodies.

The IUCN founded in 1948 comprises a network of some 450 member governments and non-governmental agencies in over 100 countries. It is subdivided into 6 commissions (including the SSC) which in turn consist of over 700 experts on a diversity of subjects including threatened species, protected areas, ecology, environmental policy law and administration and environmental education.

Functions of the IUCN include:

1. Monitoring the status of species and ecosystems worldwide
2. Planning conservation action (eg.World Conservation Strategy)
3. Promoting conservation action by governments, inter-governmental bodies and non-governmental organizations.
4. Providing assistance and advice necessary for the achievement of these actions.

It is the Species Survival Commission which is particularly concerned with gathering the data on threatened species so that action can be taken. This information which is transmitted to the IUCN is also published in the form of the Red Data Books. As you can imagine, it is an extremely large and complex task to compile such data on the ever growing myriad of organisms which are being threatened with extinction worldwide. To carry out this work the SSC must depend upon a global network of volunteer specialists in the various species--the specialist groups.

Specific Objectives of the SSC and its Specialists are:

1. to ensure survival and maintenance of genetic diversity of endangered and threatened taxa.
2. to determine and review on a continuing basis the status and needs of the taxa and the current research and management measures available and needed.
3. to make these problems known through published books, scientific and popular articles, films, newsletters, symposia and metting proceddings.
4. to ensure the conservation of the taxa through the development and implementation of conservation strategies and specific projects.

Specialist Groups

Specialist groups consist of a Chairman and Members appointed by the SSC for 3 year terms. Beyond this there is no set format and the composition and organization of these groups are highly variable. Most are a mixture of professional scientists, naturalists and qualified scientists, naturalists and qualified amateurs tied together by a common interest in conservation of a certain group.

Some specialists group are quite large. The Primate Group has 70 members; The Lepidoptera Group has 50. The Freshwater Chelonian Group has 35. Others are very small such as the Odonata Group with 7 members. Size should be based on the Chairman's ability to communicate with his membership on a regular basis.

As for organization some groups are simply chairmen and members whereas others have a more elaborate hierarchy. For example the Freshwater Chelonian Group has a Chairman, a Vice Chairman, 5 regional coordinators, 35 members and 3 consultants. Each group can work out an arrangement that suits its particular needs.

Specialist groups operate through both individual and group action. Individually members identify threatened species and other conservation problems in their own region of expertise. They then recommend conservation action for these species and situations. They also seek the personnel and funding to implement these actions.

As a group the specialists must prepare a global action plan and reach a consensus on priorities for action. This prioritized action plan must subsequently be annually revised. The group's action plan is submitted to the SSC where it is amalgamated with action plans of other groups and ultimately becomes part of the overall SSC Action Programme.. This in turn is used to develop the IUCN "Conservation Programme for Sustainable Development"-- a set of desirable conservation projects identified for possible funding.

In addition the specialist groups providing input into the Conservation Monitoring Centre at Cambridge and Kew which amongst other tasks turns out the Red Data Books. Further they review for SSC, IUCN and WWF reports, funding proposals and decisions based in their area of expertise.

Group communication is normally accomplished through correspondence, newsletters and occasional meeting. Because group members are videly scattered, meetings for the entire membership can be very expensive. An alternative for many groups is to hold regular regional meetings, after getting together in conjunction with other larger meetings.

Funding

A formidable and ever present hurdle to initiating a groups action plan is finding the necessary funding. We who deal with reptiles often find this a particularly acute problem because we have to compete with much loved cuddly furry beasts and those elaborately ornate feathered ones to try obtain our share of the conservation dollar. A common strategy used by conservationists is to select a popular or charismatic animal to sell a project which will conserve other less popular forms. This may be a good approach for reptiles.

In recent years the Primate Group has been one of the most successful in finding funding. Therefore new groups such as the snake group might well look at some of their methods. One of their key techniques has been to publish their action plan on conservation strategy. This publication includes Red Data Book sheets on the threatened species, recommended projects and progress reports. Such a publication is very impressive when applying to a granting agency.

For large projects World Wildlife Fund is usually one of the best funding agencies particularly since they give special conservation to those projects given high priority by the specialist group. They also have many chapters worldwide so that there is less chance of geographic biases in funding.

The Animal Research and Conservation Center (New York Zoological Society) also funds large projects and should be considered for your proposals. Many other agencies will fund small projects (e.g. Fauna Preservation Society, Peoples' Trust for Endangered Species). The simplest, cheapest and often most productive projects are those done by individuals in their own region. I encourage all of you to think about conservation projects needed in your own area and then initiate those actions which can alleviate the problem. Simply educating the local people to the need for conservation can be an extremely valuable service. If funds are needed contact specialist group chairmen to assist you writing and directing a proposal to an appropriate agency.

If everyone at these meetings would go back to their homes and make one positive step toward conservation (e.g. talk to school, submit an article to a local newspaper) it would be a great beginning.

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INDIAN SNAKE SKIN TRADE

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In the past

At one time habitat destruction could be considered the foremost reason for the depletion of snakes, but from the time snake skin goods came into fashion there has been an added pressure on snakes.

A local newspaper reports that "Export of snake skin fetched foreign exchange worth Rs 1.3 crores* in 1974-75. France and Spain were the leading buyers and their import value in 1974-75 amounted to Rs 41 lakhs* and Rs 34 lakhs respectively. Other buyers included West Germany, Italy and Switzerland."

After the introduction of the Wildlife(Protection)Act, 1972 the penalty for catching or keeping any of the protected snakes was severe. In spite of this, India is one of the world's major exporters of snake skins.

A report states that before the passage of the Wildlife Protection Act in India in 1972, millions of snake skins - from cobras, kraits, rat snakes, water snakes, vipers and the endangered python left the country. During the snake-skin boom of the 1950's, a single tannery in Madras processed 5,000 to 10,000 skins each day, (Defenders)

At present

Unfortunately, even after the Wildlife Protection Act came into force skins are still being exported out of India. The Economist states that an estimated 60 million dollars worth of snake skin is smuggled out of India every year.

The Indian people in general have no interest in reptile products because of religious taboos, or simply because they are too expensive, and it is evident that the vast majority are bought by foreign tourists.(Inskipp)

Tribals

Certain tribes in India specialise in catching snakes. In Tamil Nadu it is the Irula tribe. The Irula tribals of Tamil Nadu have always lived close to nature, learning its secrets and participating in its inexhaustible and remarkable resources.

Wiry and sturdy, they have been hunter-gatherers - hunting wild animals with their bows and arrows and gathering forest produce like beeswax, honey, various barks, deer horns, tamarinds, gum and herbs of medicinal value. Their contact with the dominant "civilised" societies was, and remains in some areas, even tody, minimal, with the result that these expert naturalists are freely exploited by middlemen who are often their only contact with the commercial world.

* 1 lakh = 100,000
1 crore = 10,000,000

With their uncanny knowledge of natural history, the Irulas were the obvious choice of the snake skin industry, which boomed suddenly and swiftly in the early 1950's and the 1960's. Middlemen were encouraged to activate these traditional snake catchers. The result was that millions of snakes were provided by the tribals, thereby ensuring maximum profits to the tanneries and middlemen. The proprietor of one of the best known tanneries in Madras handled upto 10,000 skins a day during the peak years according to a report by Kamal Arora.

There are over 10,000 Irulas in Tamil Nadu and about a third of them have been involved in the snake skin industry. In Pudukkotta in Tamil Nadu and elsewhere, local people like the Amblakaran and Muthurasa also catch snakes but with much less finesse. The Irula identifies snake species from tracks, droppings and shed skins, hunting it to its burrow and then digging it out with fascinating precision. His tool-kit includes a digging instrument, a forked stick to pin the head of the snake and a gunny sack to bag the snake in.

The Irulas have their own herbal remedies for snake bites and they have used medicinal herbs with good effect. Their snake medicine is a group secret which the old men of the village know. It is interesting to note that they have no medicine for krait bite, the most toxic of the Indian venomous snakes.

The skin market catering to the affluent western nations and, more recently, to the USSR, Yugoslavia and Czechoslovakia, cashed in on what was virtually a gold mine, making huge profits in the process. The backbone of the snake industry - the Irulas and other tribals - naturally do not share in these profits and are exploited by middlemen.

An Irula can catch from three to five big snakes in a day, sometimes more in areas not heavily hunted before. Chinappa, an 80-year old Irula tribal mentions, "Between 1947 and 1950, there was a big demand for snake skins. Basketfuls of snakes were sold. One snake netted one anna* and a 12½ foot python fetched the princely sum of Rs 1½ ... enough money for a month's rice."

Rates

The rates for snake skins during the peak years of 1967-68, (the statistics for which are 358,413 kg sold for Rs 107,651,889) were cobra Rs 10, rat snake Rs 10, Russells viper Rs 8, sand boa Rs 3 and python Rs 50. In the month of March, 1968 alone 17,522 kg of snake skin, valued at Rs 71,75,116 was exported from India. Roughly computed to include wastage, no less than ten million snakes were killed in that year alone. Rare species such as pythons, flying snakes and king cobras formed part of the live reptile trade, and in 1968, a record 93 live pythons and 27 live king cobras were sold through the Calcutta market.

During the dry season, according to an Irula, when snakes are not too easy to find, the skin of a rat snake fetches prices from Rs 12 to Rs 18 and that of a cobra from Rs 10 to Rs 16. During the monsoons, when snakes are plentiful, the prices go down to Rs 8 to Rs 12 for a rat snake skin and Rs 5 to Rs 10 for a cobra skin. Demand for skins of vipers, kraits, watersnakes and sand boas was is poor in Tamil Nadu and therefore these snakes are seldom caught.

* 16 annas = Re 1

Legislation

Government legislation protecting snakes put a damper on what was speedily becoming an ecological disaster. Under the 1975-76 Export Policy for Wildlife Products, export of live snakes and their products is not normally allowed. The ban was however, lifted from time to time, apparently under pressure from the skin dealers, to clear "old stocks." The World Wildlife Fund-India office in Calcutta reported the export of 2.5 tons of snake skin in 1976 and was told by the Ministry of Commerce that the ban had been lifted to clear old stocks !

Clearing old stock

The Government indirectly encourages the trade by lifting the ban to clear old skins as this report explains -

"The Bharat Leather Corporation, a public sector undertaking, is to be appointed as the agency which will purchase snake skins lying within the private sector. It is expected that they will export the products made from these skins.

The plan has been proposed as a 'once only' operation to clear the old stocks that have accumulated following the ban imposed on export of snake and lizard skins ...

The question of allowing the export of non poisonous snake skins was recently considered by the Indian Government but it was decided that it was still necessary to continue the law.

According to an assessment made by the Minister, the number of snake skins lying within the trade throughout the country, including those confiscated by the customs authorities are around 11.3 million. The Bharat Leather Corporation will purchase these skins within six months to one year and export the products manufactured from them."

The problem of preventing illegal trade in skins is monumental since it is an established and profitable business and the large number of scattered dealers are difficult to keep a check on. Illegal skin markets are reportedly still a common feature in several towns of south India. In June 1977, weekly skin markets were reported at Perungalathur near Madras where over 2,000 skins, mainly rat snake and cobra were sold.

An Irula who is now employed in an organisation doing menial jobs, admitted that though he did not catch snakes for skins now, his sons did. He himself had learnt the art from his father. Sometimes selling snake skins is the only source of income for these people; working in fields is only a seasonal job, he said. Most of the Irulas sell snake skins since that demand far exceeded that for live specimens for colleges.

Killing and skinning

The method used for skinning snakes is first killing the snake with a blow on the head. Care is taken not to injure the skin on the body as this would reduce the value of the skin. The skin is slit under the throat and cut down right to the vent along the centre of the belly scales. A small slit is then made on either side of the vent and the skin gently prised away from the flesh near the tail. Once the skin from the tail is free from the flesh, this piece of flesh is held under the feet and using both hands, the Irula, with one jerk, peels off the skin from the flesh of the snake. Salt is immediately applied on the inside of the skin and then the skin is stored in a pot till sold.

Implementation of the laws

The Tamil Nadu Forest Department has recently set up a Wildlife Unit and a Forest Protection Squad, both of which are very active and keep a check on the snake skin industry.

The following excerpts from newspaper reports over the past few years give some idea of the levels of activity in the skin trade : "17,000 snake skins worth over Rs 50,000 were seized from a private tannery in Pallavaram, by the State Forest Department. They included skins of cobras, rat snakes and many other non poisonous snakes, which were procured through unauthorised dealers mostly from Tiruchi District and Madras neighbourhood."

"In the last week of September 1981 a wildlife protection squad busted an underground tannery in Madras from tradition skin centres such as Warangal, Shimoga, Tiruchi, Pudukkottai, Kallupettai, Melur and Kallarkurichi."

In another instance "What they thought was a wild goose chase, led the Forest officials to an unlicensed snake skin tannery near Madras and 11,000 snake skins worth Rs 90,000. Forest personnel were checking the new parcel station of Madras Central Railway station for sandalwood, following a tip that it was being smuggled into the city from Salem. Several hours of search proved futile but when the tired squad was packing off, they encountered a man hurriedly hauling a gunny bag. The officials asked him to open the consignment despatched from Shimoga (Karnataka). To their surprise they found around 350 raw snake skins. Interrogations revealed the existence of the unlicensed tannery at Erukkancheri near Madhavaram. The owner has been charged under Section 44 of the Wildlife (Protection) Act 1972 according to which curing of snake skins without taxidermy licence is an offence. The small-scale tanning unit with a turnover of 20,000 skins a month, must have been in operation at least for six months ... The process which involves removal of excess fat from the skin by treatment with lime for a week and subsequent soaking in solutions containing cassia bark and myrobalan, is very simple though time-consuming and the high percentage of profit made it a lucrative venture. Madras is known for its processing skills and raw snake skins (pre-treated with salt for short storage) from Shimoga in Karnataka, Warangal in Andhra Pradesh and Tiruchi, Puddukkotai and Madurai districts land here frequently ..."

Seizure in Madras

The following are statistics of snake skins seized by the Tamil Nadu Forest Department from 1977-1982 -

Year	Articles	Number
1977-78	Snakeskin bags	36
	Cobra skins	9
	Ratsnake skins	4
1978-79	Snakeskins (cobras, ratsnake, etc)	2,735
	Python skins	3
	Products (handbags, wallets, belts, pouch, etc.)	17

Year	Articles	Number
1979-80	Products	52
	Snake skins	35,304
1980-81	Tanned skins	1,364
	Raw skins	170
	Salted skins	12,458
	Products	934
	Ratsnake skins	290
	Cobra skins	629
	Watersnake skins	1,337
	Viper skins	202
	Python skins	2
1981-82	Raw skins	16,198
	Cobra skins	1,266
	Ratsnake skins	6,064
	Viper skins	301
	Watersnake skins	216
	Products	15

Enforcement of the law is difficult especially when skins are sent in parcels, describing the contents as textiles or something quite different to what is really in the parcels. Like the incident wherein twentytwo of the 26 cases of 'papad' (a crisp condiment) destined for Dubai contained costly snake skins while the remaining 4 had 'papads' but stale and unfit for human consumption. The total market value of the 21,000 snake skins was estimated at Rs 865,000.

In another case of skins going to the Gulf: "Seven packages of snake skin, totally valued at Rs 9 lakhs were retrieved by customs officers from the sea off Mazagon Bunder. The packages had been dumped into the sea by some smugglers from a craft which sank while it was proceeding to the Persian Gulf. The retrieved packages contained 14,000 pieces of snake skin ..."

Inskipp reports that Madras used to be the centre of the snakeskin trade when it was legal and it is therefore not surprising that there are large stocks of skins still held there. A report by the Regional Director for Wildlife Preservation (Viswanathan 1979) listed 27 licensed dealers in Tamil Nadu (all except five in Madras) holding total stocks in September 1979 of 2,774,829 snake skins. Two major dealers had over one million skins each. A more recent stock-take has apparently revealed the presence of a much larger number of skins - possibly as many as ten million snakes.

In Calcutta there were 34 licensed dealers holding total stocks in December 1979 of 2,824,382 snake skins.

In Delhi there were 30 licensed dealers holding total stocks of 89,207 skins in Dec 77, 151,540 in Dec 78 and 158,694 in Dec 79.

Skin trade in West Bengal

The scene in West Bengal is as bad as that of Tamil Nadu, if not worse according to the following first hand information recently received from Calcutta. "According to the main dealer of a snake skin tannery in the village of Brajadhammore (Belmuri Railway Station), he and others are conducting a profitable trade in snake skins. The Santhal tribals who catch the snakes to supply to the dealers, mainly catch rat snakes, cobras, Russells vipers and banded kraits. The preliminary tanning is openly carried out and according to the trader, later processed in a neighbouring cowhide tannery.

Snake skins are regularly sold on certain days in the market of Mayapur. The main snake catchers of Datan in Midnapur district are Muslims and tribals who catch the snakes from Bengal (Sunderbans) and Orissa. Throughout Murshidabad, the potters known as 'Patua' catch snakes and sell their skins regularly in the markets. In Birbhum, near Amodpur Railway station, a locally well known snake skin trader carries on a lucrative business in snake skins.

Some of the major seizures of snake skins by the Revenue Intelligence officers (Central) of West Bengal from 1979 to 1982 are given below :

		Date of seizure	Value in rupees	Place
1.	Skins including snakes and other animals	9.8.79	29 lakhs	Calcutta airport
2.	"	18.7.80	25 lakhs	Petrapole Border (24 Parganas)
3.	"	5.10.81	1.26 lakhs	Calcutta G.P.O and airport
4.	"	12.2.82	1 crore	N.S.D. 'D' Berth Kidderpore dock

Conclusion

The snake skin trade has been cut to a fraction of its former destructive level by protective legislation and, the hard work of implementing these laws by branches of the Forest Department, Excise and Customs authorities. The illegal trade still goes on however and a harvest of several hundred thousand skins continues to be taken. International trade agreements such as CITES and the continued efforts of India's concerned authorities all help to keep snake slaughter to a reasonable minimum. Species like the python which are especially vulnerable definitely need tighter protection if they are to survive.

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To,

Chowdary


WELCOME TO PARTICIPANTS OF
1st IUCN/SSC SNAKE SPECIALIST GROUP MEETING
1982

SNAKEBITES AND ITS EFFECT ON THE SNAKE POPULATION IN SRI LANKA

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Introduction:

In the dry zone of Sri Lanka vast agricultural projects with new human settlements have recently commenced. It was observed that due to this there is an increase in the rate of snake bites (de Silva, 1980). This not only creates a medical problem for the humans but also in the process many snakes are killed and their habitats disturbed and destroyed. This short communication is to show that with the increase of snakebites an equal or greater number of snakes are killed.

Observations:

Epidemiological studies on snakebites have shown that "snakebite" is an occupational and rural hazard, (de Silva 1976, 1980 and 1981). We observed that around 75% of snakebite victims were cultivators (de Silva 1981). This increase (and further increase) could be attributed due to the fact that in the latest agricultural programmes of the country around 100,000 families are being "settled" in the dry zone for cultivation. This means we are creating more vulnerable people and also a greater number of snakes are being killed. Already some of these settlers have moved into the dry zone. Recent observations (de Silva 1981) in these zones showed that the increase in snakebites not only formed a medical problem for humans but also that many snakes get killed by humans and their habitats destroyed during expansion of agricultural projects.

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INDIA'S PROTECTIVE LEGISLATION FOR SNAKES

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The Indian Forest Act, 1879 can be said to be India's first piece of legislation concerning wildlife in as much as basic protection to wildlife in reserved and protected forests was provided by prohibition of shooting, fishing, poisoning water and setting of traps and snares. The elephant preservation act of 1879 and the 1887 Act for the preservation of wild birds and game which became the "Wild Birds and Animals Protection Act" in 1912 were subsequent special enactments applicable to areas in and outside the forests but only to certain specified wild birds and animals notified from time to time. The civil and police departments of the States were responsible for administration of these Acts but actually there was no proper implementation of these Acts and thus there was practically no regulation of hunting or trapping of animals and birds outside the forests.

The National Forest Policy of India, 1952 emphasised the need for according protection to wildlife, particularly rare species. It recommended enactment of special laws besides setting up of National Parks and Sanctuaries. The Indian Board for Wild Life constituted by the Government of India in 1952 opined that adequate legislation should be enacted by the Central Government and the States and that there should be an uniform set of rules and regulations in contiguous States for the effective protection of wildlife.

Though the Government of India had taken action in regard to the banning or controlling the export of a number of species of animals and birds and the products derived from them, it was found that this alone was not sufficient to preserve wildlife unless this was supported by adequate controls on exploitation of wildlife throughout the country. A decision was therefore, taken that the Central Government should enact uniform legislation for the preservation of wildlife and the "Wildlife (protection) Act" 1972 was enacted.

Over-all legal regulations of hunting or/and trapping all over the country (except in the State of Jammu & Kashmir, which has its own Wildlife (Protection) Act)whether inside the forests or outside, commenced with the introduction and implementation of the Wildlife (Protection) Act of 1972. The act totally prohibits hunting (which is defined in the act to include capturing, killing, snaring, trapping, injuring, destroying and also damaging or disturbing eggs) of endangered species and species which, though not necessarily now threatened with extinction, may become so unless accorded rigid protection. Such species are listed in Schedule I of the Act. The pythons and the Indian egg eating snake (Elachistodon westermanni) are included in Schedule I. The protection accorded to the species listed in Schedule I, does not stop with prohibition of hunting but, to be practically effective, extends also to parts

and/or products derived from them and regulates their ownership, acquisition, disposal, sale, trade, transfer and transport. Persons possessing at the commencement of the Act, any captive animal in Schedule I, or its cured or uncured trophy or salted or dried skin are required to declare the same to the Chief Wildlife Warden of the State or the authorised Officer, within 30 days of the commencement of the Act and obtain an ownership certificate with a mark made wherever possible on the article for the purposes of identification. This provision serves to take stock of the species and trophies thereof, already under possession at the the commencement of the Act so that any addition or deletion can be detected at any later stage on verification. The act prohibits any one from acquiring, possessing, selling or transferring any species or produce thereof, specified in Schedule I, without the previous permission of the authority concerned. Transport of any species or trophy thereof specified in Schedule I in respect of which ownership certificate has been obtained from one State to another, requires that the transfer be reported to the Chief Wildlife Warden or the authorised officer of the concerned State within 30 days. Thus, there is provision for control and verification at all stages in respect of pythons and the Indian egg eating snake listed in Schedule I.

All the other families of snakes known to occur in India including the sea-snakes and fresh water snakes are grouped under Schedule IV in the Act and protected. A list of the families of snakes included in Schedule IV is furnished below:

i) Amblycephalidae
ii) Anilidae
iii) Boidae
iv) Colubridae
v) Dasypeltidae
vi) Elapidae
vii) Glauconiidae
viii) Hydrophiidae
ix) Ilysiidae
x) Leptotyphlopidae
xi) Typhlopidae
xii) Uropeltidae
xiii) Viperidae
xix) Xenopeltidae

The Act accords protection for these, by providing that they can be trapped only with a licence issued for the purpose and that any curing or process of taxidermy of the trophy/skin can be done only with a licence. A dealer in or manufacturer of trophies, uncured trophies or skins, cured or uncured, of these species is also required to obtain a licence. The licencees have to submit monthly returns showing their stock, receipt and disposal. As at

present the Government of India have desired the various State Governments (Chief Wildlife Wardens) to desist from issuing any trapping licences for snakes in view of their excessive exploitation hitherto. The dealers are therefore effectively prevented from accumulating fresh stocks causing fresh slaughter for the sake of skins.

A note-worthy departure from the general trend is most of the pieces of legislation in the country, is the provision in this Act regarding "burden of proof". While in most other pieces of legislation the "burden of proof" lies on the prosecution, it is on the accused in this Act. A similar feature in the Act is the provision that all wild animals or articles or trophy or meat derived from them, when concerned in an offence under this Act, shall be the property of the Government.

The Act enpowers any Forest Officer or a Police Officer not below the rank of a Sub-Inspector to stop any vehicle or vessel, search any premises and to seize any captive animal, wild animal, animal article, meat, trophy or uncured trophy, with all tools, vehicles, vessels, weapons etc., used for committing any offence and to arrest the accused without warrant.

Stringent penalty for contravention of this Act is the provision for imprisonment upto two years or fine upto two thousand rupees or both. A minimum punishment of imprisonment of not less than 6 months (but upto 6 years) and also a fine of not less than five hundred rupees is prescribed for offences in a Sanctuary or National Park. Similarly, a minimum punishment of not less than one year and a fine of not less than one thousand rupees are provided for a second or subsequent offence in a sanctuary or National Park. On conviction, confiscation of the property, both Government property and other seizures, to the State is mandatory along with the cancellation of any licence or permit.

This legislation is comprehensive as even the appointment or constitution of authorities to implement the provisons of the Act is provided for in the Act itself, ensuring its implementation. Accordingly the Central Government have appointed a Director of Wildlife Preservation at Delhi and four Assistant Directors, Wildlife Preservation at Bombay, Calcutta, Delhi and Madras. The various State Governments have appointed Chief Wildlife Wardens and Wildlife Wardens.

Another important protective legislation for snakes in India is the institution of comprehensive ban on export of all kinds of snake skins in 1979 by the Government of India under the Imports and Exports (control) Act, 1947 as amended. An idea of the huge volume of trade that flourished in the export of snake skins can be had from the fact that two to three million pieces of snakes skins were exported per annum from Indian Ports during the period 1961 to 1970.

An indirect protective legislation that may serve the cause of a few species of snakes is the Conservation on International Trade in Endangered Species of wild flora and

fauna. The convention ensures international co-operation against over-exploitation of wild flora and fauna through international trade. It provides, in its Appendix I, for very strict regulation over export/import of these species threatened with extinction, which are/or may be affected by trade. Appendix II includes all species which though not necessarily threatened with extinction, may become so unless trade in them is subject to strict regulation in order to avoid utilisation incompatible with their survival. The Indian python (Python molurus molurus) figures in Appendix I. Sand boas (Boidae species) and the Indian egg-eating snake figure in Appendix II of the Convention. India became a party to the Convention in 1976 and is thus assured of co-operation from about 70 other member nations of the Convention.

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ON THE ENDANGERED SNAKES OF BANGLADESH

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Abstract:

Of the 79 species of snakes in Bangladesh at least nine are endangered, several others are vulnerable mainly because of snake hunting for skin and exploitation by snake charmers

Introduction

Snakes are the most feared and hated animals in Bangaldesh. People of all educational backgrounds dread snakes the most since all are poisonous(!) to them. Such ideas are far from the truth. A few species ar e really dangerous to man but most snakes are harmless and are very important in the biologic l control of rodents- a fact unknown to most Bangladeshis. They also consider it a religious act to throw a stone at a snake, even if it does not kill the snake.

According to Whitaker (1978) there are 233 species of snake in India. Of these 180 are non-poisonous and 53 are poisonous. Bangladesh lies between 20°34' to 26°38' N, and 88°01' to 92°40'E. and has an area of about 144,054 km^2; it supports 79 species of snake, including 52 non-poisonous and 27 poisonous species (Khan 1982).

Among Bangladesh snakes, the Indian python Python molurus and the Indian Egg-eater Elachistodon westermanni. are in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). The python has been declared endangered in the Red Data Book of IUCN (International Union for Conservation of Nature and Natural Resources). At least 25 other species of snakes of Bangladesh are either endangered or vulnerable. The distribution and status of the endangered species, the probable causes for their present status, and conservation measures are discussed in this paper. Distribution and status are based mostly on Montaquim et al (1981), Khan (1982) and on my own experiences.

Distribution and status

Python molurus, I ndian python, ajagar (Bengali) -- About three decages back this species had a wide distribution and was present in all 21 districts of Bangladesh. In those days most villages had enough thickets and fallow lands to provide food and shelter for the pythons. Such countryside habitats are gone due to rapid urbanisation and development of the villag es. During the last one decade there are only two records of sightings of pythons outside government controlled forests. Bangladesh has three major types of vegetation- Sunderbans mangrove forest in the extreme south-west corner, moist deciduous or sal forest

in the central belt, and semi-evergreen and evergreen forests along the eastern boundary of the country. The sal forest is almost devoid of pythons. Small populations survive in evergreen forests and populations in the Sunderbans may be viable. Tribals eat pythons, and the skins sell at a ve high price-- about 100 US dollars for a five meter skin.

Python reticulatus, Reticulated python, golbahar -- This is the largest snake of Bangladesh, growing up to a length of over five meters. The species may have never occurred beyond the semi-evergreen and evergree n forests and their environs within the civil districts of Banderban, Chittagong, Chittagong Hill Tracts, Comilla, Noakhali and Sylhet. Within destruction of the forests from between Comilla and Noakhali the species has disappeared there. Present distribution is fragmented. One smal l population survives in patchy semi-evergreen forests of sylhet and another in the similar forests of south-eastern Bangaldesh. The retirula ted python was common nowhere and is now a rare animal. It is persecuted for its rich skin and meat.

Elaphe radiata, Copperhead trinket snake, dudhraj-- The copperhead had a wide distribution both in villages and forests of the country. The village population has sharply declined in the recent past, following large scale clearing of thickets and shrubberies from the countryside. A small population still survives in the forests and their environs. The species is sought by snake-charmers and tribals do eat it.

Ptyas mucosus, Rat snake, darash shap -- The rat snake still has the widest distribution amongst our snakes persecuted for skins. It is often met in the forests and is less common in the villages. Although the number one rodent killer, this snake is killed on sight. Its superficial resemblance to the cobra is responsible for this large scale massacre. Almost eighty per cent of the snake skins sold are by those of the rat snake. The tribals relish it, and it is a favourite non-poisonous snake of snake-charmers.

Chrysopelea ornata, Ornate/Golden flying snake, kalnagani-- It is the most dreaded species in Bangladesh and hence killed on sight. It is also in high demand among snake charmers. This is due mainly to ignorance propagated by the snake-charmers whom have branded it the most poisonous snake of Bangladesh. The ornate snake had a wide distribution in the country. Now it is restricted to the forested areas and a few southern districts (Barisal & Patukhali). Its status in the villages is uncertain. A viable population might still survive in the evergreen and Sunderbans mangrove forests.

Of the non-poisonous snakes, several species are represented by small populations or have restricted distributions in the country. These are undoubtedly endangered in Bangladesh. These are the snail-eaters Pareas monticola & P. macularia; kukri snakes Oligodon cinereus, O.theobaldi & O.dorsalis; blackheaded snakes Sibynophis subpunctatus & S. sagittarius; green rat snake Zacoys nigromarginatus; banded racer Argyrogena fasciolatus; short nosed vine snake Ahaetulla prasinus; cat snakes Boiga multimaculata and B. cynodon; mangrove snake Fordonia leucobalia and Indian egg-eater Elachistodon westermanni.

Out of 29 species of poisonous snakes, 12 species of sea snakes are rather safe from persecution except a few species that get entangled in fishing nets. Most fishermen release them unharmed. The Russell's viper, cobra and krait, however, are killed by the hundreds.

Naja naja naja & N.n. kaouthia, Binocellate/Monocellate cobra, gokhra.

N. naja was widely distributed in the country. During the past decade a substantial number were killed and exported. The cobra, with its wide hood and markings, is easily recognised as a poisonous snake and is killed on sight. It is the favourite species among snake-charmers as it raises its hood and makes false strikes. The cobra is now a rare species in Bangladesh. The snake-charmers are likely to procure them in great numbers from neighbouring countries.

Bungarus fasciatus & B.caeruleus, Banded & Common krait, shankini & kal keotey shap. Both these kraits were widely distributed in the past. At present the former is rare and the latter uncommon. The common krait is still the commonest of the poisonous species, mainly because it is an inconspicuous and unpredictable snake. It normally escapes the eyes of the villagers. The banded krait is killed for its rich, colourful skin.

The other species of kraits, B. walli, B.lividus and B. niger were never common in Bangladesh. The record of their presence based on tanned skins. The species appear to be partial to the northern Rangpur and Dinajpur districts.

I have collected one of the two species of coral snakes likely to be present in Bangladesh. The species are partial to the moist evergreen forests of the eastern side of the country.

Vipera russelli, Russell's viper, chandrabora -- The viper has an uneven distribution in the Bangladesh. It used to be more common west of the Jamuna, west of 90°E. longitude. Now it is uncommon in there and rare in the eastern side of the Jamuna River. Skin trade takes a heavy toll on the viper and may be the lone cause of its decline in the country.

Probable Causes of Population Decline

1. I consider the skin trade responsible for the destruction of the maximum number of snakes in the country. In addition to yearly illegal and legal exports of thousands of skins the local market is literally flooded with snake skins and articles

2. As in many other countries, Bangladeshis are quite ignorant about their snakes. Their hatred is based on misconceptions spread by the snake-charmers.

3. Habitat destruction is responsible for wiping out the village population of snakes.

4. Procurement of live snakes for the snake charmers is important.

5. It is likely that live specimens are illegally exported from the country

Suggested Conservation Measures

1. All trade of snake skins should be stopped, and export banned.

2. All non-poisonous species of snakes should be included in Schedule III of the Bangladesh Wildlife Preservation Act, 1973, thereby affording them minimum legal protection. At present, only two species of pythons, Diard's worm snake and the hookednosed sea snake are listed as such.

3. To make the public aware of the important role snakes play in the biological control of rodents and harmful insects, a "snake park" should be established, perhaps at Dacca. This will help overcome misbeliefs about snakes.

44. Booklets and brochures should be published by competent authorities to make most snakes familiar to the public.

5. Anti-venom serum 'injection) be procured from abroad or produced in the country, should reduce snakebite mortality to a minimum.

Acknowledgements

I am thankful to Mr. Romulus Whitaker, Chairman, snake Specialist Group of SSC/IUCN and Director of Madras Snake Park for arousing my interest in snakes when I was in India between 1974 and 1977. His two field trips to Bangaldesh also helped me to identify some snakes in the field.

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SNAKES UNDER PRESSURE IN THE SUNDERBANS

Because of the export of snakes and their products (veno

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Because of the export of snakes and their products (venom, skin, etc), unnecessary fear, destruction of habitats, indiscriminate exploitation - some species of snakes are under constant pressure on the Indian side of the Sundarbans of West Bengal.

Species under constant pressure are :-

1. Naja kaouthia and Naja naja - overcollecting by snake catchers, skin trade, killed when seen as they are poisonous snakes.

2. Bungarus caeruleus - killed when seen as it is one of the most poisonous snakes.

3. Vipera russelli - skin trade

4. Python molurus - skin trade, habitat destruction

The people of the Sunderbans generally do not kill the rat snake (Ptyas mucosus) as it controls the rat population. They call it 'Bastu Samp' (i.e. the snake of the ancestral homestead).

Snake catchers (particularly tribal people) from different parts of India, come to the Sunderbans every year. Sunderbans people insist that they catch only the poisonous snakes though non poisonous snakes like the bronzeback tree snake (Dendrelaphis tristis), the vine snake (Ahaetulla nasuta) etc. are also caught. The Sunderbans people generally do not let them catch the rat snake from their houses and fields.

It has been seen that the people here are only frightened of poisonous snakes and a few of the non poisonous snakes (as they wrongly consider them as poisonous) as there are very few qualified doctors and proper medical aids. People still believe in the 'Ojhas'. A project on 'How to prevent snakebite' has been started in which leaflets in the local language (Bengali) is distributed to the people giving information about snakes, their behaviour, etc. and good results have been reported.

We are deeply grateful to the Madras Snake Park Trust for kindly supplying valuable information about snakes which enables us to carry out this programme.

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RODENT DAMAGE TO VARIOUS AGRICULTURAL CROPS OF INDIA AND THEIR BIOLOGICAL MANAGEMENT

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INTRODUCTION

Rodents, as vertebrate pests of major importance affect the production, storage and processing of agricultural crops and their eventual utilization by man and livestock for food, fibre and protection. In India, where malnutrition and starvation are known to exist due to disparity between human population and available food, rodents eat about 10 per cent of agricultural production. Moreover, as India is situated in tropical and subtropical regions of the world with green vegetation available throughout the year, the turnover rate of rodents is much faster than in other biomes of the world. In the world, rodents are responsible for the annual loss of about 33 million tons of stored cereals and rice alone (WHO, 1974).

In some fields with important crops in north India, reduction in rodent populations through integrated pest management techniques yielded cost return ratios to the extent of 1 : 900 for vegetables (Advani and Mathur, 1982); 1 1:247 for wheat (Advani, et al 1982 a); 1:220 for stored grains (Prakash et al 1981); and 1:150 per acre of paddy in Sind (Pakistan) (Greaves et al 1977). However hitherto no authentic and quantified information exists for other crops like maize, barley, sugarcane, all tuberous crops, arecanut and oilpalm. Preliminary investigations in cacao and coconut crops yielded information that pods and nuts valued at rupees 500 and 650 respectively can be saved when one rupee is spent on trapping of rodents in plantations (Advani, 1982e).

Damage magnitudes and association of various rodent species with the crops studied so far, are presented.

METHODS

The results presented in this paper mostly pertains to studies conducted in twelve villages near Jodhpur (26° 16'N; 73° 01'E) in Rajasthan state. The population ecology and dynamics of rodents were studied after Prakash (1975), whereas the assessment of damages by rodents to different crops were done after Greaves et al (1977). Control operations were carried out after Prakash (1977).

RESULTS AND DISCUSSION

Vegetable crops

In Rajasthan, studies in twelve vegetable crops in twelve villages, showed a predominance of the Indian desert gerbil, Meriones hurrianae;

Indian gerbil, Tatera indica and soft-furred field rat, Rattus meltada in infested crop fields. The small field mouse, Mus booduga and a gerbil, Gerbillus gleadowi were also damaging the vegetables, mainly tomato and brinjal. The rodent damage to various crops ranged from 4.1 to 19.9 per cent, the average being 8.7 per cent (Advani and Mathur, 1982). As a result of trapping, control and other management practices, rodent populations were reduced by 92.5%. Rodent damage also declined by 91.9 per cent and the production of crops increased by an average of 7 per cent per hectare. The cost benefit ratio of rodent control work was 1:900 (in rupees).

Chilli

Chilli is a main crop of the farmers of Rajasthan and is exported to neighbouring states in India and to middle eastern Arab countries. The average rodent damage to this crop was 11.48, 27.85 and 25.74 per cent at vegetative growth, maturity and threshing stages respectively (Advani, 1982b). With continuous management practices, the relative rodent damage was reduced by 83.54, 89.91 and 87.59 per cent respectively to these three stages of growth. Along with three predominant rodents, M. hurrianae, T. indica and R. meltada, the Bush rat, Golunda ellioti gujerati and Indian palm squirrel, Funambulus pennanti were also captured in high numbers from the crop fields. In several cases, M. hurrianae were found to thrive upon chilli in storage as seen in their stomach contents.

Wheat

In three varieties of wheat, Desi (local), Kharchia (salt tolerant) and Kalyansona (hybrid) the average rodent damage waa quantified to be 18.66, 21.28 and 16.29 per cent respectively (Advani et al 1982a). The cost benefit ratio obtained after two years' work on rodent pest management practices was, 1:247. T.indica predominated the Kalyansona and Kharchia varieties of crop, whereas, M. hurrianae infested the Desi variety, in more relative abundance. A third species, R. meltada which has shown its preference for wheat in the field as well as in storage (Rana and Alvani, 1981) also occurred in moderate densities. Along with rodents, a shrew, Suncus murinus sindensis, hitherto known as insectivorous, was also found to feed upon wheat vegetation (Advani and Rana, 1981).

Millet

About 90 per cent of the farmers of Rajasthan state depend upon millet (summer-rainfed crop) for their family needs. Out of seven species infesting millet, M. hurrianae, T. indica, R. meltada and G. ellioti were the four major rodent pests infesting this crop (Advani 1982c). The damage inflicted was about 15.0, 7.6 and 20.1 per cent at sowing, vegetative growth and harvesting stage. Management of about 90 per cent of the rodent population resulted in a cost:return ratio of 1:267 (Advani et al 1981).

Oil seeds

About 8 per cent of rodent fauna captured during five years studies (1977 to 1981) in twelve villages in Rajasthan, was found to infest oil seed crops, mainly Sarson (Advani, 1982d). R. meltada, E. pennanti, G. ellioti

were three main pests besides the two predominant gerbils infesting this crop. The per cent damage was 5.5, 60.9, 10.8 at sowing, growth and harvesting stages respectively. In Gujarat, about 50 per cent of groundnut was being damaged by field rodents (B.D. Rana - personal communication).

Coconut

In recent studies at Central Plantation Crops Research Institute, Kasargod, rodent damage at a level of 28.5 per cent was evaluated in west coast variety of the coconut (Advani, 1982c). In the hybrids DxT, TxD) and Lakkadive variety it was ranging from 10.2 to 20.5 per cent. The house rat Rattus rattus was the predominant rodent species, making up about 70 per cent of the total. This species is a major pest of stored grains in houses and godowns in Rajasthan (Prakash et al, 1981), with the highest average litter size (6.60±0.10) among all rodents and a 27.03/youngones/female annual productivity rate (Advani 1982a; Rana et al 1982). Other species, the field mouse, Mus booluga and the lesser bandicoot rat, Bandicota bengalensis were also captured from nurseries of coconut. During the flowering of coconut, the Western Ghats squirrels, Funambulus tristriatus also causes considerable damage. In one instance about 250 male flowers and capsules were plucked by a single animal in one hour. Propagation of spores of mycorrhizal fungi through fecal and urine of rodents causing fungal diseases is also a new interesting aspect of research, as found in the Oregon coniferous forests of America (Maser et al 1978). Regular trapping of rodents with local traps for four months reduced the damage by over 60 per cent, resulting in a return of Rs 650, while only one rupee was spent on labour and cost of each trap. In Lakshadweep, as much as 6 million coconuts worth of 35 lakhs rupees are damaged per year (Whitaker and Bhasker, 1978).

Cacao

Heavy damage (75 per cent) by rodents can be seen in any of the farmers' fields having cacao plantations (Advani, 1982e). Species like the long-tailed tree mouse and a fruit bat, Cynopterus sphinx were collected in rodent traps in 1.05 per cent relative abundance of total small mammal fauna. The Inlian flying fox, Pteropus giganteus also damages cacao pods besides crops such as coconut, banana, guava and grapes. Regular trapping of rodents and bats in cacao plots resulted in a cost benefit ratio of 1:500 in plantations near Kasaragod.

Forest plantations

In Rajasthan, due to debarking of stems and roots of important trees like Albizzia lebbek, Prosopis cineraria and Acacia tortilis by rodents (mainly Cutch rock rat, Rattus c. cutchicus), heavy mortality among plants is observed (Prakash, 1974). Similar damage was also observed in A. tortilis plantations in Jaisalmer and in P. juliflora in Great Rann of Cutch (Prakash, 1977).

Grasslands and fodder crops

Nine species of rodents with a preponderance of gerbils, infest grasslands in the western Rajasthan biome (Advani 1982f). In the monsoon

season, rodents damage inflorscence. They feed upon stems, seeds and roots of the predominant grasses (Cenchrus spp., Lasiurus sindicus) grown for livestock, causing great loss in the productivity of grass lands and in turn affect the milk production of the region, which is the source of income for about 50 per cent of the inhabitants of the arid zone. The annual forage feed requirements of gerbils at a density of 400 to 470/ hectare, is about 1,040 kg/ha compared with the annual forage production of this rangeland of only 1,210 kg/ha. (Prakash, 1977).

Soil erosion and desertification

The extensive burrow systems of the desert gerbils and murids as well as their high numbers (as many as 14,000 per 100x100 m plot), is a great danger for soil conservation in Rajasthan. By tunnelling, gerbils c can excavate 61,500 kg of soil in a day per km^2 in crop fields and 10,43,800 kg soil/day/km^2 in uncultivated lands (Sharma and Joshi, 1975).

Destruction to other crops and storage

The results of some studies conducted in a small area for a short term period are tabulated in Table (1). In rural complexes in Rajasthan, regular six monthly rodent trapping and control work resulted in saving of grain worth Rs 220 for every rupee spent. (Prakash et al, 1981).

RODENT PEST MANAGEMENT BY PREDATORS

In regulating rodent numbers, predators play an important decisive role. However, parallel annual breeding cycles and reproduction capability of predators decide their effectiveness in controlling rodents. Reptiles, birds and mammals are some of the major vertebrates preying upon rodents in India. In Rajasthan, two species of monitor lizards, Varanus bengalensis and V. griseus are large, fast and powerful and can help to manage rodent p populations on the ground as well as in the trees. However, due to their diurnal activity patterns, they can prey upon diurnal rodents like Indian desert gerbil, Meriones hurrianae, bush rat, Golunda ellioti gujerati and the Indian palm squirrel, Funambulus pennanti, and raid nests of nocturnal species. F. pennanti remains were collected in monitor stomach contents along with birds, lizards, fishes, beetles, crabs and snakes (Minton, 1966).

Snakes have been found to be promising agents in regulating rodent numbers, Prakash (1962) listed some snake predators as the rat snake, Ptyas mucosus; the earth snake Lytorhynchus paradoxus; five species of coluber; the sand snakes, Eryx johni, E. conicus; the krait, Bungarus caeruleus; the cobra Naja naja and the viper Echis carinatus. In addition to these, Minton (1966) reported that Sphalerosphis arcbarius also feeds upon rodents.

Among birds, recently Jain and Alvani (1982) found that about 66 per cent of the fecal contents of the owl Athene brama had remains (bones, skulls, hairs, etc) of Mus spp. on an yearly basis. Shikra Accipiter badius; tawny eagle Aquila rapax; merlin Falco chicquera and kestrel Falco tinnunculus are other bird species feeding upon rodents (Prakash 1975).

Predation by mammals like the longeared hedge hog, Hemiechinus auritus collaris (Krishna and Prakash 1960), the Indian false vampire bat, Megaderma lyra lyra (Advani, 1981a, Advani and Makwana, 1981). Asiatic jackal, Canis aureus; foxes Vulpes bengalensis and V. vulpus pusilla; Jungle cats, Felis libyca and F. chaus prateri and mongoose Herpestes edwardsii are known to regulate rodent populations to some extent (Prakash, 1975).

Opinion of farmers about predating capability of snakes

In a survey of rodent pest management in three distinct ecological and socioeconomic regions of India (Table 2), 70 per cent of the farmers of Indian desert (Rajasthan) opined in favour of snakes, as promising predators of rodents. Whereas, in Udaipur with different crops and a higher rainfall, the preference for snakes reduced to 46.0 per cent in favour of birds and mongoose (Advani 1980). In the villages nearby Kasargod (Kerala) 42.5 per cent of farmers favoured snakes followed by birds and mammals. As several snake species are abundant in the sandy tracts and dunes of the Indian desert (particularly vipers, rat snakes, sand snakes) and the predominant gerbils construct their burrows in open rangelands, sandy tracts or crop fields, the farmers of this region believe in the efficacy of snakes as predators of rodents. Whereas in the Udaipur and Western Ghat biomes (Kasaragod) due to the thick vegetation cover and forests, a rich predatory bird fauna occurs and the opinion of farmers is divided among snakes, birds and mammals like the mongoose and cats.

CONCLUSION

The ecological management of rodent pests is a very important aspect to be kept in view with reference to their habits, habitats, behaviour, reproductive cycles, breeding propensities and crop preferences. With the continuous use of poisons, the rodents develop resistance as has happened in some European countries (Drummand 1966). Also, the use of higher doses of acute poison like zinc phosphide and placement of poison baits for more than one day has developed bait shyness among murids (Prakash et al 1975) as well as gerbils (Prakash and Jain 1971). Bait shyness persists for even 130 days in the case of the Indian gerbil, M. hurrianae. However, systematic and periodical (six monthly) control operations with poisons and trapping have provided very encouraging results in the Indian desert (Advani et al, 1981) (Advani et al 1982 a, b, Advani and Mathur, 1982, Prakash et al, 1981).

The role of predators (particularly reptiles) is very important in managing rodent populations is the absence of chemical control in backward areas like Rajasthan (Prakash 1962) in particular and India as a whole. To find out the exact status of snakes and other predators vis-a-vis their role in management of rodent and other pests, it is necessary to undertake seasonal studies on stomach and fecal content of reptiles. Even more important is to study the population dynamics and breeding cycles of snake species inhabiting diversified ecological zones of India and the corresponding population cycles and breeding seasons of rodent pests to be managed.

Some studies may be undertaken on the efficacy of snakes and other predators inside parks and under laboratory conditions. In this direction

Whitaker and Bhaskar (1978) have suggested use of non venomous rat-eating snake or monitor lizard, for rodent control in Lakshadweep. The fear among farmers against keeping snakes for rat control may be the biggest obstacle in this direction. However, in forest areas and grasslands this may be done without such a problem.

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TABLE I

RODENT DAMAGE TO VARIOUS CROPS : RESULTS COMPILED ON THE BASIS OF SHORT TERM STUDIES IN INDIA

Crop	Damage propensity	Source
Cotton	57%	Panchabhavi and Thimmiah, 1975
Groundnut	1-4% 12-31 kg/acre	Srivastava, 1966 Bindra and Sagar, 1968
Coconut	3-17%	Srivastava, 1966
Betel nut	20%	Valsala, 1958
Sugarcane	65-97 kg/ha loss 66.50 Rs/ha	Bindra and Sagar, 1968 Gupta et al 1971
Tea bushes	upto 50% (roots)	Verraraghavan, 1966
Barley	5-12%	Srivastava, 1968
Paddy	6-9% 1,400 kg (Storage)	Srivastava, 1968 Spillett, 1968
Sorghum	6%	Srivastava, 1966

TABLE 2

OPINION OF THE FARMERS IN THREE DISTINCT ECOLOGICAL ZONES OF INDIA ABOUT THE ROLE OF SNAKES AND OTHER PREDATORS IN REGULATING RODENT POPULATIONS

Zones	Farmers interviewed	Predators of rodents (% opinion of farmers)					
		Snakes	Lizards	Birds	Mongoose	Cats	Others
Indian desert (jodhpur)	150	105 (70.0)	5 (3.3)	10 (6.6)	4 (2.6)	20 (13.3)	6 (4.0)
*South Rajasthan	100	46 (46.0)	6 (6.0)	15 (15.0)	16 (16.0)	14 (14.0)	4 (4.0)
Western Ghats (Kerala)	40	27 (42.5)	3 (7.5)	8 (20.0)	6 (15.0)	6 (15.0)	- (0.0)

*From Advani, 1980

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THE POTENTIALLY-ENDANGERED SNAKES OF AUSTRALIA

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Jenkins (1979), in a review of endangered Australian reptiles, identified only two Australian snakes as potential candidates for inclusion in the Red Data Book: the elapids Hoplocephalus bungaroides and Neelaps calonotus.

Certainly, the available data suggest that no single species of Australian snake is currently in danger of extinction. However the data are scanty, and although there have been autecological studies of one or two of our larger elapid species, most of Australia's 160+ snake species have not been subject to detailed ecological study. Consequently most of the available data are derived from casual observations in the wild or in captivity, or from studies of museum specimens.

In Australia, the danger to survival of species or regional populations comes from four sources in decreasing order of potential severity:

(1) Irreversible changes in native habitats due to development for primary production (including agriculture, grazing and forestry) or for urban growth. Habitats currently under greatest pressure are lowland rainforests and brigalow.

(2) Direct interaction (either as prey or predator) with the cane or marine toad (Bufo marinus).

(3) Depletion of snake numbers by reptile collectors for trade or private purposes.

(4) Destruction or regular disturbance of micro-habitats by snake collectors or ornamental stone collectors.

Given these various potential pressures it is possible to draw up a somewhat subjective list of snake species at risk. Although my order of ranking might be challenged by other specialists, I believe that most would agree with the selection of species. Typhlopid snakes are excluded from my list because of the dearth of knowledge in Australia concerning their biology, ecology and distribution.

1. Morelia spilotes pilotes (family Boidae) - large and beautiful python restricted to closed, tall open and open forest habitats along the coast and ranges of New South Wales; heavily protected in NSW law as an endangered species but still much sought-after by collectors; probably most threatened because it occurs in the most densely populated part of Australia, where a coastal urban sprawl is not only damaging or removing much of its habitat, but is subjecting the species (especially the young) to heavy predation by domestic and feral cats and dogs; good populations probably remain on NSW south coast and ranges.

2. Hoplocephalus bungaroides (family Elapidae) - a small elapid much sought after by collectors despite stroung protection under wildlife protection laws; however greatest risk comes from disturbance (by snake collectors) or removal (by landscape garden suppliers) of the sandstone slabs under which the species shelters, and by the increasing urbanisation of much of its range; healthy populations probably remain on southern coast and ranges of NSW.

3. Elapognathus minor (family Elapida) - a 'rare' species with a distribution restricted to the most heavily populated area of Western Australia; not subject to pressure by collectors.

4. Neelaps calonotus (family Elapidae) - as for Elapognathus minor

5. Echiopsis atriceps (family Elapidae) - a recently discovered species from a small area subject to major habitat changes; conservation status uncertain.

6. Liasis amethystinus (family Boidae) - Australia's largest python, confined to closed forests in north-eastern Queensland; subject to a variety of pressures including collecting (despite heavy penalties), reduction in available rainforest habitat and predation (especially of young) by feral cats, dogs and pigs; probably good populations remain in more remote parts of its Australian range, while the species is still abundant in New Guinea.

7. Chondropython viridis (family Boidae) - probably the python most sought after by collectors in our region, despite full protection under Queensland wildlife laws; 'rare' in Australia, being confined to small areas of closed forest on the east coast of Cape York Peninsula; status of Australian populations unknown, but still widespread and abundent in New Guinea.

8. Sea snakes (family Hydrophiidae) - at risk for the first time in Australia due to a recent decision by the Australian Government to permit the development of an export trade in sea snake skins (a decision endorsed by the Queensland State Government); the trade appears to have developed out of several bureaucratic retreats to the 'too hard' basket; these include the difficulty of separating specimens taken in territorial waters from those taken in international waters, the difficulty in defining a sea snake (they are effectively 'fish' in Queensland), and the impossibility of knowing whether a sea snake is collected by accident (i.e. in a prawn trawl) or deliberately; it is

the following larger species which are most sought after and most likely to be taken: Aipysurus laevis, Lapemis hardwickii, Astrotia stokesii, Hydrophis elegans, Hydrophis ornatus and Hydrophis pacificus. Action to protect these snakes can only come through their inclusion on one of the CITES appendices, but the trade is too new in Australia to gauge its effect on sea snake populations.

9. Several species of snakes are reported to have suffered serious or even devastating reductions in population density as a result of their interaction (rimarily as predators) with the cane (or marine) toad, Bufo marinus. These include the colubrid Styporhynchus (previously Amphiesma) mairii, and the elapids Pseudechis australis, Pseudechis porphyriacus, Oxyuranus scutellatus, and Hemiaspis signata, while some pythons are said to be affected. All of the available data are anecdotal in origin, and there is a clear need for quantified ecological studies to explore the validity of these assertions.

It should be emphasised that only with increased research effort on taxonomy and geographic variation are we likely to be able to identify intraspecific taxa which may be under threat. Recent studies of widespread 'species' have demonstrated that some regional isolates (whether or not they be recognised taxonomically) are seriously declining.

In conclusion, a number of snake species in Australia have suffered major reductions in numbers or eradication at the local or regional level, due primarily to structural and biological changes in their habitats as a result of human activity for agriculture or urbanisation. However there has as yet been no clearly identified case of a species seriously endangered to the point where it may face extinction.

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METHODS OF CONSERVATION OF UROPELTIDS

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It is difficult to formulate one or two uniform methods to all species of Uropeltid snakes because the habitats differ much.

1) Rehabilitation is possible where total destruction of habitat has taken place either by inundation or heavy rain or deforestation.

2) Conservation centres may be established.

3) Sanctuaries may afford ample protection for many species of a similar climate. Earthworms of different types may be brought and cultivated in one area. It is easy to provide sufficient organic manure like humus and cowdung. Even soil of different pH can be mixed up. In Nalu mukku tea estate (Tinnevelly hills) two different species, Uropeltis liura and Teretrurus sanguineus, coexist in the same area where soil of two different nature and two different species of earthworms are mixed up.

4) In their own habitats enriching the soil with organic wastes may help in increasing the quantity of earthworms. This may lead to increase in Uropeltid populations.

5) Providing sufficient ground flora in the forests, grasses, ferns and various herbs may offer shelter and food for earthworms and Uropeltids.

6) Allowing a compulsory border -land in the plantations between roads or pathways and coffee wastes will maintain the Uropeltids species in respective areas.

7) Planting trees, where deforestation has been heavy making the land barren, brings back the species that have migrated.

8) Inundated fields leave large bunds at intervals. This may retain the species.

9) Many species of Uropeltids may adapt themselves to changing environments provided moisture and earthworms and shelters are available. Therefore regular conservation centres can be easily provided for the preservation of Uropeltid snakes. These are harmless snakes which do not cause any skin trouble. People are afraid of handling them: the prevalent sayin is the fingers rot and break to pieces when touched. Public education emphasising their esthetic and economic value might help a lot in preserving different species of Uropeltids from destruction by man and domestic animals.

10) Diseases like mouth rot and infestation by round worms do not seem to be common; controlled animals when brought to conservation centres may be isolated and treated.

11) Precaution should be taken in preventing large scale onslaughtof pigs which devour Uropeltids.

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Snake skin in India is much in demand in the internal leather trade and industry as well as in foreign market. Poisonous snakes are also heavily exploited now for extraction of venom and also for their skin. Destruction of forest, extension of agriculture and establishment and extension of human settlements are some of the immediate causes which have limited snake populations in India, but fear and abhorrence by human beings is another important factor in restricting snake populations. Many people are ignorant of the useful part snakes play in maintaining the balance of nature.

Our first aim should be to find ways and means to educate people for conservation of snakes through all the available mass media. We should try to teach people that all snakes are not harmful, and even poisonous snakes are also useful. They are helpful in controlling harmful rats, mice and insects. We might refer to the important role played by Bungarus fasciatus (Schneider) in protecting fishes in our ponds by eating fish-eating snakes.

In India a species wise survey of snake has not been carried out. We don't know the exact status of even the most commonly exploited nonpoisonous and poisonous snakes. From our field experience we can definitely say that the most commonly exploited snakes such as Python, Eryx, Ptyas etc are now much less common in some areas where they used to be abundant just twentyfive years ago. Therefore, we should request organisations and institutions to develop methods and contribute funds and facilities to carry out surveys of snakes. particularly those species which are at present most exploited.

A list of species follows (Table 1) which I think are most exploited and gradually becoming less common than a few years before. They urgently need protection. Snake skin is now banned for export by the Indian Board of Wildlife but huge quantities of snake skins are still being illegally exported. Recently, Calcutta customs officers have illegal exports detected of such skins. Killing snakes in the country has not stopped, and even when banned it continues because of the demand of skin in the international market. Snake leather will continue piling up in the godowns of leather merchants. These merchants will continue putting pressure on the Government for export licenses and also indulge in ill trade.

Table 1. LIST OF SOME COMMON ENDANGERED SNAKES OF INDIA

(The names in /- -/ are local names)

Species	Common name	Distribution	Economic Importance
Python molurus Russell	Indian python, Rock python, (Ajagar).	Sri Lanka in the south, Sind & Punjab in the west and West Bengal in the east.	for skin
Python reticulatus (Schneider)	Reticulated python	Nicobar Island	"
Eryx johni johni (Russell)	John's sand boa (Lal Dumukho, Ghugi)	N. Western India Sri Lanka (very rare).	"
Eryx conicus russell	Russell sand boa, (Thutur)	Whole India exceptin; Eastern side	"
Ptyas mucosus (Linn.)	Rat snake, (Dhamin), (Darash).	Sri Lanka, whole of India; Andaman	
Chrysopelea ornata (Shaw)	Golden tree snake, (Kalnagini). Flying snake	Bihar, Orissa & W. Bengal	Skin as decorative purpose, pet & snake chamer for show
Ophiophagus hannah (Cantor)	King cobra, (Sankhachur, Ahi Raj).	Whole of India	Poison & Skin

I propose that two immediate conservation actions be considered in case of species which are becoming rare due to exploitation or habitat destruction.

First, some particular areas of Reserved Forests should be declared sanctuaries for the particular species which still thrive or once used to thrive there, after properly investigating the cause of their decline. For example, the Manibhadra pahad (Hill) are a near Gonia in Puri Dist., and Chandaka Reserve Forest area of Cuttack Dist. of Orissa wer e well known for occurrence of Indian python, but now athe species is rare in these forest areas. The pressure of exploitation of this species in these areas is much more than any other places in Orissa, perhaps due to their close proximity to cities such as Cuttack, Bhubaneshwar and Puri. Adjoining Reserved Forests of these big cities are supply houses which swell snake skin to the cottage industry for manufacturing shoes, handbags, belts, purses etc.,

I do not think that banning exploitation of a species, restricting skin exports, or encouraging mass education programms sufficient for successfully saving a species which is economically and commercially important in a underdeveloped or developing country. I think we should try to satisfy the need of the market by captive breeding or farming methods. If we forget this aspect of conservation, poaching will undoubtedly increase. In this connection I wish to mention that Nandankanan Biological Park is most experienced in breeding and rearing pythons in captivity. Start here I wish to leave the matter of the poisonous snakes of India to our Chairman, who has much experience with them in the field as well as captivity.

Some of the very rare snakes of the Indian subcontinent mostly occurring in the Indochinese and Oriental subregion) are mentioned below. Most of these species may appear rare because proper surveys have not been made in their ecological niches or habitats. For their conservation we must know their status. For example, the species Elachistodon westermanni Reinhardt, the Indian egg/eating snake was previously known only from Mal, Jalpaigur Dist., North Bengal and Purneah, Bihar. At present, it has been further recorded from Chitwan Dist., Nepal and Nainital Dist, Uttar Pradesh (Corbett National Park). Now we can state that the species is widely distributed in the forest of Duars and Tarei. Due ot its arboreal habit it is not easily collected and was therefore considered a very rare species.

Therefore, I propose forming a working group of herpetologists of India belonging to different institutions who will decide which are the rare species of snake here. It would organise and undertake status surveys for each of these species, prepare data sheets, decide the cause of the rarity and finally suggest management methods which they consider necessary. At present, though the Zoological Survey of India is working efficiently in this field, the strength of its herpetology division is not sufficient to undertake such a big responsibility alone. Some herpetologists belonging to Madras Snake Park, Bombay Natural History Society and Universities should be able to do also good work in this field.

Table 2: LIST OF SOME RARE SPECIES OCCURRING IN THE INDIAN SUBCONTINENT

Typhlops psammeces Gunther	Madras, S.India	Only type sp. known
T. thurstoni Boettger	Nilgiris, S.India	Only 4 type sp. known
T. leucomelas Boulenger	Galle, Sri Lanka	Only type sp. known
T. tenuicollis (Peter)	Himalayas & Naga Hills, Assam	Only 2 type sp. known
T. oatesi Boulenger	Andamans	Only type sp. known
T. bothriorhynchus Gunther	Assam	Only type sp. known
T. andamanensis Stoliczka	Andaman	Only type sp. known
Opheodrys hamtoni (Boulenger)	Mogok, Burma	Only type sp. known
O. doriae (Boulenger)	Assam, U.Burma, S.E.Yunnan.	Only 3 type sp. known
Contia memahoni Wall	Quatta, Baluchistan, Palistan.	Only 4 type sp. known
Contia memahoni Wall	Sind & W. Punjab	Only 4 type sp. known
Lytorhynchus paradoxus (Gunther)	Afghan Baluchistan Border	Only 3 type sp. known
L. mynardi Alcock & Finn	N.Thailand	Only 4 type sp. known
(Oligodon joynsoni (Smith))	Namsang, Assam	Only type sp. known
O. erythrorhachis Wall	Gopaldhara, Darjeeling Dist.	Only 2 type sp. known
O. juglandifer Wall	U.Rotung Valley	Only 2 type sp. known
C. melazonotus Wall	Tindharia, Darjeeling	Only 2 type sp. known
O. melaneus Wall	Sandowy, Burma	Type & only known sp.
O. mcdougalli Wall	Tongking	Only type sp. known
O. lacroii Angel & Bourret)	S. Annam	Only type sp. known
(Calmaria uniformis Smith)	Peninsular India	A rare species
Dryocalamus gracilis (Gunther)	Pegu, Burma, Nicobar	Only type sp. known
Sibynophis bistrigatus (Gunther)	Nicobar	Only type sp. known
Natrix nicobarensis (Sclater)	Sibsagar, Assam	Only type sp. known
N. peali (Scalater)	Cherrapunji, Assam	Only type sp. known
N. xenura (Wall)	Bufma	Only type sp. known
(N. bellula (Stoclczka))	Tong-king	Only type sp. known
N. angeli Bourret)	Pirmad, Kerala	Only 3 type sp. known
Boiga dightoni (Boulenger)	N.Bengal, Assam	Only 3 type sp. known
Bungarus lividus Cantor	Andaman	Only 4 type sp. known
B. Andamanensis Biswas & Sanyal	Shevaray Hills, S.India	Only 2 type sp. known
Callophis beddomei Smith	U. Burma	Only type sp. known
Trimeresurus kaulbacki Smith	Nicobar	Only 2 type sp. known
T. labialis Fitinger		

The list will also show that except for some common and widely distributed species like Typhlina bramina most of the species belonging to the families Typhlopidae and Uropeltidae are called rare mainly due to their burrowing habits. Our knowledge mainly depends on chance collection. However, these burrowing snakes should be surveyed by more technically improved methods.

I have not listed any species belonging to the family Uropelitidae because most of them come under the category of rare species having very localised and limited distribution, such as Nilgiri, Anaimalai, Palni, Tinnevelly, Sirumalai, Bombay and the W. Ghats hills of S.India. Fortunately, there are areas in these hills comes within the Reserved Forest and National Park, where agriculatural practices and land management against the living conditions of the uropeltids are not usually carried out.

The species marked in the above show that there are more rare species in northeastern India. This may be due to the difficult and inaccessible terrain in this region which could not previously be surveyed properly; hence we may have incomplete knowledge of their distribution.

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THE ROLE SNAKES PLAY IN EDUCATION, IN UNITED STATES ZOOS

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Throughout recorded history, the serpent has been worshipped and feared, immortalized in legend, maligned, respected, reviled and studied. Few creatures elicit the response of terror in man, as does the snake. Man's curious interest is often spurred on and excited by his attraction for the unknown, the misunderstood, the bizarre and the deadly.

Since time immemorial, serpents, both real and imagined, have crept into man's homes, religions, dreams, art, literature, and deepest apprehensions. Our knowledge of snakes, their ways and abilities, although often erroneous and misinterpreted, are among the first bits of zoological information learned early in life, imprinted by fear and retained vividly in our recollections. Most of us cannot recall the first time we observed a cat, bird, or fish. However, I would venture to suggest that most of us remember our first encounter with a snake, or stories of frightening experiences and encounters related by others. Let us imagine for a moment how well remembered the Biblical story of Adam and Eve would be (Genesis, Chapter 3 : 1-2), if Eve had been tempted in the Garden of Eden by a common chicken ? Would the story of Moses casting down his rod before Pharoah (Exodus, Chapter 7 : 1-12) hold as much significance if the staff had turned into a floundering fish or methodical turtle ? I think not. It would seem that the use of snakes to convey a theme or message is hardly unique to modern methods of education.

Snake appeal does not seem to be limited to any single society, ethnic origin, age or religion. The cults of serpent worship are known through the world : Egypt, Judea, Greece, Rome, Dahomy, China, India, and exist today in the southeastern mountain communities of the United States. Serpent symbolism manifests itself universally; phallically, implying continued life; curatively, as the Staff of Asclepius; and as a ward against snake bite, the misfortunes of evil, and as talisman of good fortune, good health and long life.

Therefore, it is little wonder that visitors to zoological collections around the world flock in the greatest numbers to view displays and demonstrations involving snakes. There are over 230 major zoological collections in the United States. More people visit zoo's annually than attend all sporting events combined. Nearly 70 percent of the visitors to a zoological park with varied collections of wildlife, make it a point of visiting the reptile exhibits, which usually feature snakes as the prime attraction. As of January, 1982, U.S. reptile and amphibian collections included 382 genera, 952 species, and 1,352 forms. (Inventory of Reptiles and Amphibians in Captivity, 1982. Frank Slavens, Wonderland Zoological Gardens, Seattle, Washington, U.S.A.).

Audience attraction to these most popular displays and demonstrations offer educators a unique opportunity to present to young and old alike, in an entertaining and informative manner, concepts of ecology, biology, conservation, animal behaviour, and the basic premise that man exists on this planet in concert with all forms of living things.

Snakes are presented to the public using various techniques to convey educational messages. Through live demonstrations, the visitor may view harmless species as friendly animals, under the control of a keeper or trainer. On the other hand, poorly conceived performances which are designed to instill fear and terror in the visitor, usually have a counter-productive effect, and promote the killing of snakes when they are encountered in the wild. Educational demonstrations may focus on the snake's natural capabilities, such as locomotion, behavioral displays, and the animal's abilities to secure prey. It is during the course of such demonstrations, frequently associated with holidays or other festive occasions as a supportive theme, that members of the public, particularly children, have the opportunity to observe snakes under carefully controlled conditions, safely and with objectivity. For many, the experience will be long remembered as the first non-frightening encounter the participant has had with a bizarre creature. The lesson taught is basic : that snakes are living creatures like any other animal. A well informed lecturer, emphasizing the beneficial role snakes play in the biological community, may at the same time reinforce the lesson by allowing the visitor to touch the snake, and establish for himself that the animal is flesh and blood like any other, and is perhaps even attractive and amicable.

Once fear is challenged by reason and personal experience, the door is opened for broader introduction. Displays of even deadly species can demonstrate, if adequately supported by interpretive graphics and labels, adaptations to climate, habitats, and relationships to other animals in the ecosystem. Concepts can focus on native species, familiar to the visitor, and broaden his awareness by comparing and contrasting the same concepts to the habitats and ecosystems of exotic species of other lands.

The importance of conservation, involving snakes as well as other forms of wildlife, can be brought to attention by focusing on the economically beneficial role snakes play in controlling destructive and disease carrying mammals. By displaying a live animal, particularly with her young, and pointing out the quantity of food she and her offspring consume, the point can be made. By adding a display showing a commercial skin manufactured from the same species, the visitor can be made acutely aware that a living animal is represented by every skin taken, and that the loss of great numbers of any species can alter the function of an entire ecosystem. The ultimate effect is upon man himself.

The identities of potentially dangerous venomous species are often most vividly portrayed when displayed live, and in contrast to harmless similar looking species. Venoms, fangs, defensive behavior, as well as proper snake bite therapy, can be presented with inter-

pretive graphics and labels. Audio visual presentations or displays which encourage visitor participation may add to the learning experience. So do the exhibition of species in natural habitat settings.

At the New York Zoological Park, the visitor is introduced to reptile physiology and reproductive biology through a "Reptile Nursery", the first of its kind in the world. Visitors see more than three to four hundred baby reptiles born annually in the collection. Snake eggs are incubated in full view of the public, and may hatch as the public watches. Children and parents alike are delighted. A keeper or courteous attendant is frequently on hand to answer questions and add to the visitor's experience, offering new insights into the world of animal reproduction and maternal care.

Surveys have shown that most repeat visitors to zoological parks and displays were introduced to them by their parents, as part of a happy family experience, and were prone to renew that experience with their own children over and over again. Thus the concepts of education and conservation are seeds, which when thoughtfully and tastefully are presented to the inquisitive mind of a small child, can bear continuing fruit and awareness for generations to come.

Snakes elicit a unique excitement and interest from the public which few animals convey. The utilization of snakes for educational purposes is limited only by the imagination, resourcefulness, and capacities of the zoological institution and the interests of its staff.

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CAPTIVE PROPAGATION OF ENDANGERED SNAKES AS A CONSERVATION TOOL

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Introduction

The need for captive propagation of snakes may become imperative as populations of a wild species go below a certain safety level, enough to classify it as vulnerable or endangered. Remarkable success has been achieved in the captive breeding, rearing and rehabilition of endangered species of crocodilians worldwide so that a fairly thorough 'cook book' can be had for most endangered crocodilians today. Work on the captive breeding of endangered snakes on the other hand has been, at best, haphazard. No coordinated attempt to breed, rear and rehabilitate a threatened snake species in its native habitat appears to have been undertaken. This short paper does not attempt to provide an exhaustive manual for the captive breeder, but enumerates the problems involved in such an endeavor and suggests guidelines to overcome those difficulties.

Literature :

A review of the literature discloses only too clearly the paucity of information on captive breeding of snakes. Most of the records that are available come from zoos or snake parks from around the world. Many of these institutions have no special interest in snake breeding and often breeding occurs accidentally rather than intentionally. Consequently a great deal of information regarding copulation, gestation, hatching, size and disposition of young, mortality rate and so on is lost. Also sometimes, breeding results from wild caught females and the abovesaid information is unavailable. Another reason for the dearth of information is that many private collectors who do succeed in breeding a species do not publish their findings.

Aim of captive breeding :

The ultimate goal of any captive breeding programme should be to rehabilitate an endangered species in its native habitat to replenish diminishing populations. This requires that the species in question should be bred in its own country. This has several advantages which will be discussed later.

Proper habitat management and protection is the most important aspect of conservation. This is normally enough to improve the status of an endangered animal. Captive propagation is not a substitute for habitat management and captive breeding and restocking is worthless if the habitat where they are to be released is inadequate or unsuitable.

Before any breeding program is attempted several basic questions need to be answered.

1. Is the species to be bred endangered, and if so, to what extent ? Is it diminishing throughout its range ? For what reason ? Is a full term breeding program essential/justifiable ?

2. What are the specie's requirements ? Has any work been done on its habits in the wild ?

3. Is there adequate suitable protected habitat for the release of the captive reared animals ?

4. Is there enough man power and money for monitoring the released animals ?

5. Is the species given adequately implemented paper protection ?

First it is necessary to establish the status of the animal concerned by extensive surveys throughout the area the animal is known to occur. A knowledge of the animal's biology, specifically, its breeding biology in the wild, is necessary for the success of the breeding program. A simple mistake such as wrong sex ratio, sub-optimum temperature or altered photoperiod could make the breeding program unsuccessful even if other factors are favourable.

The three main ingredients to start a breeding program viz. funds and facilities, enough animals and knowhow are usually available only in well established zoological gardens. Most of these institutions however, unfortunately, are more interested in maintaining collections comprising many varieties. While this may be more interesting to visitors and good for the prestige of the institution, it contributes little towards the conservation of individual threatened species. In a conservation oriented zoo emphasis would be not on displaying a larger variety but on maintaining viable breeding groups of endangered species.

Having established which species are most in need of captive breeding within a country, several zoos could take the responsibility of rehabilitation, each zoo or park specialising in a particular species. A prevalent drawback among zoos in India and other third world countries is a lack of communication. To overcome this problem and to facilitate easy access to information, a snake breeding data centre should be established in each country or region which would regularly receive bulletins from the various breeding centres and publish annual reports on progress made, techniques, etc.

Existing Sanctuaries and National Parks could be made use of for releasing the captive reared animals after establishing that the area meets the habitat requirements of the species and after ascertaining its carrying capacity. Legislation protecting the animal, if not already in force, should be implemented and publicised.

Most important of all, an endangered species should be bred in its own country if the efforts taken for its propagation are to be fruitful. There is conservation value if zoos in America are successful in breeding large numbers of an endangered Indian snake but are unable to rehabilitate them in their native habitat due to political and monetary reasons. Even if it should be possible, the costs involved would be phenomenal.

STRATEGIES AND TECHNIQUES EMPLOYED IN CAPTIVE BREEDING :

Different species vary in their thermal, nutritional, subtrate and seasonal requirements. It is therefore impossible to generalise on what strategies or techniques one should employ to achieve breeding. The suggestions given here are applicable to all snakes in a broad sense but must be adapted to meet individual species requirements.

A thorough knowledge of the physiological and environmental factors affecting reproduction is essential for the success of a breeding program. It is beyond the scope of this paper to go into the details or all the factors concerned with reproduction. Crews and Garrick (1980) recognise three broad categories of environmental stimuli that profoundly influence reproductive physiology, and which can be manipulated in the captive setting -

a) Climatic Stimuli : Light, temperature and humidity.

b) Physical Stimuli : Space, habitat and food; and

c) Social Stimuli : Behaviour of conspecifics and species typical social organisation.

Climatic stimuli :

Temperature, humidity and photoperiod, besides many other factors have an influence on reptile reproductive behaviour. In nature animals often get the cues that start their reproductive cycles from the "Length of day rather than the more obvious seasonal change in temperature." (Bates, 1961, cited by Jones, 1978). Enclosure temperature and relative humidity have to be determined based on the species concerned. It is obvious that the requirements of desert species will vary greatly from those occurring in moist climes.

The influence of photoperiod, (ie. the length of time during which an animal is exposed to sunlight) is considered by some workers as more important than was previously suspected. Jones (1978) recognises it as "an important factor which may increase reproductive potential in captive reptiles" and states that "the effects of exposure can be negligible or severe depending on wave length (color), intensity, changes in either of these, length of exposure time" (and so on). Citing Aronson, he further states that "one of these effects can be an increase in gonadal size and hormonal activity." Artificial lighting and heating are normally unnecessary when a species is raised

within its distributional range. However, if a species is bred outside its country, photoperiod can be computed on the basis of the latitude of the wild population.

Physical stimuli : space and habitat

Housing :

Spatial and habitat requirements differ according to whether a species is aquatic, arboreal, terrestrial or subtarranean in habits. Many workers have noted that breeding occurred more often when the animals were housed in undisturbed quarters than when in public display cages. While public display cages have to be esthetically pleasing and suggestive of the animal's natural habitat, this is not a must for breeding enclosures. In fact, the simpler the cage design, the better. The enclosure should require minimal maintenance and should suit the habits of the species housed. A thermal gradient should be provided for the animal to choose from. For species raised within their distributional range, a simple enclosure comprising of interconnected indoor and outdoor units works admirably. In tropical countries the indoor enclosure could be maintained at a comfortable 80°F with the help of a desert aircooler during the hot months. Most reptiles like to hide and hence hide boxes and hollow logs should be provided.

Food :

A non-standardised feeding schedule comprising all the essential vitamins and minerals is an important factor. Calcium for instance, is particularly important for egg production. Since these elements are present in appropriate quantities in natural prey, it is best to feed thd snakes on live or freshly killed food as far as possible. The quantity and frequency of feeding have to be determined for each species and sometimes, for each individual. Frequent feedings to juveniles to hasten growth, and subsequently, sexual maturity, though attractive, may actually be detrimental to the snake's health and should be avoided (Huff, 1980). This is particularly applicable to boids which tend to become overweight in captivity and lapse into captive stagnancy, a condition which will be discussed later.

Social stimuli :

Many herpetologists are of the opinion that the sexes should be maintained apart for most of the year and put together only during the breeding season or when copulation is desired. Or a pair may be temporarily separated and then reintroduced. The hypothesis behind this is that such a move renews tactile and olfactory stimulation and promotes courtship and mating.

Sex ratio :

Most often, the desired sex ratio for a particular species is either unknown or unavailable. A common strategy is to rotate a single

male among several females or introduce a female into an enclosure containing several males. Whenever possible, however, it is better to have more males per female. Sperm viability tests should be carried out on each male in the breeding population to ensure that sterile males (if any) are not allowed to mate. It is also important that the male and female come from different stocks. Inbreeding can deteriorate the quality of further generations and hence has to be avoided at all costs.

Sex determination :

Sex determination in snakes is not difficult after practice and experience. The hemipenis-eversion and probe techniques are effective.

Dormancy :

A common problem with animals that have been together in captivity for too long is that they tend to become lethargic and lose all interest in sexual activity. Huff (1980) has aptly termed this condition "captive stagnancy" a condition "Characterised by the snake becoming so accustomed to routine that it becomes lazy, lethargic and generally inactive". Snakes exhibiting such a condition will seldom breed unless a change is effected in the routine. Change in feeding schedule, type or quantity of food offered and other interruptions or alterations in the maintenance of the reptile are recommended for breaking captive stagnancy.

Artificial stimulation to induce mating :

Various types of artificial stimuli have been used to induce mating in dormant reptiles. The release of musk, brought about by aggression between males in a breeding group is known to play an important role in bringing the sexes together initially, and subsequently stimulating courtship. The release of musk may sometimes be brought by manual prodding, slapping or poking (Huff, 1980). Subjecting them to an unnatural situation or moving them to different quarters may also be effective in inducing mating. A pair of pythons at the Madras Snake Park started to copulate after they had been transported together in a cloth bag by jeep. A pair of Jamaican boas at the Columbus Zoo reportedly did not copulate till their unit was housed with water. From these few sketchy records it can be seen that the stimuli in each case had been different. A knowledge of the habits of the species concerned could yield valuable information as to which stimulus (if necessary at all) would be most effective.

Post coital care of females :

It is thought advisable to shift females to separate, undisturbed quarters after mating. Many boids brood their eggs till hatching and may not feed during this period of 50-60 days. While this voluntary starvation may not adversely affect a normal female, it could severely jeopardise the life of an undernourished snake. Female snakes should

therefore be induced to feed prior and after copulation, if necessary supplementing the diet with a well balanced vitamin-mineral preparation. Gravid females may be injured by larger specimens crawling over or laying on them.

Artificial incubation of eggs :

The success or failure of a breeding program depends a great deal on this crucial factor. The incubator can be a wooden box, plastic container or glass jar and the substrate damp paper towels or sterile sand. These are of relatively less importance. The two key factors to successful incubation are temperature and humidity. Some general guidelines are outlined below :

1. Temperature is the most critical factor. In the native environment, the eggs can be incubated at normal room temperature. When artificial heating is provided, stability of temperature should be maintained. Unnatural or drastic fluctuations can kill the developing embryos. Similarly temperatures too high have known to produce congenital defects in many species while too low temperatures produced stunted hatchlings. Optimum temperatures for eggs of many species have to be determined by trial and error or by utilising data available on related species.

2. Humidity should be relatively high. On no account should the eggs be allowed to dry. Low humidity often causes eggs to shrivel and die.

3. Incubators. At the Madras Snake Park we have successfully incubated the eggs of many snake species in plastic boxes. The substrate we commonly use is sterile sand. The eggs are placed in a row centrally, as many as the box will hold. The eggs are placed over the substrate and not buried under. Since the sand tends to absorb moisture, water is sprayed along the edges when the eggs are first placed in the box. Further watering is done if the eggs show even the slightest signs of denting or drying up. Water condensed on the lid is wiped off each morning. All eggs are pencil marked on top at the time of placement to ensure that if removed from the box later they can be placed back in the original position. As far as possible the eggs are not disturbed or handled. Without quantitative data we have found hatching rates in undisturbed eggs is higher than that of those which have been disturbed or moved about after commencement of incubation. Agglutinated eggs are separated soon after being laid and incubated separately. The lid of the incubator should be sealed properly or neonates may escape. The incubator should be protected from predators and ants. Spoilt eggs may be discarded. Growth of contaminants such as mold and fungi is usually a sign that the egg has died (Ross, 1980).

4. Eggs should not be opened to see if they are fertile. This does not give any useful information. The opened egg, if fertile,

may be the only fertile egg, and if infertile may be the only infertile egg (Ross, 1980).

5. Potentially gravid animals should not be x-rayed unless absolutely essential. X-rays are potent teratogens and may kill eggs or developing young outright or cause congenital defects in them.

Care of young

The most serious problem faced in bringing up hatchlings is food. The hatchlings of many snakes like pythons are fairly large at birth and readily feed on baby chickens, other small birds and baby rats. But smaller and more choosy hatchlings may pose difficulties. In such cases, the snakes have to be force fed till they are ready to eat by themselves. At the Madras Snake Park we have successfully raised hatchlings of several species of snakes on gecko tails, beef or frog flesh, supplementing their diet with vitamins when found necessary.

The snakes are not generally "force" fed; rather the food is gently inserted into their mouth. This is usually enough to encourage natural swallowing. It is noteworthy to mention here that many snakes that were raised on the diet have grown normally and have not shown any signs of deficiency as they started feeding on live prey within a few days to few weeks.

Release of captive bred specimens :

Sites chosen for release should be carefully selected after ascertaining, among other things, if whether there is enough food and cover. The snakes should be clipped for future identification and their length and weight recorded at the time of release. A simple yet excellent clipping system is described by Brown and Parker (1976). Recapture data can give valuable information regarding growth, movement and also as to how the population is faring. Sloughed skins can also be used to gain a rough idea about population statistics. For obvious reasons, the snakes released should be at least half adult size for small sized snakes and at least quarter size for larger species like pythons. This greatly increases their chances of survival as they are able to fend for themselves better than very small specimens.

Discussion :

Several important points have been only mentioned in passing or omitted altogether. The use of hormones or artificial insemination have not even been touched upon. As emphasized in the introductory paragraph, this paper merely serves to focus attention on this aspect of snake conservation.

In conclusion I would like to touch upon the ethics of maintaining endangered species in captivity. Anybody who maintains such animals bears the obligation and responsibility of ensuring their safety and productivity. Many zoos, particularly in third world countries still carry on the wasteful

practice of maintaining non-breeding populations or individuals of endangered species just to add variety to their collection. These same animals could contribute to the conservation of the species in the proper hands. Institutions with such animals should either start their own breeding units or loan their animals to breeding centres. Captive bred animals are not only useful for restocking but can also greatly help in reducing the pressure on wild population. Captive reared animals, when sold to other institutions, settle down and breed more easily than wild caught individuals which may take a long time to get acclimatised to captive conditions.

Finally, it should be remembered that conservation of the habitat is our best bet. As Honegger (1980) rightly points out, the impression that captive propagation can be a substitute for sound environmental conservation must be carefully avoided.

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This paper was prepared for and presented at the 1st meeting of the IUCN/SSC Snake Specialist Group, November 8 - 12, 1982, at the

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Perur Post Office
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ROLE OF INDIAN ZOOS IN SNAKE CONSERVATION

... L.N. Acharjyo
Nandan Kanan Biological Park
P.O. Barang, Dist. Cuttack
Orissa 754005
INDIA

Out of over two thousand species of snakes found in the world, more than 200 species of snakes occur in India and they are spread over almost throughout the country upto a height of approximately 5000 metres in the Himalayas. Though only about 50 species of Indian snakes are venomous and though four of them (the cobra, the krait, the Russells viper and the saw-scaled viper) are really dangerous, the very sight of one and all snakes creates a fear psychosis in the mind of the common man. There are several tales, superstitions and myths concerning snakes, all over the country. Ignorance about this group of interesting reptiles is mainly responsible for bringing about their destruction. To the common man a snake is always deadly and dangerous. It has been aptly said by Walter Rose, an African herpetologist that "A person's fear of snakes varies inversely with his knowledge of them, the greater the ignorance the greater the fear." This is equally true to the conditions of India as well. Unless the misconceptions about the snakes are dispelled from the mind of rural and urban population, the future of all snakes is bleak. The destruction of snake habitats to meet the increasing needs of the growing population adds to the existing pressure on snakes for their survival. To cater to the increasing demands of the international luxury leather markets, ruthless killing of snakes for their skins continue unabated in many places in spite of the implementation of the Wildlife (Protection) Act, 1972.

There are about 40 zoos in India, each attracting large numbers of visitors everyday, thanks to the increasing interest of the people in nature and wildlife. Initially the primary object of a zoo was recreation and entertainment, But gradually the need was felt for conservation and propagation of endangered species, educating the public and creating an awareness about wildlife and research on various aspects of its inmates in addition to providing inexpensive and useful recreation for all classes of people. The popularity of zoos among the public can be seen from the number of visitors that visited the 12 leading zoos of the country in 1978 (Table 1).

Table 1 (Source : International Zoo Yearbook, Vol 20, 1980)

S.No	Name of the zoo	No. of visitors in 1978
1.	Delhi Zoological Park, New Delhi	1,211,771
2.	Municipal Hill Garden Zoo, Ahmedabad	1,662,000
3.	V.J.B. Udyan, Bombay	4,090,000
4.	Alipore Zoological Garden, Calcutta	2,078,970
5.	Assam State Zoo, Gauhati	572,137
6.	Zoological Garden, Jaipur	637,607
7.	Sakkar Bagh Zoo, Junagadh	400,000
8.	Kanpur Zoological Garden, Kanpur	572,216
9.	Prince of Wales Zoological Trust, Lucknow	882,821
10.	Trivendrum Zoological Garden, Trivendrum	590,693
11.	Nandan Kanan Biological Park, Orissa	494,760
12.	Madras Snake Park, Madras	900,000

The number of visitors to the zoos is increasing year after year. Zoos play an important role in the conservation of snakes by educating the public and creating an awareness among them about snakes. It is now well known that snakes help in the control of rats which do more demage to food and health in India than snakes. The common man is unaware of the useful role of snakes as they eat rodents which destroys a lot of foodgrains. Man's fear of snakes prompts him to kill them. Visitors to zoos show a great interest in snakes but unfortunately the snake collections in most of the zoos of this country are poor. This is due to the lack of knowledge about the management of snakes in captivity and the same fear psycho psychosis about snakes among the zoo personnel. Hence it is necessary to encourage public zoos to have natural snake enclosures exhibiting the indigenous snakes of the country both venomous and non venomous. To achieve this, the available technical knowhow has to be fully utilised for imparting training to the zoo personnel in the management of snakes in captivity.

Display of signboards with all details about the snakes exhibited in many languages including the local language will enrich the knowledge of the visitors. Through audio-visual aids special talks can be arranged for school and college students periodically about the identification of snakes, their behaviour, etc. Live snake demonstrations can be arranged from time to time especially on holidays and the economic value and ecological value of snakes could be explained to the public. The identification of venomous and non venomous snakes and first-aid in cases of snake bite will help dispel many of the unwanted fears from the minds of the public. Stulents may be encouraged to visit the snake corner of the zoo and to handle the harmless ones if possible.

Leaflets in different languages including the local language with illustrations of the poisonous and non poisonous snakes, and their behaviour may be distributed to the public. Conservation oriented research on several aspects of the snakes' life such as reproductive behaviour, feeding behaviour, growth, etc. can be easily studied in the captive collection of snakes in zoos. Such projects in zoos may be able to create an interest and awareness about snakes among the public which ultimately may help in the conservation of snakes.

* *

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COUNTRY AND REGIONAL REPORTS

... Romulus Whitaker
Chairman
Snake Specialist Group
Madras Snake Park Trust
Raj Bhavan Post Office
Madras - 600 022

Introduction

Regrettably many of the Snake Specialist Group members could not attend the first meeting. However, both members and correspondents have sent enough information to summarize the situation in some regions and in many cases to identify species which need help or on which data is lacking. In general large, conspicuous snakes, species with valuable skins and species living in rapidly changing habitats due to human activities are the ones which are under pressure and need studies and conservation action. Protection of habitat is felt to be of more importance than protective legislation for species in most countries with the notable exception of countries in Asia where individual species are under heavy pressure for their skins and meat.

Australia

Group Member or correspondent: Fred Parker
717 Ross River Road
Kirwan 4814
Australia

Fred Parker writes that while he knows of no critical situations for Australian snakes, he comments on the decline of the King Brown(Pseudechis australis), though there is no supportive data other than recollection of earlier snake collectors. In the long term the effects of Bufo marinus (see Papua New Guinea) may become a major threat to the continued existence of a few species. probably those whose diet is mainly or entirely amphibians. Meanwhile a sea snake skin industry has started in the Gulf of Carpentaria (Queensland) with Canberra (Central Gowernment) approval for the export of 40,000 skins a year. No State Department has any interest in sea snakes or the desire to control the fishing of them.

Harold Cogger
Deputy Director & Curator of
Reps & Amphibians
The Australian Museum
6-8 College Street
Sydney, NSW 2000
Australia

The following excerpts are from Harold Cogger's "Reptiles and Amphibians of Australia" (Reed Books, 1979) Varying degrees of protection for reptiles are now in operation or being contemplated for most parts of Australia. The collection of reptiles can only be justified if their capture does not endanger the continued existence of wild populations, and if the knowledge to be gained from their capture is likely to lead to a better understanding of their biology and ecology, and thus the ultimate management and/or survival of those populations.

Despite or perhaps because of a current ban on the export of reptiles, there is an apparently thriving smuggling operation. However, reptile populations in Australia are rarely endangered by direct human exploitation of the animals as a resource.

For most reptiles survival will depend not on the formality of 'legal' or statutory protection but on the survival of the environment in which they live.

As yet few quantitative data on the effects of land use and management on populations of reptiles are available. Research is much needed to provide the basic data that would allow adequate conservation measures to be determined.

Graeme F Gow
Curator of Reptiles & Amphibians
Northern Territory Museum
Bullocky Point, Fannie Bay
Northern Territory
Australia

In recent years several new species of snakes have been described in Australia. Python oenpelliensis is regarded as a rare animal, the eight recorded specimens have all been collected from a limited area of the Western Arnhem Land escarpment. Python bredli is not regarded as rare but is a geographically isolated species restricted to Centralia. A small venomous snake, Brachyaspis atriceps was found in Western Australia in 1979 by the Western Australian Museum; only two specimens are known.

BANGLADESH

Reza Khan
Asst. Professor
Dept. of Zoology
University of Dacca
Dacca - 2

Dr. Reza Khan writes that no work has been done on the snakes of Bangladesh except some very scanty studies. He is preparing a snake conservation brochure in Bengali. Species under constant pressure are:

Python molurus molurus, P.m bivittatus	- skin trade, habitat loss
Python reticulatus	- skin trade
Ptyas mucosus	- killed when seen as it is believed to such cows' milk
Elaphe radiata	- skin trade
Bungarus fasciatus	- skin trade, venom export
Naja naja naja and N. N. kaouthia	- capture, habitat destruction
Ophiophagus hannah	- skin trade
Vipera russelli	

BRAZIL

A.R. Hoge
Herpetology Department
Institute Butantan
Sao Paola
SP Brazil

The pit viper Bothrops insularis, restricted to Queimada Grande Island, is fairly well protected because access to the island is difficult according to Dr. Hoge.

COSTA RICA

Harry W Greene
Asst. Curator of Herpetology
Asst. Professor of Zoology
Museum of Vertebrate Zoology
2593 Live Sciences Building
Berkeley, California 94720

Dr. Greene is inviting studies on the bushmaster (Lachesis muta) and other lowland neotropical snakes in Costa Rica.

Lachesis muta is of some concern on a number of grounds, despite (as well as because of) the fact that we know very little about its biology. The bushmaster is a large vertebrate predator, apparently restricted to lowland wet forest in Latin America--a habitat subject to substantial and ongoing human encroachment. Based on what we know about other large viperids, it probably has slow growth and low fecundity; it is apparently nowhere common; and, because it is venomous and potentially very dangerous, it is subject to direct human persecution.

Perhaps I should add that at this point, I don't see any form of legal protection as particularly important to the status of animals like bushmasters that are not subject to extensive commercial exploitation. Far more important are protection of proper habitat and obtaining detailed information on behaviour and ecology.

CUBA

Luis S Varona
Norte 29, Nuevo Vedado
La Hababa 6
Cuba

Dr. Varona writes "all snakes are killed at first sight! This is due to superstition and wrong or no information, in spite of the fact that all our snakes are harmless to man. The more endangered are those of the genera Epicrates and Tropidophis; because of their size they are the most readily seen. The only suggested action is "conservation education".

CHILE

Herman Nunez C
Curator of Herpetology
Museum of Natural History
Casilla 787
Santiago, Chile

Dr. Nunez writes: "In Chile we have six species of snakes but I don't think any of them are endangered or under heavy pressure. Because they are naturally scarce their populations are very low."

CHINA

Group member or correspondent: Huang Chu-Chien
Peking Institute of Zoology
Academia Sinica, Peking
China

Heavy exploitation of snake population for food and medicinal preparations takes place in Taiwan, China, Japan, North and South Korea, Thailand and many parts of Indonesia and Malaysia. Much of the catch is processed and sold in Hong Kong and Singapore. The species under heaviest usage include cobras, banded kraits, reticulated pythons, mamushis and amphibious sea snakes.

Dr. Huang Chu-Chien has sent a list of snakes found in China and efforts are being made to get trade statistics.

EASTERN EUROPE and the MIDDLE EAST

Group member or correspondent: Vladislav Jirousek
Director, Zoopark
Jihlava
Czechoslavakia

Vladislav Jirousek has sent the following notes on snakes in trouble, species he has had considerable field experience with. He recommends that the following species be added to the Red Data Book lists:

Vipera kaznakovi	USSR, Turkey
Vipera bornmuelleri	Lebanon
Vipera lebetina turanica	USSR, Afghanistan, Pakistan

He supports the proposal to include Vipera ammodytes transcaucasiana but feels V.xanthina raddei is not endangered stating that large populations exist in the high mountain plateau of Armenia.

Other species which are rare or under pressure are:

Eryx jaculus (Javelin sand boa) - small populations mostly on southeastern slopes of stony habitat in Yugoslavia, southeastern Bulgaria and a few localities in USSR. Often killed as it does not flee when encountered. Remedial measures include public education.

Naja n. oxiana (Central Asiatic Cobra) - Now becoming rare in the USSR due to over exploitation (catching for venom and killing in fear), and inadequate protection. Remedial measures include limiting of catch for venom extraction and release of snakes after venom extraction.

RDB - Endangered

Vipera ammodytes transcaucasiana (Long-nosed viper) - Though the biotype of this species (Georgia - USSR - and possibly northern Turkey) is not being altered the species occurs only in a few isolated localities of small extent. Further studies of range and status are needed.

RDB - Rare

Vipera latifi Endemic to the Elborz mountain chain in Iran, this is a small rarely seen viper. Its habitat is apparently not endangered however; further information on range and status is desireable.

RDB - Endangered

Vipera lebetina schweizeri (Levantine viper) - This snake lives on some of the western islands in the Aegean sea- Heavily pressured by tourism and their development, over collected, this subspecies may not survive unless within a reserve encompassing sufficient suitable habitat.

RDB - Vulnerable

Vipera xanthina raddei (Armenian viper) - This snake is reportedly more abundant than previously assumed in its stony, mountain slope habitat in USSR, Armenia, and northern Turkey. A specialist on this species is Dr. Levon Surenovic Sachidzanjan, manager of the zoo in Jerevan, Armenia.

RDB - Rare

EUROPE

Group member or correspondent: Rene Honegger
Curator of Herpetology
Zoological Garden
CH8044, Zurich
Switzerland

Rene Honegger lists the following European species in need of studies and/or protection:

Endangered	Vipera ursini, Vipera ursini rakosiensis, Vipera ursini renardi.
Vulnerable	Coluber hippocrepis, Elaphe longissima longissima, Natrix natrix cetti, Vipera ammodytes montandoni, Viper aspis aspis, Vipera berus, Vipera lebetina schweizeri

Indeterminate — Coronella austriaca, Elaphe quatuorlineata, Elaphe situla.

FIJI

F.G.A.U. Clunie
Fiji Museum
P.O. Box 2023
Suvai, FIJI

Mr. Clunie writes that Ogmodon vitianus is known from only a few specimens from Viti Levu. He writes: "It is hard to say whether it is endangered... and may be more elusive than rare. The Pacific boa (Candoia bibroni) is still common on Viti Levu despite the presence of the mongoose. In 1981 Fiji's Cabinet very firmly rejected a Fiji National Trust sponsored bill which would have given legal protection to all Fiji's native terrestrial vertebrates.

GERMANY

Group member or correspondent: Konrad Klemmer
Curator
Senckenberg Museum
Senckenberg Anlage 25
D-6000 Frankfurt (Main-1)
W. Germany

"All six species of snakes in Germany are protected by law, also the venomous species. One of these is probably extinct in Germany (i.e. Vipera aspis), populations of the other species are declining. As it is rather difficult to get sufficient data for estimating population changes in snakes very little is known. I am doing some field work with Elaphe longissima which occurs in Germany only in a few isolated populations. The standing of one of those populations near Frankfurt is not too bad".

HUNGARY

Group member of correspondent: Keith Corbett
British Herpetological
Society, 136 Estcourt Road
Woodside, London SE25 4SA

Keith Corbett of the British Herpetological Society gives the latest status position of one of the endangered snakes endemic to Hungary and eastern Australia:

"It would be premature of me to report on any immediate snake problem in Europe but by co-incidence both myself and the late Donald Street were associated in assessing the habitat and status for one of Europe's most threatened snakes Vipera ursini rakosiensis in its remaining refuge of the Hungarian Puszta. It used recently to be locally abundant also in eastern Austria and accordingly the Council for Europe are deliberating on what can be done there within the brief of their 'Critical Habitat Strategy'. It is unfortunate that Hungary is not involved with the Council of Europe for I believe ~~that there are real problems~~ that there are real problems there surrounding most of its remaining habitat.

Although seen more easily when in the damp (summer) meadow Puszta, this species probably requires the adjacent dry sandy Puszta dune slopes, and if so then this habitat is under severe pressure. There are good Puszta reserves in Hungary, but, these are usually maintained for 'cultural farming' and the resulting wildlife value is mostly associated with the low-lying and potentially damp Puszta.

Elsewhere in Hungary, there are non-protected areas of dune Puszta with this snake and several other interesting reptiles, but they are being increasingly destroyed via mechanised agricultural reclamation and by military disturbance. Apart therefore from what lessons can be learnt and applied to Austria, I would propose international co-operation with the Hungarians (via IUCN) to more fully assess this habitat and ensure that its xerophytic grass and shrubland is adequately conserved".

INDIA

B.K. Tikader, Director
Zoological Survey of India
34, Chittaranjan Avenue
Calcutta - 700 012

Dr. Tikader reports: "It is true that the number of certain species of snakes has decreased considerably in India and species like Elachistodon westermanni, Python molurus, Python reticulatus, Spalerosophis arenarius, Colulur gracilis, Liopeltis stolizkae, Coronella brachyura, Oligodon erythrorhachis, Oligodon melaneus, Dendrelaphis caudolineolata, Lycodon flavomaculatus, Dinodon gammiei, Dryocalamus gracilis, Boiga quincunciata, Bungarus bungaroides, Callophis beddomei are either endangered or little is known about their exact status.

Certain species of larger snakes like Elaphe prasina, Elaphe radiata, Elaphe helena, Ptyas mucosus, Coluber fasciolatus, Naja naja and Ophiophagus hannah are subject to enormous pressure from commercial exploitation for their skins.

Frequent surveys are being undertaken in many parts of India for establishing the exact status of many reptiles (including snakes). Since the adoption of the Wildlife Protection Act (1972) 237 species of snakes have been included on the Schedules (I to IV), thus proving them legal protection from hunting, killing and trapping.

In the Zoological Survey of India we are presently working mainly on the following herpetological projects (1) Taxonomic and ecological studies on reptiles of Bastar (Dr. R. C. Sharma, Superintending Zoologist and Shri D.P Sanyal, Zoologist) (2) Studies on the reptilian fauna of Bankura and Purulia districts of West Bengal (Shri S. Ahmed, Asst. Zoologist) (3) Taxonomic and ecological studies on the herpetofauna of Rangeet Valley, North Bengal (Dr. R.C. Sharma, Superintending Zoologist and Shri D.P Sanyal, Zoologist (4) Studies on the lizards and snakes of Southern India (Shri T.S.N. Murthy, Zoologist).

In reviewing the endangered species literature, one is struck by the diversity of opinions that arise from the same set of data. For example, some state lists are often indefensibly pessimistic with regard to the status of certain species. I believe that these exaggerations dilute the efforts to protect truly endangered species and district attention from more serious environmental problems. For instance, there has been a great amount of concern expressed over the high prices that snake species such as Elaphe subocularis, Lampropeltis mexicana and Trimorphodon biscutatus command in the pet trade, and this has been used as evidence that the species is being decimated by collectors. The truth of the matter is that the high prices derive from the fact that these snakes are rarely caught because they are nocturnal and secretive with two of them being restricted to rocky hills and outcrops which are difficult areas to census. These snakes could not be eliminated from even a small portion of their extensive range, even by an army of paid collectors. It would be more productive to forget about special protection for these species and to concentrate on the knottier problems caused by bullfrog predator, pollution and habitat destruction. There had been a lot of effort expended in restricting collecting, both scientific and commercial; because this is relatively easy to do, but little has been done in the way of preserving critical habitats."

JAPAN

Group member or correspondent: Michihisa Toriba
Japan Snake Institute
Yabuzuka-honmachi
Nitta gun
Gunma, Japan
(for Dr. Y Sawai)

No species of snakes are considered endangered in our country. However, we have a rare species on Kume-jima island, Ryukyu Archipelago, which is known by only two specimens but is not considered endangered because its habitat has not been changed so greatly.

On the other hand, we have a curious population of a species. An albino population of Elaphe climacophora, which is one of the commonest snakes in the country, is restricted to a certain part of Iwakuni City, Yamagichi Prefecture (western most prefecture in Honshu Island). This population is protected by the Japanese Government as a natural monument. It has rapidly decreased in number recently, and artificial breeding is carried out by Iwakuni City and our institute.

MALAYSIA

Group member or correspondent: Stephen Ambu
Institut Penyelidikan Perubatan
(Institute for Medical Research)
Jalan Pahang
Kuala Lumpur 02-14
Malaysia

Regarding endangered species of snakes, I am unable to quote any species as no survey has been carried out. However, the python (P.reticulatus)in Malaysia is a threatened species and it is eaten as a delicacy. Though it is a protected animal (the only protected snake) the authorities find it difficult to implement the law.

The Malayan pit viper (Ancistrodon rhodostoma) is a very common snake in the northern states of Perlis and Kedah bordering Thailand. Due to rapid development in the area, the number of snake bite victims in these states has increased tremendously in the past few years. This indicates that their habitat has been disturbed and they are now being found in developed areas. In time they will disappear from these areas due to unsuitable habitat and lack of food. The human population willbe at low risk from snake bites while the Malayan pit viper itself will become endangered.

The Malayan cobra is a common and widespread snake in Malaysia, however it has disappeared from developed areas. Recently there have been many reports about common cobras coming into newly built houses in developed areas. This shows that they are in search of a suitable habitat. In oil palm estates where they were found in abundance at one time, the population has been greatly reduced. This is an indirect result of effective poison baiting of rodents in the estates which has reduced food supply for snakes.

Thus the greatest danger the reptile species face in Malaysia is the rapid development of their habitat for human use. Logging and clearing of thousands of acres of land for commercial purpose has been the disappearance of many species of animals from certain parts of Malaysia. The Malayan Nature Society plays an active part in trying to save prime forest land for conservation of nature.

MAURITIUS

Group member or correspondent: David Bullock
University of Durham
Department of Zoology
Science Laboratories
South Road, Durham DH1 3LE
England

"You may be interested... in our proposed expedition to study the snakes on Round Island, Mauritius. Two of the proposed team, myself and Ben Osborn, visited Round Island in 1975 when we found one specimen of Bolyeria multicarinata and 26 of Casarea dussumirei. The purpose of our proposed visit in July/August 1982 is to monitor the reptile populations and resurvey vegetation plots by methods worked out in 1975."

Quentin Bloxam
Curator of Reptiles
Jersey Wildlife Preservation
Trust

Les Augres Manor
Jersey
Channel Islands

I an give you some up to date information on the boas of Round Island:

I regret I could not find any Bolyeria multicarinata (Round Island boa) but did find a small fresh piece of shed skin which I consider is Bolyeria. Unfortunately, I was pulled off the Island a week ahead of schedule, needless to say that last week was going to be spent carrying out intensive searches for this species.

During three and a half weeks on the island, fiftyeight Casarea dussumieri (keel-scaled boa) were caught or sighted, of which fifty were scale-clipped, photographed, weighed, measured and released. Specimens were captured all over the island including young ones. I suspect that they are more common than previous estimates have indicated. However life is traumatic for them as nearly every specimen has scars on their bodies, from skinks, tropic birds and shearwaters. This is conjecture on my part but I believe these to be the only logical causes.

The captive situation here (of Round Island boas) has been one of mixed results. Last summer we hatched two babies successfully for the first ever recorded captive reproduction of this species. Thus establishing that they are egg layers. The infants were very small (3.5 grammes each) and proved to be exceptionally difficult to feed. As a result after three and a half months we lost them. Despite this I am not too disappointed, we have learned a great deal about them and did have some success in force feeding techniques. I look forward to the next breeding season and hope to have a happier ending to our efforts. Seven Round Island boas are being maintained at the Trust.

THE NETHERLANDS

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Secretary General, SEH
Rijksmuseum V Natuutlijke Historie
Postbus 9517
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Netherlands

Anton H.P. Stumpel
Research Institute for Nature
Management
Postbus 46,3956 ZR Leersum
Netherlands

All the three snakes (in the Netherlands) are called vulnerable (which means: under heavy pressure):

"Coronella austriaca austriaca (Colubridae) is our rarest snake. Its decline is the greatest. Especially in the last 30 years this species has been injured by habitat loss and changing of its habitat. It occurs in some nature reserves. Unfortunately, at this moment we have little information about its exact distribution. A survey of this daily and seasonal activity is being carried out now by Dr. J. van Gelder in one locality with the help of transmitters. Our institute will start a project for studying its habitat requirements. Vipera berus berus (Viperidae) is living dispersed in the eastern half of our country. A number of populations lives within our nature reserves. Nevertheless, even there some of them are declining. The reasons are not known yeat.

Natrix natrix helvetica (Colubridae) was quite numerous locally some decades ago. Numbers have decreased very strongly now. Reasons are thought to be lack of suitable egg-laying places and the intensive land use by man. Some populations live in small nature reserves.

Since 1982 all Dutch reptile species are also under protection of the Convention of Bern (Appendices II and III).

PAPUA NEW GUINEA

Group Member or cor : Fred Parker
717, Ross River Road
Kirwan Qld. 4814
Australia

Fred Parker feels that the rarely seen Boelen's python warrents field studies. Its distribution is little known but fortunately there are no direct pressures on boeleni be they hunting, collecting or habitat threat. The Papuan Black Snake (Pseudechis papuanus)is apparently rare now, perhaps due to the infestation of the South American cane toad (Bufo marinus).

SOLOMON ISLANDS

Mike McCoy
P.O. Box 615
Honiara
Solomon Islands

"Loveridgelaps (a small elapid) is an extremely rare snake and could certainly be regarded as a threatened species. The same probably applies to the diminutive Bougainville elapid (Parapistocalamus hedigeri".

SURIMAN

M.S. Hoogmoed
Secretary General, SEH
Rijksmuseum V Natuutlijke Historie
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NL-2300 RA Leiden
Netherlands

Dr. Hoogmoed writes: " Regarding species listed in your extract of the 'World Checklist I can give you my opinion on several species occurring in Suriman. They (Boa constrictor, Corallus caninus, C.enydris, Epicrates cenchria, Eunectes murinus, Clelia clelia) still do occur in reasonable numbers, according to my field experience. There is no hunting for hides, nor is the natural habitat being destroyed. So at least in Suriman these species seem to be safe".

SOUTH AFRICA

Bill Branch
1 Port Elizabeth Museum
Box 13147
Humewood, C.P 6013
South Africa

Bill Branch summarizes the snake conservation scene in South Africa as follows:

" P. sebae in South Africa, enjoys considerable protection in the numerous game reserves. In addition many private farmers are aware of the potential of pythons in pest control (eg. hyrax, cane rats, etc). It is protected by Provincial Ordinance in all of South Africa, South West Africa, etc. Historically the python occured in the Eastern Cape Province, but the last recorded speciman was killed in 1927. It is not known from the Transkei, and has probably been long ago exterminated from this traditional African homeland. Tortoises are also extinct in this region. Efforts are now being undertakan by the Cape Department of Nature Conservation to reintroduce pythons in the local game reserves in the Eastern Cape.

The status of Python anchietae is difficult to determine at the moment. Its range is politically disturbed and scientific collecting impossible because of the security situation. Its rarity subjected it to collecting pressure some years ago, when access to the region was easier. However it occupies rugged country, and should be holding its own. It has recently been bred in captivity for the first time, and indications are that it is very easy to maintain in captivity. An organized captive breeding programme for this species should be initiated. The Transvaal Snake Park have a number of specimens, including captive-bred young, and would make a logical centre. Perhaps is could be registered as such.

Few other snakes in South Africa merit such consideration. As with everywhere, most species show population decline around centres of human habitation. However, these pressures are still minor in the region. The only snake threatened in the region by habitat destruction as the Gaboon adder in Zululand. But forest reserves exist in the region, and the snake is protected by specific legislation in the Province. Moreover it is widespread throughout the forested regions of Africa, and its decline in Zululand is a local problem.

Perhaps the one snake that may be suffering from over-collecting is the Namaqualand adder, Bitis peringueyi. This small adder has an exotic life style, and is much desired by zoos and pet keepers. It is relatively easy to collect and its range is becoming increasingly accessible. Although it is unlikely to suffer from habitat destruction, it may be showing population declines due to collecting.

UNITED KINGDOM

Group member or correspondent: Keith Corbett
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Keith Corbett gives the following outline of the plight of the three species of snakes in the U.K.:

"Our rarest reptile is undoubtedly the secretive Coronella austriaca, and we now believe that its adult population does not exceed the low thousands; members of the Conservation Commission like myself accept a pessimistic figure nearer 2000 only. The main reason for its demise is the loss and fragmentation of dry heathland (Calluneta) and particularly of its mature phases. Although there are many sites of lowland dry heath designated as Sites for Special Scientific Importance (SSSIs) by our Nature Conservancy Council (NCC), scant attention has been paid, financially or man-power wise, to the essential task of active habitat management to reduce threatening encroachment of the introduced and alien pine tree (mainly Pinus sylvestris), and the similar post-fire degradation caused by subsequent encroachment from the Birch (Betula sp.) and Bracken (Ptoridium sp.) The BHS has been organising and carrying out the necessary remedial management on selected reptile sites during the 1970s; this almost entirely through WWF grant aid. Our work was initially aimed at restoring habitat for the equally endangered lizard Lacerta agilis, but as the effects of this work has been monitored it has become apparent that when the site was large enough, C.austriaca breeding has also been restored. It is now pleasing to note that we are having some success in persuading owners and managers of some of those SSSIs also designated as nature reserved to similarly manage at least some parts of these reserves.

Nevertheless, the problem has assumed such proportions, and I should have said that this encroachment has proved irreversible when not resisted at an early date, that nothing short of a major national project on dry heath would contain the situation. Of late we have been joined by the whole of the voluntary wildlife conservation movement as encompassed by the 'Wildlife Link' pressure group.

The Grass Snake (Natrix natrix) has its own problems and whichmay yet turn out to be severe. Its UK distribution is restricted to the south by its egg-laying habits, and it appears that even then it is only successful in its reproduction in our relatively cool summers by its learned ability to lay in the semi-artificial incubation sites of rotting vegetation, as provided by old farm manure heaps or the saw-dust piles from saw-mills. However, by reason of economic advance these features are fast becoming things of our rural past, and being a relatively long lived snake the true effects on this species may still remain to be seen. General decline has been noted but there has been no quantification as yet. It is essential to our mind that some work is sponsored to locate this key feature of the species' ecology and perhaps protect and enhance the better of these ancestral egg-laying sites. We have recently circulated an article to the parent body of our Country Naturalists Trusts for circulation to all Trust members (125,000). This gives an account of the particular vulnerability of the herps and the need and methods for survey. Grass snake egg sites are included for special priority. How many of their membership's active field workers will be persuaded to co-operate remains to be seen, but any extra effort will be a bonus, for naturalists are as you know rather hesitant to become involved with herp. work. Birds and flowers yes, but snakes and toads...

Another quite unnecessary problem concerns snake killing and persecution. Coronella is protected under our law (though now its habitat) but in practice any snake- like animal may be killed under the legitimate excuse that it might be an Adder! (Vipera berus). Even on our protected and managed sites we have known examples of Natrix being blasted by shot-gun by otherwise responsible and conservation minded citizens. The overall effect cannot be judged though wherever there is public pressure snakes tend to disappear. The reason that I say this is an unnecessary problem is that the U.K. was a part to the Council of Europe's Resolution (78) 22 on amphibians and reptiles, and a signatory to the subsequent Berne Convention on Wildlife Conservation, both of which expressly require member states to forbid the deliberate killing of all snakes. Yet when our government's official advisors the NCC gave their recommendations for the recent Wildlife and Countryside Act, they felt unable to support our private amendment to make it illegal to kill any herptile in the U.K., in line with the Berne Convention ruling."

URUGUAY

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Dr. Achaval writes: "I think that as a general rule the ophidian fauna of Urugay is not liable to be in immediate danger. Some species are indeed scarce but it may be due to the fact that they are in the southernmost part of their range. These are: Dromicus almadensis, Lygophis flavifrenatus, Rhadinaea occipitalis, and Rhadinaea poecilopogon. However I should mention that the tropical rattlesnake, Crotalus durissus terrificus, on account of its low population level and heavy pressure on it, may be considered the only snake seriously endangered in Uruguay"

U.S.S.R.

Group member or correspondent: Olga L Rossolimo
Director
Zoological Museum
Moscow, USSR

The following species are listed in the Red Data Book of the USSR: Ptyas muscosus, Elaphe situla, Elaphe longissima, Oligodon taeniolatus, Rhynchocalamus melanocephalus satunini, Naja oxiana, Vipera kaznakovi, Vipera ammodytes transcaucasiana, Vipera xanthina raddei.

Dr. Rossolimo writes that the main factors affecting wild snake populations in the USSR are destruction of appropriate biotopes by technological activity, intensive catching for medical purposes, and killing of snakes by local people. Although there is no legislation protecting snakes, those populations inhabiting reserve stations, national parks, etc. are protected and some species are under partial protection (their catching being restricted) even within other areas. For decreasing pressure on wild venomous snake populations, special serpentaria have been established in which the following species are kept for medicinal purposes: Vipera lebetina, V. berus, Echis carinatus, Naja oxiana, Agkistrodon halys. They are situated in Baku City, Tashkent, Ashkabad, Moscow and Kara Kala.

U.S.A.

Bradford G. Blodget
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Nongame & Endangered Species
The Commonwealth of Massachusetts
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Bradford Blodget reports: "In the state of Massachusetts, we have four species of snakes listed as "Species for Special Consideration in Massachusetts". These include: Northern Copperhead (Agkistrodon contortrix mokeson), Timber Rattlesnake (Crotalus horridus horridus), Black Rat Snake (Elaphe obsoleta obsoleta), and Eastern Worm Snake (Carphophis

amoenus amoenus). The two venomous snakes are categorized as "state rare":--long-established species whose populations are either documented to be declining or known to survive in such critically low numbers as to be considered likely to become extirpated from the Commonwealth without special action--while the Rat Snake and Worm Snake are listed as "state local":--long established species in the Common wealth that are restricted to very limited areas.

The threats facing these snakes include: habitat destruction or modification, overcollecting, and, in the case of venomous species, persecution, Recent regulatory changes promulgated by our Fisheries and Wildlife Board extend legal protection to the above four species (and several other reptiles and amphibians) which may now not be killed, taken, or collected except under authority of a scientific collecting permit, which is only issued for bona fide scientific or educational purposes. Other necessary measures we plan to institute include status surveys to determine the distribution and population status of these snakes, followes by axquisition or protection of critical habitat wherever practical and possible (depending, of course, on available funding).

Group member or correspondent: Ken Dodd
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U S A

Ken Dodd lists the following species of snakes protected under the U.S. Endangered Species Act of 1973 and summarizes what is known of several other species which probably require protection:

Mona boa	Epicrates monensis monensis
Puerto Rico boa	Epicrates inornatus
Virgin Islands Tree boa	Epicrates monensis granti
New Mexico ridge-nosed rattlesnake	Crotalus willardi obscurus
Atlantic salt marsh snake	Nerodia fasciata taeniata
Eastern indigo snake	Drymarchon corais couperi
San Francisco garter snake	Thamnophis sirtalis tetrataenia

He writes that "good surveys have been undertaken on the San Francisco garter snake and New Mexico ridge-nosed rattlesnake. There are limited surveys underway on the Puerto Rican boa being conducted under contract through the US Forest Service in Puerto Rico. We desperately need surveys on both the Mona and Virgin Island tree boas; both are very rare. I think only 10 Mona boas have ever been reported. The Virgin Island tree boa occasionally turns up but is threatened by the continual development of St. Thomas. The Atlantic salt marsh snake needs both a survey of available remaining habitat as well as a review of its systematic status - we simply don't know whether there are any pure Atlantic salt marsh snake populations remaining or whether they have been hybridized out of existence. The Fish and Wildlife Service is spending $ 45,000 over three years of habitat surveys and radio telemetry studies on the Eastern Indigo snake. This includes

information on reintroduction into formerly occupied habitat. However, we still need surveys, especially of populations in Florida and the threats of habitat destruction.

Group member or correspondent : Richard A. Seigel
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Richard Seigel writes that the massasauga Sistrurus catenatus is in definite need of protection. This snake is considered rare in Missouri where there are only three known populations, only one occuring within protected land. Their status is the same throughout much of the eastern U.S.

This species is primarily threatened by habitat destruction, it is specific in its habitat selection, preferring marshy meadows or moist prairie areas. These areas are also made use of by farmers and land-developers for draining and construction. Sizeable populations of these snakes are only likely to survive on protected wildlife refuges.

A survey of likely habitats in the eastern U.S. should be undertaken to determine its present status by state and or local wildlife officials, and public land already found to form a massasauga habitat should receive high priority and should be acquired if possible.

Group member or correspondent : John C. Murphy
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U S A

John Murphy questions the endangered status of Boa constrictor, the eastern indigo snake (Drymarchon corais couperi) and other widely distributed species that appear on endangered lists. Known rare or localized species such as Clonophis kirtlandi and the massasauga (Sistrurus catenatus) receive scant protection.

Group Member or correspondent : Jerome A. Jackson
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Dr. Jackson reports : The species here that are most noticeably in trouble are the following :-

Southern Hognose Snake (Heterodon simus)
Rainbow Snake (Farancia erytrogramma)
Eastern Indigo Snake (Drymarchon corais couperi)
Black Pine Snake (Pituophis melanoleucus lodingi)

All of the above have recently been listed as endangered

by the state of Mississippi. I have no data concerning their populations, but all are threatened by human development activities - the first two by clearing and draining of areas, the last two by forestry practices and destruction of southern pine forests.

Group Member or correspondent : Richard B. King
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Mr. King writes : "I am presently doing my dissertation research on the Lake Erie water snake (Nerodia sipedon insularum) one of the snakes listed on the World Checklist of Endangered Amphibians and Reptiles.

My research centers on the evolution and maintenance of pattern polymorphism in island populations of these snakes. Naturally, in the course of my work I am gathering much data on the natural history and demography of these snakes. While I have summarized little of this information to date several points are clear : 1) Populations of Lake Erie water snakes on islands in western Lake Erie have been greatly reduced in the last three decades. 2) Water snakes are absent from or rare on a number of islands which formerly supported large populations. These snakes are presently protected on islands in Canadian waters but not on islands in the United States."

Group member or correspondent : Dale R. Jackson
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Florida Natural Areas Inventory
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Dale Jackson writes : "As zoologist for the Florida Natural Areas Inventory (a state natural heritage program), I will be compiling and updating precise information on the state distributions and population trends of approximately 400 species (vertebrates and invertebrates). Snakes included on my preliminary priority list are : Drymarchon corais couperi, Stilosoma extenuatum, Lampropeltis calligaster rhombomaculata, Diadophis punctatus acricus, Nerodia fasciata taeniata, Nerodia fasciata clarki, and Tantilla oolintica; Lower Florida Keys populations of Storeria dekayi, Elaphe guttata and Thamnophis sauritus; and Florida populations of Agkistrodon contortrix and Pituophis melanoleucas."

Group member or correspondent : Mark Jennings

Six rare or endangered snakes in California have received attention from Mark Jennings and colleagues. Status sheets have been prepared for the six :

San Francisco garter snake	Thamnophis sirtalis tetrataenia
Two-striped garter snake	T.couchii hammondii
Giant garter snake	T.couchii gigas
San Joaquim whipsnake	Masticophis flagellum ruddocki
Alameda striped racer	M.lateralis euryxanthus
Southern rubber boa	Charina bottae umbratica

A sample of the white sheet prepared for the Southern rubber boa is reproduced here as an ideal format to follow worldwide.

SOUTHERN RUBBER BOA

Charina bottae umbratica Klauber, 1943

Order SERPENTES Family BOIDAE

STATUS Rare (State of California) (1).

DISTRIBUTION San Bernardino and San Jacinto Mountains of San Bernardino and Riverside counties, California, U.S.A., between elevations of 1525 m and 2440 m. Intergrades with C. b. bottae on Mt. Pinos and Tehachapi Mountains, Kern County (2). Unconfirmed reports of specimens from localities in the Los Padres National Forest, Ventura and Santa Barbara counties (M.R. Jennings, pers. comm.). Former distribution probably similar but could have occurred in some other mountainous areas.

POPULATION No estimate.

HABITAT Usually associated with moist coniferous forest and woodland, living under fallen trees, rotting logs, and rocks. Charina bottae bottae has been reported from the sagebrush country of eastern Oregon.

BREEDING RATE IN WILD Females probably give birth to 2 to 5 young (Stewart loc. cit.).

CONSERVATION MEASURES TAKEN Protected by the State of California since 1 July 1971 (Stewart l. c.) with strict enforcement of laws to prevent collection. The U.S. Forest Service has investigated the distribution of this snake on its lands in southern California and a Southern Rubber Boa Advisory Committee has been formed to coordinate studies and management of this subspecies (3). Study currently underway to determine the taxonomic relationships between populations in the Sierra Nevada Mountains and southern California.

CONSERVATION MEASURES PROPOSED Adoption of recommendations made to the Southern Rubber Boa Advisory Committee to lessen the impacts of habitat destruction from resort development, smog, logging, and wood gathering (2).

NUMBER IN CAPTIVITY Very few (Stewart, pers. comm.)

BREEDING POTENTIAL IN CAPTIVITY Poor (Stewart, pers. comm.)

REMARKS The existing populations are high-mountain relictes separated from each other and from the more continously distributed northern subspecies, C. b. bottae. Recreational and commercial use of the mountains is an increasing hazard to this subspecies (Stewart l.c.)

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Group member or correspondent : Norman J. Scott Jr.
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Hasty endangered categorization and stringent (but mainly unimplemented) paper protection is not saving species. Norman Scott in his report "Status of the amphibians and reptiles of Arizona, New Mexico, Oklahoma and Texas" reiterates the following argument which focuses on a worldwide problem.

In reviewing the endangered species literature, one is struck by the diversity of opinions that arise from the same set of data. For example, some state lists are often indefensibly pessimistic with regard to the status of certain species. I believe that these exaggerations dilute the efforts to protect truly endangered species and distract attention from more serious environmental problems. For instance, there has been a great amount of concern expressed over the high prices that snake species such as Elaphe subocularis, Lampropeltis mexicana and Trimorphodon biscutatus command on the pet trade, and this has been used as evidence that

the species is being decimated by collectors. The truth of the matter is that the high prices derive from the factt that these snakes are rarely caught because they are nocturnal and secretive with two of them being restricted to rocky hills and outcrops which are difficult areas to census. These snakes could not be eliminated from even a small portion of their extensive range, even by an army of paid collectors. It would be more productive to forget about special protection for these species and to concentrate on the knottier problem caused by bullfrog predation, pollution and habitat destruction. There has been a lot of effort expended in restricting collecting, both scientific and commercial; because this is relatively easy to do, but little has been done in the way of preserving critical habitats.

This paper was prepared for the 1st meeting of the IUCN/SSG Snake Specialist Group Meeting held from 8 - 12 Nov 82 at

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THREATENED SNAKES IN EUROPE - ABSTRACT

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A majority of the approximately twenty-nine snake species occuring in Europe (excluding Turkey and USSR) appear to be suffering local declines and to be significantly threatened in some portion of their range. However, very few are seriously threatened in Europe as a whole, and all endemic snake species appear to retain satisfactory populations. Of primary concern are the localized and isolated highland and lowland subspecies of Vipera ursinii (V. u. ursinii and V. u. rakosiensis respectively); these are seriously threatened by habitat loss and over-collecting. The Aegean subspecies of Vipera lebetina (V. l. schweizeri) is threatened by heavy persecution and collecting. Four much more widespread species, Coronella austriaca, Elaphe quatuorlineata, E. situla and Vipera berus are significantly threatened in a major part of their European range. Two species may be similarly threatened, Elaphe longissima and Natrix natrix, but data are not available for parts of the range. A population in southeast Bulgaria may be rare in Europe if it is confirmed to represent the Asian Coluber rubriceps not C. najadum. Major requirements in European snake conservation are firstly, more effective habitat protection, and secondly, more long-term field research.

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The region covered by this report includes Europe as generally understood, but excludes the westernmost fringes of Turkey and the U.S.S.R., often considered as part of Europe.

Approximately twenty-nine species of snake occur in Europe so defined. These are listed below, in alphabetical order; endemic species are indicated.

Climatically the region is highly variable, ranging from Mediterranean over most of the southern peninsulas of Iberia, Italy and Greece, to arctic in northern parts of Norway, Sweden and Finland. Although at relatively high latitudes, the climate of the western fringes of the region is moderated by the warm Gulf Stream and the oceanic influence of the Atlantic, while east and central parts have a more continential climate with harsh winters and hot summers.

The maximum number of species occur in southern regions, where the climate is more suited to the physiological limitations of reptiles, where the often complex topography affords a wide variety of microhabitats, and where the intensive agriculture so typical of the northern lowlands is not generally so widely practised.

Of the twenty-nine snake species in Europe only a very few species, notably the Western Whip Snake Coluber viridiflavus, appear to retain relatively good populations over all or most of their range. A majority are suffering local decline and are significantly threatened in some portion of their range, although they may be reasonably common in other parts. On the other hand, very few are seriously threatened in Europe as a whole; in particular there is no evidence that any of the endemic species are in trouble.

The primary threat to the survival of European snakes is habitat modification. This is aggravated in some cases (Elaphe species for example) by over-collection by or for terrarium keepers. Direct persecution by man also affects most snake species, but it is not clear whether this can cause populations to decline in more than a few cases.

Various aspects of habitat modification have been identified as serious threats. In northern populations of the Grass Snake Natrix natrix, for example, changes in agricultural practice (including a shift to cereal growth) have led to widespread disappearance of manure piles which were a typical egg-laying site. This appears to be a key factor in the decline in northwest European populations is simple loss of mature dry lowland heath, the prime habitat for the species in this area. This habitat is too often regarded as 'wasteland' fit only for agricultural reclamation; the distinctiveness of the habitat and associated plants and animals is not widely enough recognized. However it may be that decline of a snake species cannot be attributed to any particular factor: Smooth Snake populations in parts of France have declined since the early part of the present century without any perceptible change in land-use or in climate.

Doubtless the loss or reduction in density of prey species is another consequence of habitat modification that affects snake populations, but this remains totally unquantified.

Decline in European snake species is generally most marked, or better documented - or both - in northern and central parts of Europe. Not only are most species present in these parts approaching the limits of their physiological tolerance, and are thus susceptible to fluctuations in climate, but the multitude of threats caused by increasing human populations, expanding industry, intensification of agriculture, and various forms of pollution all appear more serious. For example, both the Dice Snake Natrix tessellata and Aesculapian Snake Elaphe longissima are considered endangered in the Federal Republic of Germany, but populations are generally satisfactory in southern parts of their range, including Italy, Greece and parts of France.

Because of regional differences in the status of snake species, the pervasive and probably often unrecognized effects of habitat modification and the difficulty of obtaining really good quantitative data on the size of snake populations, it is difficult to determine which species should be considered threatened in Europe as a whole.

A major problem is the lack of long term quantitative data on fluctuations in snake populations. Although an experienced field biologist may suspect numbers to have declined locally, simply on the basis of frequency of observation, it is usually impossible to provide any rigorous evidence. This is less of a problem in only a few species, especially Vipera species, where colonies are typically based in quite restricted winter and summer habitats and individuals may be readily observed at appropriate times of year. In Europe it is often a major achievement just to encounter good numbers of snakes and extremely

difficult to present an argument for conservation of snakes. The answer to this problem is to promote more research on snake ecology.

It should be emphasized that because of the nature of the threats, conservation action aimed at individual species may be largely ineffectual. Protection, and management if necessary, of representative areas of intact natural ecosystems is the main conservation action required. On the other hand, legislation should be formulated to control expessive collecting of these species for which this is a threat. Both these aims may be best achieved through full implementation of the Convention on the Conservation of European Wildlife and Natural Habitats, opened for signature at Bern in 1979.

The snake species occurring in Europe are listed below, with a note of their range and conservation situation. Endemic species are indicated by an asterisk. Species of special concern are provisionally assigned a letter indicating the appropriate IUCN status category (defined below). These assignments are subject to revision.

Coluber algirus Algerian Whip Snake

Malta. Outside Europe in northwest Africa.

Status unknown, possibly uncommon.

* Coluber gemonensis Balkan Whip Snake

Endemic to Europe. Greece, north along the Adriatic coast of Yugoslavia, just enters northeast Italy.

No evidence for serious decline.

Coluber hippocrepis Horseshoe Whip Snake

Spain and Portugal, southern Sardinia and Pantelleria (Italy). Outside Europe in northwest Africa.

No evidence for serious decline.

Coluber jugularis Large Whip Snake

The Balkans area, including Greece, Albania, Yugoslavia, Bulgaria Romania and southern Hungary. Outside Europe to southwest USSR, Turkey and the Middle East.

No evidence for serious decline.

Coluber najadum Dahl's Whip Snake

Parts of the Balkans area, including Greece, Albania, Yugoslavia and Bulgaria. Outside Europe to southwest USSR, Turkey and the Middle East.

No evidence for serious decline.

R ? Coluber rubriceps

Recently reported from the Ropotama River area in southeast Bulgaria. Outside Europe in Turkey and the Middle East. Rare in Europe.

Taxonomic status not clear. Traditionally regarded as a subspecies of C. najadum.

* Coluber viridiflavus Dark Green Whip Snake

Endemic to Europe. Northeast Spain, much of France (also Corsica), parts of Switzerland, northwest Yugoslavia, Italy including Sardinia and Sicily.

No evidence for serious decline. Sometimes common.

V Coronella austriaca Smooth Snake

Widespread. In all European countries (not the Republic of Ireland), absent from much of Iberia, most of Scandinavia, absent from Mediterranean Islands. Extinct in Denmark. Outside Europe in USSR, Turkey and Iran.

Significantly threatened in Belgium, England, Federal Republic of Germany, France, perhaps Italy, Luxembourg, Netherlands, Switzerland and Sweden. Rare in Finland and Poland. Most serious declines in England, Federal Republic of Germany and Netherlands. Threatened by habitat loss by reclamation, urbanization, afforestation, and possibly by over-collection.

Coronella girondica Southern Smooth Snake

Portugal and Spain, southern France, west Austria, Italy. Outside Europe to northwest Africa.

No evidence for serious decline.

K Elaphe longissima Aesculapian Snake

Northern Spain, much of France, Switzerland, Austria, Italy, Greece, Albania, Bulgaria, Yugoslavia, Romania, Hungary, extreme south of Federal Republic of Germany, south Czechoslovakia, south Poland. Outside Europe in southwest USSR, Turkey and Iran.

Seriously threatened in Czechoslovakia, Federal Republic of Germany, and Switzerland. Very rare in Poland. Rare in Spain. Possibly locally threatened in Italy. Apparently satisfactory in most of range. Outside Europe threatened in USSR.

Threatened by habitat loss, over-collection, and possibly by climatic fluctuations in the north of the range.

V Elaphe quatuorlineata Four-lined Snake

Italy, Yugoslavia, Albania, Greece, Bulgaria, east Romania. Outside Europe in southwest USSR, Turkey and Iran.

Significantly threatened in Italy, Romania, possibly Greece.

Threatened by habitat loss and over-collection.

* Elaphe scalaris Ladder Snake

Endemic to Europe. Portugal, Spain southern France.

No evidence for serious decline.

V Elaphe situla Leopard Snake

Italy, Yugoslavia, Albania, Greece, southern Bulgaria. Outside Europe in southwest USSR and Turkey.

Very rare in Bulgaria, significantly threatened in Italy and Greece. Threatened in USSR.

Threatened by habitat loss and over-collecting.

Eryx jaculus Sand Boa

Albania, southern Yugoslavia, Bulgaria, east Romania, Greece. Outside Europe in North Africa, Turkey, south USSR and Middle East.

Possibly extinct in Romania, but no evidence of serious decline elsewhere.

Macroprotodon curcullatus Hooded Snake

Portugal, Spain. Outside Europe in North Africa.

No evidence for serious decline.

Malpolon monspessulanus Montpellier Snake

Portugal, Spain, southern France, north Italy, Yugoslavia, Albania, Greece, Bulgaria. Outside Europe in North Africa, Turkey, south USSR, Middle East.

No evidence for serious decline. Sometimes relatively common.

Natrix maura Viperine Snake

Portugal, Spain, France, southwest Switzerland, northwest Italy also Sardinia. Outside Europe in northwest Africa.

Seriously threatened in Switzerland, no evidence for marked decline elsewhere.

K Natrix natrix Grass Snake

Widespread, in all European countries (except the Republic of Ireland), Not in northern Scandinavia. Outside Europe in northwest Africa, Turkey, USSR, Iran.

Rare or in local decline in Finland, Denmark, Netherlands, Belgium, Luxembourg, Federal Republic of Germany, Switzerland and United Kingdom.

Populations still very widespread. Sometimes common in much of range.

Natrix tessellata Dice Snake

Italy, Switzerland, Austria, Federal Republic of Germany, German Democratic Republic, Czechoslovakia, Hungary, Romania, Bulgaria, Yugoslavia, Albania, Greece. Outside Europe in USSR, Turkey, Middle East, Central Asia, Saudi Arabia.

Seriously threatened in Federal Republic of Germany. Sporadic in parts of range, e.g. Hungary. Sometimes common.

Typhlops vermicularis Worm Snake

Albania, south Yugoslavia, south Bulgaria, Greece. Outside Europe in USSR, Turkey and Middle East.

No evidence of decline.

Vipera ammodytes Sand Viper

Northeast Italy, Austria, Romania, Yugoslavia, Albania, Greece. Outside Europe to Turkey and southwest USSR.

No evidence of serious widespread decline, locally decreasing.

Vipera aspis Asp Viper

Northeast Spain, France, Switzerland, southwest Federal Republic of Germany, Austria, Italy. Seriously threatened in Federal Republic of Germany, declining in Switzerland. Relatively common in much of France and Italy.

W Vipera berus Adder

Widespread in Europe but absent from Albania, Greece, Spain, Republic of Ireland. Outside Europe through USSR to Sakhalin, also China.

Localized populations and locally declining in much of Western Europe including Belgium, Federal Republic of Germany, France, Italy, Netherlands and Switzerland. Declining also in Czechoslovakia and Romania and in inhabited areas in Hungary. Declining in parts of Finland. Status appears satisfactory in Norway, Sweden and parts of United Kingdom.

Vipera latasti Lataste's Viper

Portugal, Spain. Outside Europe in North Africa.

No evidence of serious decline.

V* Vipera lebetina Blunt-nosed Viper

A distinct subspecies, V. l. schweizeri, is present in the western Cyclades islands (Greece), on Milos, Kimolos, Polyagos, Siphnos, possibly Kithnos and Antimilos.
Outside Europe other subspecies range through North Africa, Turkey, Cyprus, the Middle East to south USSR and northwest India.

Greek population threatened by persecution and collecting.

* Vipera seoanei Seoane's Viper

Endemic to Europe. Northern Portugal, north Spain, extreme southwest France. Formerly regarded as a subspecies of V. berus.

No evidence of serious decline.

V/E Vipera ursinii Orsini's Viper

Occurs generally as a series of small highly localized populations, at present treated as four subspecies. The south European highland form V. u. ursinii occurs in southeast France, central Italy, the southwest Yugoslavian mountains (north to Krk), and in southwest Turkey. A second subspecies, the lowland form V. u. rakosiensis, is present as relict populations in Austria, Hungary, Romania, Bulgaria and northeast Yugoslavia.

Outside Europe a third subspecies, V. u. ebneri, is found mainly in highland areas from northeast Turkey, the Caucasus, the Elburz chain in Iran, to eastern Kazakhustan. The fourth subspecies, V. u. renardi, is widespread in steppe regions from northeast Romania through the Ukraine to eastern Kazakhstan.

V. u. ursinii is rare and declining in France and Italy, due to habitat loss and over-collecting. V. u. rakosiensis is probably extinct in Austria, near extinct in Romania, declining in Hungary, all mainly due to habitat loss. V. u. renardi just enters Europe in Romania where near extinct.

Vipera xanthina Mountain Viper

Present on several Greek islands in the extreme eastern Aegean Sea; Chios, Leros, Lipsoi, Patmos, Simi, Outside Europe in Turkey (related forms in USSR and Lebanon better treated as full species).

No status data available, no evidence for decline.

Telescopus fallax Cat Snake

Northeast Italy, Yugoslavia, Albania, Greece, Maltá, south Bulgaria. Outside Europe in Turkey, USSR, Middle East.

No evidence of serious decline.

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