



CENTRAL ZOO AUTHORITY

APPLICATION FOR SMALL GRANT FELLOWSHIP
Please read appendix I for instructions (last page of this document)
Form must be filled in English

Internal Project Number (To be filled in by CZA):

1. GENERAL INFORMATION

Date of application: 01.02.2006

Name of the Zoo / organization : Zoological Garden, Alipore, Kolkata.

Contact person/ : Dr. Subir Kr. Chaudhuri, Director, Zoological Garden, Alipore, Kolkata - 700027.

2. CLASSIFICATION OF PROPOSAL

Improvement of the Zoo	Scientific Management	Ex-situ Conservation	Welfare of animals	of the	Any other, please specify
	✓	✓			

3.. DATE OF INITIATION OF THE PROJECT

1st April, 2006 (Expected)

4. DURATION OF THE PROJECT:

3 years

5. LOCATION OF THE PROJECT.

Region /State : Eastern Region, West Bengal.

Closest main city : Kolkata.

6. STAFF INVOLVED IN PROJECT (please include Curriculum Vitae of the individuals):

1. Name (+ title) + Zoo/Organization : Dr. Subir Kr. Chaudhuri, Ph. D.
Director, Alipore Zoological Garden, Kolkata

Period to be spent on the project from : 01.04.2006 to 31.03.2009 (day/month/year/) for.....
Hours/week

Role / Function in the project : Supervisor of the project.

2. Name (+title) + Zoo/Organization : Dr. Goutam Kr. Saha, Ph.D.
Department of Zoology, University of Calcutta

Period to be spent on the project from : 01.04.2006 to 31.03.2009 (day/mbnth/year/) for.....
Hours/week

Role / Function in the project : Project Leader.

3. Name (+title) + Zoo/Organization : Mr. Rudra Prasad Das, M.Sc.

Period to be spent on the project from : 01.04.2006 to 31.03.2009 (day/month/year/) for.....
Hours/week

Role / Function in the project : as Research Assistant.

7. PROJECT PROPOSAL

7a. Background and history of the project (max. 300 words)

Conservation breeding of Brow-antlered deer (*Cervus eldi eldi*) in the Zoos of Eastern & North-Eastern Region of India

Brow-antlered deer or *Cervus eldi eldi* or Sangai is a highly endangered species and confined to open flat grasslands and phumdis and floating vegetation in marshes of Loktak Lake in Keibul Lamjao National Park in Manipur, in less than 10 sq. km. area. Sangai has been incorporated as critically endangered in Red Data Book by IUCN, Appendix I by CITES and Schedule I, Part I of Wildlife (Protection) Act, India. At present the wild populations of mature individuals is approximately 100 and is constantly declining, while the captive population consist of approximately 171 individuals in 17 different zoos of the country.

Breeding for the purpose of maintaining optimum level of heterozygosity in the species and avoiding breeding between kins is called 'conservation breeding'. Endangered species which have no chances of survival in wild, a last chance of survival is through conservation breeding under ex-situ condition and raising stocks for rehabilitating them in wild as and when it is appropriate and desirable.

Zoos are now treated as centres for ex-situ conservation of wild endangered animals. But, recent amendment of the Wildlife (Protection) Act, Section 11, reveals that zoos cannot acquire animals from wild. Therefore to make all zoos self sufficient in their collection, conservation breeding is necessary. By successive breeding a genetically viable population of species can be stocked.

For successful captive breeding programme, knowledge on biology and ecology of wild animals are necessary. Study on the behavioural and physiological phenomena which are difficult and next to impossible in the wild can be carried out in zoos. Also observation and samples can be collected on consistent basis.

At the Regional (Eastern & North-Eastern) Zoo Directors' Conference held at Kolkata in March, 2005, Alipore Zoological Garden has been selected for conservation breeding of brow-antlered deer of the Eastern and North-Eastern Zoos as mentioned in pg. 36 of the proceeding of "Co-ordinated Captive Management of Endangered Species". As a part of this concept the present project has been proposed.

7b. Main problem or question (max 200 words)

- A. Sangai is endemic to India, a single population only in one location (pocket population) which is extremely regional.
- B. Gradual decline in area of occupancy due to human settlement, interface, cattle grazing, damming, fishing, hunting and extension of agricultural facilities. Loss of habitat by siltation, burning of grass is also responsible.
- C. Since it is at present represented by a single isolated pocket population, there is every possibility that any disease or natural calamities can wipe out the total wild population.
- D. Population fragmentation and reduction in population size facilitate inbreeding depression - resulted in accumulation of deleterious recessive genes in individuals following continuous mating between close relatives.
- E. There is at present no concerted effort by the zoos in the region for conservation breeding of the species.

7c. Aims and objectives of the project (max 200 words)

- A. To observe the basic biology, behaviour and ecological requirements of the target animal at Alipore Zoological Garden, Kolkata and other zoos in the Eastern and North-Eastern region.
- B. To analyse the existing stock in regard to inbreeding heterozygosity and kinship through biotechnological interventions.
- C. To prepare a management plan for the conservation breeding of Sangai in the zoos of Eastern and North-Eastern region.

7d Methodology and/or proposed activities (max 300)

By using Micro-techniques like RAPD markers, STR with Micro-satellite markers, PCR etc. the genetic variations within the population can be determined.

Methodology of Mitochondrial DNA extraction from head hair shafts:

Isolation of DNA:

Cut 10-15 hair roots about 0.5 cm into a 1.5 ml eppendorf tube.
50 µl of lysis buffer [10 mM Tris (pH 8.3); 50 mM KCL and 0.5% Tween] and 10µl of 20 µg/ml solution of Proteinase K in 10 mM Tris-HCL (pH 7.5) are added.

Vortex it for 30 seconds.

Ultracentrifuge at 13000 rpm for 1 second.

Incubate overnight in a 56 - 60°C water bath.

Incubate for 10 minutes at 94°C (to denature the Proteinase KI presume).

Cool down to room temperature.

Ultracentrifuge at 13000 rpm for 1 second.

Ready DNA for PCR.

12-14 mer arbitrary primers will be designed and the G-C content will be calculated.

In a 0.5 ml PCR tube, the followings are added : PCR buffer (2.5 µl), dNTPs = 4X1µl (1µl for each A, T, G, C), Magnesium Chloride solution (0.5 µl), BSA (1 µl), Primer (1 µl), Taq DNA Polymerase (0.5 µl), DNA (1.5 µl), Sterile water (14 µl) and Mineral oil (16 µl) are added.

Run PCR for 30 cycles. 1 cycle (6 mins.) = 94°C (2 mins.), 40°C (1 mins.), 72°C (3 mins.).

Visualization of Amplified Products: Prominent bands will be visualised by using 1.8% agarose Gel Electrophoresis.

Documentation of RAPD bands: The gel will be photographed and the bands will be scored. The genetic distance from scored bands will be calculated using UPGMA software.

[Reference: Graffy, EA, Foran DR. J Forensic Sci. 2005 Sep; 1119-22
Nei M & Li W.H. Proceeding of Natural Academy of Sciences. 1979 USA 74 5267-73]

OR,

Live animals or recommended part of the body of the animals in the respective zoo will be sent to the CCMB/LaCONES for detection of inbred depression, heterozygosity, kinship, infertility etc.

8. COLLABORATION (IF ANY): Please specify with which institutions/organisations will collaboration take place and type of the collaboration & support should also be indicated.

NGO's	NAME	LOCATION
Ministries	
Universities :	<u>Department of Zoology, University of Calcutta.</u> <u>35, Ballygunge Circular Road, Kolkata-700019; West Bengal</u>	
Research institutes / or any other :	<u>CCMB/ LaCONES: Hyderabad.</u>	

Type of the collaboration and support : Academic and infrastructural facilities like laboratory, equipments, space, library and expertise.

8a. Support from host zoo: (Please specify what support the host zoo will be providing, it could be in the form of laboratory, equipment, space or personnel).

- Target animals
- Laboratory
- Equipments
- Personnel

9. BASIC TIME SCHEDULE

3 Years

10. OUTPUT

10a. Describe which output can be expected from this project (reports, (scientific) publications, management plans, educational tools, etc. etc.) and how they will be disseminated.

- Periodic Reports,
- Publications,
- Management Plans.

10b. Describe the (practical) relevance of this project for ex-situ conservation and scientific management of animals in general

- A. Determination of genetic relatedness and the degree of inbreeding depression, which will help in designing breeding programmes.
- B. The identification of animals with high genetic variations.
- C. The establishment of gene resource bank of endangered species. Preservation of genetic components in the laboratory will help in future for artificial fertilization for a targeted individual. This preservation can be called as 'frozen zoo'.
- D. The establishment of techniques in assisted reproduction and intervention of mankind to improve the fertility status and reproductive performance of an

- organism can conserve it. The assisted reproduction is important for maintenance of genetic variation and to facilitate breeding in captive condition.
- E. Human resource development in wildlife molecular ecology and reproductive biology.
- F. Training of zoo personnel and wildlife managers for effective management of wildlife.
- G. To control and eradicate sexually and genetically transmitted diseases.

10c. Describe how results/output will be evaluated (timelines and benchmarks)

An expert committee will be formed later, to evaluate and monitor the progress of the proposed work, in consultation with Central Zoo Authority. This may be structured as follows -

- A. Project leader
- B. Research Supervisor
- C. An expert as suggested by Management Committee of Alipore Zoological Garden.
- D. An external expert as suggested by Central Zoo Authority.

11. FEASIBILITY (How well is the execution of the project guaranteed? Possible risks such as logistics, permits, other finances and how are these risks dealt with).

The Alipore Zoological Garden and the Department of Zoology, University of Calcutta will meet time to time to shoot out the problems related to logistics, finances and other problems.

12. FINANCIAL ASPECTS (please include budget overview (in Rs.) in an appendix)

PROVISIONAL BUDGET ESTIMATE (in Rs.)					
Head of account	1 st year	2 nd year	3 rd year	Total	
1 Salary for Research Assistant (@ Rs. 8000/ pm fix)	96,000	96,000	96,000	2,88,000	
2 Chemicals and Lab ware	60,000	50,000	50,000	1,60,000	
3 Contingency	30,000	30,000	30,000	90,000	
4 Travel	20,000	20,000	20,000	60,000	
Total	2,06,000	1,96,000	1,96,000	5,98,000	

GRAND TOTAL: Rs. - 5,98,000.

12a. Other financial sources applied for and/or guaranteed

- In case of Forest Dept./Corporation/Trust: please also mention the details
- Indicate if source is applied for or already guaranteed

- NIL -

2. Name Department / Institute: Self

Address:

Amount applied for or guaranteed:

Rs. _

3. Name Department / Institute:

Address:

Amount applied for or guaranteed:

Rs. ...

13. DECLARATION

The information submitted in this application is true, to the best of my knowledge. Should any significant developments arise after this application is made, I shall notify the Member Secretary, Central Zoo Authority.

SIGNATURE

Dr. Subir Kr. Chaudhuri

Dr. Goutam Kr. Saha

Director/Curator/
Officer-In-charge of the Zoo
(Supervisor of the Research)

Research Project Leader

Chief Wildlife Warden/
Municipal Commissioner/
Owner/Zoo Operator

Signature:

Date: 31.1.2006.

Seal

Dr. S. K. CHAUDHURI
M.Sc., Ph. D., F.Z.S. (Cal)
Director

Zoological Garden, Alipore
Kolkata-700027

Signature:

Date: 31.1.2006

Dr. G. K. Saha
Reader in Zoology
University of Calcutta

Signature:

Date:

Include with the proposal:

- A curriculum vitae of the applicant and individuals involved in the project
- Background information about the zoo involved (max. 1 page)
- Budget overview

Brief Background Information:

Alipore Zoological Garden was established in the year 1875 with a view to display, preservation and conservation of endangered wild life. It is situated at the heart of Kolkata City covering a total area of 20.4 hectares and is considered to be a large Zoo. At present it harbours a total 128 different species of animals (Mammals – 43, Birds – 71, Reptiles – 14) of which 32 species belonging to Schedule I & II of Wildlife Protection Act, India (stock as on 31st December, 2005). The Garden also harbours a good numbers of brow-antlered deer (*Cervus eldi eldi*) which was first incorporated in Zoo in 1955 from Keibul Lamjao national park, Manipur (single female was brought in 1955 and in the year 1956 single male was introduced). At present the total population of brow-antlered deer in the zoo is 18 (13 males and 5 females).

Zoos are now treated as centres for ex-situ conservation of wild endangered animals. But, recent amendment of the Wildlife (Protection) Act, Section 11, reveals that zoos cannot acquire animals from wild. Therefore to make all zoos self sufficient in their collection, conservation breeding is necessary. By successive breeding a genetically viable population of species can be stocked.

Recently in the Regional (Eastern and North-Eastern) Zoo Directors' Conference held at Kolkata in March, 2005, the garden has been selected for conservation breeding of brow-antlered deer of the Eastern and North-Eastern zoos. The zoo has a well equipped veterinary support, basic infrastructural facilities for research project, well trained research personnel and zoo keepers.

APPENDIX - I

PROVISIONAL BUDGET ESTIMATE (in Rs.)					
	Head of account	1st year	2nd year	3rd year	Total
1	Salary for Research Assistant (@ Rs. 8000/ pm fix)	96,000	96,000	96,000	2,88,000
2	Chemicals and Lab ware	60,000	50,000	50,000	1,60,000
3	Contingency	30,000	30,000	30,000	90,000
4	Travel	20,000	20,000	20,000	60,000
	Total	2,06,000	1,96,000	1,96,000	5,98,000

GRAND TOTAL: Rs. – 5,98,000.

References:

1. **Prof. Samir Bandopadhyay**
Professor, Department of Zoology,
Ballygunge Science College,
37, Ballygunge Circular Road,
Kolkata - 700019
Contact No. - 9331021657

2. **Dr. Goutam Saha**
Reader, Department of Zoology,
Ballygunge Science College,)
37, Ballygunge Circular Road,
Kolkata - 700019
Contact No. - 9433182500

3. **Kedarnath Bhattacharya**
Reader & Head of the Department,
City College,
102/1, Raja Ram Mohan Sarani,
Kolkata - 700009
Contact No. - (033)2350-1565/6505

CURRICULUM VITAE

Name : Dr. Subir Kumar Chaudhuri

Designation : Director, Zoological Garden, Alipore

Address : Zoological Garden, Alipore, Kolkata-
700027.

Marital Status : Married

Academic Qualifications : M.Sc., Ph.D.
(in Zoology)

Ph.D. Thesis : "Investigations on the Coccidian
parasites of some zoo and wild
mammals of India."

Professional Societies : Fellow of the Zoological Society
of Kolkata.

Workshops and Scientific
sessions attended in India : a) participated and presented
research paper in the "First
Asian Congress of Veterinary
parasitology" held in Patna in
1990.
b) participated in "Indian Zoo
Directors' Conference and Workshop:
Zoo's in the next millennium" held
at Kolkata in April, 2000.
c) participated in the Workshop on
"healthcare management of wild
animals in zoos" held in New Delhi
in May 2003.

(2)

d) participated and presented paper in the "Indian Zoo Directors' Conference" held in Darjeeling in November, 2003.

e) participated as a co-ordinator and presented paper in the Regional (Eastern and North Eastern) Zoo Directors' Conference on "Coordinated Captive Management of Endangered Species" held at Kolkata in March, 2005.

Scientific sessions attended in abroad :

participated and presented paper in "XXII International Symposium on diseases of zoo and wild animals" held in Netherlands in 1980.

Erection of new species in the name of Subir Kumar Chaudhuri

Isospora Chaudhurii n.sp. Basu Sujata, 1994. new species of Isospora and Eimeria from common mynah (Acridotheris tristis) and spotted dove (Streptopelia chinensis) verh. ber. Erkrz. zootiere 36:385-390.

professional Experience :

A. Served as resource person:

1) Served as a resource person to teach in the tenth and fourteenth orientation programme in U.G.C. sponsored Academic Staff College at Burdwan University in 1992 and 1994 respectively.

(contd....2....)

: ii) Served as a resource person to teach in the refresher course in zoology in the U.G.C. sponsored Academic Staff College at Burdwan University in 1992.

iii) Taught few classes in the post-graduate course at the Environmental Science Department, University of Calcutta in June, 2003.

List of publications

: CHAUDHURI, S.K. (1978): Studies on the Silkie fowl (Gallus gallus domesticus Linn) at the Alipore Zoo. Proc. Ind. Sci. Congr., p. 309.

CHAUDHURI, S.K., and CHAUDHURY, A., (1979): on genus Eimeria Schneider, 1881 from intestine of Garganey teal. (Anas querquedula Linn) Proc. Ind. Sci. Congr., p. 106

CHAUDHURI, S.K., CHAUDHURY, A. (1979): Occurrence of an Eimeria sp. (Coccidia: Protozoa) in the Cotton Teal (Nettapus coromandelianus Blyth). 2ND. Nat. Congr. Parasitol.

CHAUDHURI, S.K., CHAUDHURY, A. (1980): Investigation of Coccidiosis in "Tigon" a hybrid carnivore kept in the Zoological Garden of Calcutta, India. Verh. ber. Erkr. Zootiere 22: 267-272.

(4)

: CHAUDHURI, S.K., CHAUDHURY, A. (1982):
Relationship between sporulation
and the effect of temperature and
Chemical exposures on the Isosporoid
Coccidium of a White Tiger (Panthera
tigris tigris Linn.) of Calcutta
Zoological Garden, India. Verh.ber.
Erkrgr. Zootiere 24:331-336.

CHAUDHURI, S.K., and DAS, S.K. (1990):
A review of Coccidian Fauna of Zoo
and wild mammals of India in the
perspective of their host specificity.
Proc. 1st Asian Congr. of Very. Parasit.
P-113.

CHAUDHURI, S.K., and DAS, S.K. (1991):
Tigon: An interesting hybrid Cat. Sci.
Courier. 2:13-17.

CHAUDHURI, S.K., and DAS, S.K. (1992):
Studies of host-specificity of
Coccidian parasites in captive and
wild mammals of India. Verh.ber. Erkrgr.
Zootiere 34 : 317-327.

BASU, J., BASU, SUJATA and CHAUDHURI,
S.K. (1992): preliminary observations
on oocysts of Coccidian parasites
from two reptilian hosts in West
Bengal, India. Verh.ber. Erkrgr. Zootiere
34 : 329-334.

CHAUDHURI, S.K. and DAS, S.K. (1993):
Encatchment and transport of deer
and antelopes. Verh.ber. Erkrgr. Zootiere
35 : 133-139.

(5)

: CHAUDHURI, S.K. (2000): Evolution of Zoo concept vis-a-vis management. Souvenir published for the celebration of 125 years of Calcutta Zoo : 38-40.



Dt. S. K. CHAUDHURI 21.11.2006.
M.Sc., Ph. D., F.Z.S. (Cal)
Director
Zoological Garden, Alipore
Kolkata-700027

BIO-DATA

Name: **DR. GOUTAM KUMAR SAHA**
Father's Name: Sri Gopinath Saha
Date of Birth: 07. 10. 1960
Present Position: Reader in Zoology, University of Calcutta,
35, Ballygunge Circular Road, Kolkata 700 019
West Bengal, INDIA.

Phone No: + 91 33 2472- 7158 (R)

e-mail: gkszoo@rediffmail.com

Permanent Address: TIKARHAT (Chiramill), P.O. Lakurdi, Burdwan 713
102, West Bengal, India
Ph. +91 342 2530072

Marital Status: Married
Nationality: Indian

Educational Qualification

<i>Examination</i>	<i>Year</i>	<i>University</i>	<i>Marks</i>	<i>Division</i>	<i>Position</i>
B. Sc. (Zoo. Hons.)	1981	Burdwan University	64.5%	1st Class	1st
M. Sc. (Zoo/ Ento)	1983	Burdwan University	69.0%	1st Class	1st
Ph.D. (Sc.)	1991	School of Tropical Medicine, Calcutta & B.U			

Prizes and Awards: National Scholarship, University Gold Medal,
CSIR Senior Fellowship

Research Experiences:

1. Nineteen years experience in the field of Medical Entomology (Allergy and Applied Immunology, Vector Biology) & Wildlife Conservation Biology
2. Awarded research fellowship (JRF & SRF) by D. S. T., Govt. of India at Calcutta School of Tropical Medicine during 1986-1989.
3. Ph. D. on Environmental Science related problem "Dust mite allergy" from Calcutta School of Tropical Medicine and Burdwan University
4. Awarded CSIR Senior Fellowship with individual project on 'Control of house dust mites' at Dept. of Zoology and worked at Indian Institute of Chemical Biology .

c.	Bio-ecological status of Satyr Tragopan in the Singhalila National Park, Darjeeling	Dept. of Forest, Govt. of W. B.	1993-96	Project Coordinator
d.	Faunistic and ecological studies of Chironomid fauna of Darjeeling-Sikkim Himalayas	D. S. T. Govt. of India	1995-98	Principal Co-investigator
e.	Ecology of Tragopans in Northeast India	World Pheasant Association	1997-2002	Project Adviser & Co- investigator

Research Project ongoing :

1. UGC sponsored project on Studies on the house dust mite fauna of Kolkata metropolis in relation to nasobronchial allergic disorders.
2. MoEF sponsored project on Studies on the population status, distribution and habitat preference of Kalij Pheasant and Satyr Tragopan in the Neora Valley National Park , Darjeeling, West Bengal.

Research Guidance for Ph.D. Students:

- i) Certain aspects of ecology and behaviour of the Satyr Tragopan (*Tragopan satyra*) in the Singhalila National Park, Darjeeling India. By Ms. S. Khaling under North Bengal University
- ii) Studies on some aspects of ecology of Red Panda (*Ailurus fulgens* Cuvier 1825) in the Singhalila National Park, Darjeeling, India. By Ms. S. Pradhan under North Bengal University
- iii) Distribution and habitat preference of *Tragopan satyra*, *T. blythii* and *T. temminckii* in Northeast India By Mr. Dipankar Ghosh under Calcutta University.

Number of students registered for Ph. D Degree : Five

Teaching Experiences:

- a. Fifteen years experiences in undergraduate and post graduate teaching at P. G. Department of Zoology, Darjeeling Govt. College, Durgapur Govt. College, University of Calcutta and Burdwan (Guest Lecturer).

Other information:

- a. Participated in the orientation Programme of UGC at Academic Staff College, University of Burdwan, 1992.
- b. Participated in 7th and 9th Refresher Course in Zoology at the Academic Staff College, University of Burdwan, 1993 & 1994.

- c. Participated in UGC sponsored Refresher Course on Environmental Biology at the University of Burdwan, 1999 .
- d. Participated in UGC sponsored Refresher Course in Environmental Studies at University of Calcutta, 2001.
- e. Acted as a resource person in Refresher Course in Life Science at University of Calcutta.
- f. Acted as Course Coordinator of Refresher Course in Life Sc, 2003.

Authorship of Books/Monographs :

- a. Distribution and ecology of anopheline fauna of hilly regions of India : an overview. Published by Bengal Natural History Society and sponsored by Dept. of Sc & Tech., Govt. of West Bengal, 1995.
- b. Mammalian specimens of Bengal Natural History Museum, Darjeeling. Published and sponsored by Dept.of Forest (Wildlife Wing) Govt. of West Bengal, 1996.
- c. Catalogue of the avian specimens of Bengal Natural History Museum, Darjeeling. Published and sponsored by Dept. of Forest (Wildlife Wing), Govt. of West Bengal.1997.
- d. Life Science Update published by ASC, University of Calcutta, 2003.

Membership :

- a. Fellow, Indian College of Allergy and Applied Immunology
- b. Fellow, Zoological Society (FZS)
- c. Founder life member, Indian Academy of Allergy.
- d. Life member, Association of Zoologists of India.
- e. Life member, Indian Science News Association
- f. Life member, Indian Society for Parasitology.
- g. Fellow member, Entomological Society of India.
- h. Life member and Executive Committee member Zoological Association of Burdwan.
- i. Assistant Secretary, Zoological Society of Calcutta.
- j. Member, Invertebrate Conservation an Information Network of South Asia (ICINSA)
- k. Member, Captive Breeding Specialist Group, South Asia.
- l. Member Asia Pacific Association of Allergy and Clinical Immunology.
- m. Member Indian Bird Conservation Network (IBCN).

Extracurricular Activities :

- a. Represented W.B. State Volley ball team in National School Games, 1978
- b. Represented Burdwan University Volleyball team in East Zone Interuniversity tournaments for six consecutive years. Led the team twice as captain (1983 & 1984)
- c. Participated in All India Inter-university Volleyball Tournament twice at Bangalore and Kuruksetra.
- d. Represented Burdwan District Volleyball Team for eight consecutive years (Twice as captain of the champion team)

References :

- a. Prof. A.K. Hati, Former Director, Calcutta School of Tropical Medicine, 8/1D Neogy Para Road, Kolkata – 700 036, INDIA.
- b. Dr. A.K. Ghosh, Former Director, Zoological Survey of India, C/O Centre for Environment and Development, 329 Jodhpur Park, Kolkata 700 068, India

Jantam Saha
30.1.2006