



Consolidated report for the period from 1st April 2007 to 31st March 2013



PI : Dr D. Swarup (till Feb 2010)
 Dr A.K. Sharma (from March 2010)

Co-PI : Dr Mohini Saini and Dr Asit Das

Associates : Dr S. Dey (Medicine)
 Dr S.D. Singh (Avian Disease)
 Dr A. Pawde (Surgery)
 Dr A.G. Telang (CADRAD)
 Dr P.K. Gupta (Biotechnology)

&

Scientist Experts nominated by:

JD (CADRAD)
 HD Bacteriology
 HD Parasitology
 HD Medicine

Consolidated report of the period 1st April, 2007 to 31st March 2013

Preamble

The Centre for Wildlife Conservation, Management and Disease Surveillance was established in 1984 during 5th five year plan in Indian Veterinary Research Institute, Izatnagar with the mandate to cater the need of disease investigation in wildlife and to provide expert consultancy to various zoos and National park authorities. Since its inception, the Centre has been engaged in providing disease diagnosis facilities and wildlife health management consultancy besides conducting research on need based problems in wildlife. In addition, 30 Veterinary Officers belonging to various State Governments such as Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Gujarat, Himachal Pradesh, Kerala, Madhya Pradesh, Mizoram, Nagaland, Orissa, Rajasthan, Tripura and West Bengal were trained through National Diploma in Zoo and Wild Animal Health Cure and Management (NDZWA).

Keeping the services provided to wildlife in captivity in view, the Central Zoo Authority, MoEF, New Delhi recognized the Centre as "National Referral Centre on Wildlife Healthcare" for a period of five years in 2007 and sanctioned a onetime grant of Rs 30.36 Lakhs to establish latest diagnostic facilities at the centre. The MoU to this effect was signed between CZA and IVRI in August 2007 (Copy attached as Annexure I). During this period, several cases of unusual mortalities in wildlife were attended and preventive guidelines were suggested, notable being the investigations on the cause(s) of disease and unusual mortality of Gharials in the Chambal River, of peacocks in Rewari, Haryana and of vultures in Bikaner, Rajasthan, and the management of mortality in blackbucks in Sikandra Agra. Several consultancies were provided for the treatment of ailing animals in the Indian zoos and National Parks. Besides focusing on disease diagnosis and healthcare of wild animals, eight need based research projects funded by various agencies were taken up.

1. Research Projects handled by the Centre

1. Standardization of animal diets in Indian zoos (Funded by CZA) (20.08.2007 to 19.10.2010)

(PI): Asit Das

Co-PI- M. Saini, D. Swarup, K. Sharma, S.K. Saha, Narayan Dutt, B.C. Das

2. Development of standards, guideline and protocol on disease diagnosis and healthcare of animals in Indian Zoos (Funded by CZA) (1.04.2008 to 31.03.2010)

PI: D. Swarup

Co-PI- Mohini Saini, Asit Das,

Collaborators- A. K. Sharma, V.P. Singh, Amar Pal, Pankaj Kumar

3. Monitoring diclofenac residues in cattle and buffalo carcasses in India for supporting Gyps species vulture conservation (Funded by BNHS, Mumbai) (1.04.2008 to 31.03.2010)

PI: Mohini Saini

Co-PI- D. Swarup and Asit Das (IVRI) & Vibhu Prakash, Principal Scientist (BNHS, Mumbai)

4. Development of molecular marker for sex identification in Gyps vultures (Funded by IVRI) (1.09. 2009 to 31.08.2011)

PI: Dr Mohini Saini

Co-PI: D. Swarup, Dr A.K. Sharma, Dr Asit Das, Dr P.K. Gupta (IVRI), Vibhu Prakash (BNHS)

5. Influence of plane of nutrition on fecal pellet characteristics and blood metabolite status in black buck and spotted deer (Funded by IVRI) (1.04.2006 to 31.03.2009)

PI- Asit Das

Collaborators- D. Swarup, Mohini Saini, A.K. Pattnaik

6. Influence of duration and level of feeding on feed consumption, nutrient utilization, serum metabolite and mineral status in semi-captive Asiatic elephant (*Elaphus maximus*) (Funded by IVRI) (1.04.2009-31.3.2012)

PI: Dr Asit Das

Co-PI- D. Swarup, Mohini Saini, B.C. Das

7. Diclofenac monitoring in cattle and buffalo carcasses surveyed in 2009-10 and investigating other causes of mortality in vultures in India (Funded by BNHS, Mumbai) (1.8. 2010 to 30.9.2012)

PI- Dr Mohini Saini

Co-PI- A.K. Sharma, Asit Das and Praveen K. Gupta (IVRI)
Vibhu Prakash (BNHS VCBC, Pinjore)

8. Nutritional interventions to improve nutrient utilization, feather colouration and reproductive performance of captive pheasants (Funded by IVRI) (1.09.12 to 31.08.2015)

PI- Dr Asit Das

CoPI- A.K. Sharma, A.K. Garg, Mohini Saini

2. Activities of National Referral Centre

- 1) Attending wildlife disease outbreaks and extending the veterinary consultancy services.
- 2) Necropsy examinations of carcasses and histopathological diagnosis of morbid specimens
- 3) Standardization of diet for wild animals in Indian Zoos.
- 4) Generation of normal haemato-biochemical parameters in different wild species.
- 5) Species-wise cataloguing of bones from wild animals.
- 6) Standardization and use of molecular markers for wildlife species identification.
- 7) Imparting education and training on wildlife through National Diploma on Zoo and Wild Animals, Summer School on Wildlife Health Management and Forensics, Short term training of Zoo Veterinarians.

3. Salient findings of the disease diagnosis under National Referral Centre on Wildlife Healthcare (2007-2013)

National Referral Laboratory was established at CWL with the financial support received from CZA where laboratory investigations were carried out based on necropsy, histopathology, and other laboratory techniques including PCR and ELISA (Figure 1). During the period under report, postmortem examinations were conducted on 345 carcasses received from different Zoos, National Parks and Forest Departments (Table 1). Histopathological, microbiological (including bacteriological, serological and virological, fungal, antibiotic sensitivity), toxicological (specimens of animal tissues and fodder/ plant materials), parasitological and haemato-biochemical examinations were conducted on specimens received from different Zoos, National Parks and Forest Departments (Table 2). Expert consultancy was provided to different Zoos and Wildlife Sanctuaries in the country to treat the ailing animals and during unusual mortality (Table 3).

Majority of the post-mortem cases revealed traumatic injuries resulting into massive haemorrhage and shock. Based on necropsy or/and laboratory examinations several important diseases/conditions that were diagnosed included:

Neoplasms (carcinogenic/non-carcinogenic)

- Adenocarcinoma of lung in a lioness
- Chalangiocellular carcinoma in a Green Pheasant
- Cholangiocellular adenocarcinoma in a sloth bear (Fig 3 D)
- Fibrosarcoma in a white tiger and a baby lion
- Hemangiopericytoma in a white tigress
- Hemangiosarcoma in a tiger
- Highly vascular rhabdomyosarcoma in a Chowsingha
- Infiltrated cholangio-cellular carcinoma in a sloth bear
- Intra alveolar and bronchiolar carcinoma in a sloth bear
- Mesothelioma in Wolf (Fig 3A, B)
- Metastatic adenocarcinoma in a lion
- Metastatic adenocarcinoma in three sloth bears
- Ophthalmic neoplasm and hemangiopericytoma in a tiger
- Osteosarcoma in a rhinoceros and an owl

Toxicity

- Heavy metals Arsenic and organo-phosphate in a sambar
- Heavy metals Arsenic in stomach contents of a guldar

- Hepato-nephropathy in a lion
- Insecticides toxicity in Sarus, crow and guldar
- Nitrate-nitrite poisoning in blackbucks, fodder samples
- Organochlorine poisoning in three tigers, three guldars and one each of leopard, pig, monkey, elephant cub and White peafowl

Parasitic infestations

- *Amphistome* sp. in a Swamp deer rumen
- Amphistomes, *Anoplocephala* sp., *Paranoplocephala* sp., *Bivitellobilharzia* sp. in rhinoceros
- Babesia sp. (both small and large forms) and Hepatozoon species in panther
- *Fasciola jaksoni* & Strongyles infection in 12 elephants
- Fasciolosis (Cirrhosis) in four blackbucks (Fig 2 B, C)
- Haemoprotozoan parasite in tigress
- Hepato-nephropathy due to Goussia protozoan infection in gharial
- Babesiosis in panther
- *Hepatozoon felis* in a leopard
- Lungworm infestation (*Aleurostrongylus* sp.) in leopard cat (Fig 2 E, F)
- *Macracanthorhynchus hirudinaceus* infestation in wild boar
- *Mecistocirrus* sp. in a Swamp deer abomasum
- Round worms from GIT of elephant identified as *Murshidia* Sp., *Amiroides* Sp. and *Equinurbia* Sp.
- *S. Spirometra* sp. (Tape worm) and *Capillaria* sp. (Round worm) in GIT of Fishing Cat
- Schistosomosis in dolphin
- Severe intestinal coccidiosis in a nilgai (Fig 2 D)
- Severe tapeworm infestation due to *Anoplocephala* sp. in rhinoceros (Fig. 2 A).
- *Toxocara cati* in tiger, guldar and leopard
- *Physalopera* sp. in tiger and leopard
- *Trichuris* sp. in faecal sample of a tiger
- Trypanosomiasis in wolf

Viral diseases

- Canine distemper in two tiger cubs, a tiger, a tigress and a red panda
- Infectious canine hepatitis (adenoviral infection) in seven sloth bears (Fig 3 C)
- Newcastle disease virus infection in peacocks
- Rabies a sloth bear

Bacterial diseases

- Tuberculosis in 23 sloth bears and one each of chital, nilgai and Cape buffalo
- Leptospiral infection in both carnivorous as well as herbivorous species such as tiger (Fig 3 E), white tiger, jaguar, lion, leopard, panther, spotted deer, bison, elephant, and buffalo. Main serovars encountered were *Grippityphosa*, *Icterohaemorrhagiae*, *Pomona*
- Severe necropurulent nephritis due to *streptococci* infection in a white tiger
- Infectious peritonitis in lion

Fungal diseases

- *Candia albicans* in a peacock lung
- Mycotic gastritis due to *candida sp.* in crocodile
- Systemic aspergillosis (*Aspergillus fumigatus*) in peacocks and Himalayan griffon vulture (Fig 3 G, H).

Metabolic diseases

- Osteo-arthritis in tiger
- Diffuse fatty changes in liver with intrahepatic cholestasis in Zebra

Miscellaneous

- Bullet injury in three nilgai, two blackbucks and one tiger
- Anthracosis of lung in a panther
- Electrocution in leopard
- Dystocia due to foetal mispresentation in a chital
- Chronic interstitial nephritis and severe pulmonary anthracosis in Bonnet Monkey
- Severe renal tubular degeneration "cloisonne kidney" in a tiger
- Visceral gout in vultures (Fig 3 F)
- Interstitial pneumonitis with anthracosis in otter

Acknowledgements

The team of National Referral Centre on Wildlife Healthcare is grateful to the Central Zoo Authority, MoEF, Govt of India, New Delhi for the financial support. We also thank the Director, Joint Directors of IVRI and all the Zoo Directors for providing necessary facilities. The help and support rendered by HD (Pathology), HD (Medicine), HD (Surgery), HD (Parasitology), HD (Bacteriology & Mycology) at IVRI, Izatnagar is deeply acknowledged.



(A.K. Sharma) 26.1.13
Principal Investigator

Table 1- Summary of postmortem examinations (1.04.2007-31.03 2013)

Species	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2007-2013
Bat			2				2
Blackbuck	9	6	6	11	9	20	61
Bear		3	1				4
Bird		1					1
Cat		1					1
Crocodile	1			1	2	2	6
Gharial				2	3		5
Hog deer				1		2	3
Langur				1	1		2
Leopard	1	4		3	2		10
Monkeys		17			2	10	29
Nilgai	1		3	4	2	5	15
Owl		1			1	1	3
Pangolin					1		1
Partridge						1	1
Peacocks	28	10		6	6	8	58
Rabbits				3			3
Rhinoceros						1	1
Sambar	1				1	3	5
Sarus crane		1			2	1	4
Snakes						2	2
Spotted deer	5	1	1	6	4	2	19
Swamp deer			1			1	2
Tiger	1	4	2	1	1	4	13
Turtles	5				80	4	89
Vulture					2		2
Water hen						2	2
Wild bear			1				1
Total	52	49	17	39	119	69	345

Table 2-Summary of the disease diagnostic services (1.04.2007-31.03 2013)

Services/ Examination	2007- 08	2008- 09	2009- 10	2010-11	2011-12	2012-13
Histo- pathological	150 tissues from 83 animals	167 tissues from 82 animals	122 tissues from 37 animals	390 tissues from 83 animals	304 tissues from 69 animals	569 tissues from 130 animals
Micro- biological	11	6	1	102 (including 48 bacteriological, 48 serological and 6 virological)	111 (including 4 bacteriological, 96 serological and 8 virological, bacterial isolation and sensitivity 3)	61 (including 12 bacteriological, 21 serological and 24 virological, 3 fungal, 1 antibiotic sensitivity)
Parasito- logical	9	4	2	10	8	90
Haemato- biochemical	13	5	2	10	5	12
Toxicological	-	30	10	39	43	72
Post-mortem	30	24	21	39	109	69
Clinical Consultancy	9	8	6	10	10	9

Table 3 - Consultancies provided during 2007-13

(2012-13)

1. Divisional Forest Department, Haridwar for treatment of injured a Guldar
2. Dudhwa Tiger Reserve Palia Khiri for treatment of wounded elephant (Fig 4 H)
3. Bhagwat Bhakti Ashram Trusti, Rewari (Haryana) for disease investigation, and treatment during unusual mortality of peacocks
4. Pt. G.B. Pant High Altitude Zoo, Nainital for health evaluation of animals
5. Social Forestry Department, Bareilly for treatment of three nilgai, two owl, two monkeys and one blackbuck
6. Dudhwa Tiger Reserve, Palia Khiri (UP) for treatment of one elephant
7. Dudhwa Tiger Reserve, Palia Khiri (UP) for addressing the problem of Rhino mortality (Fig 4 F)
8. IFFCO Aonla for health check up of deers
9. Director, Sepahijala Zoological Park, Tripura for taking necessary precautions, consider the suggestions, follow up measures in zoo for prevention of Anthrax

(2011-12)

10. Pt. G.B.Pant High Altitude Zoo, Nainital for health evaluation of animals
11. Social Forestry Department, Bareilly for Treatment of injured Black buck and injured peacock
12. M.C. Zoological Park, Chhatbir (Punjab) for treatment of ailing Lion
13. Surgery and treatment of Rescued of wild Eagle
14. Kukrail Rehabilitation Centre, Lucknow, UP for Health evaluation of Gharials
15. Jodhpur Zoo for disease investigation of Tigers suffering from Leptospira (Fig 4 D)
16. Sahaswan, Baduin Veterinary Officer for treatment of Blackbuck
17. Nanadankanan Zoo, Bhubaneswar for expert's opinion for healthcare of rescued Sloth bear
18. Dudhwa Tiger Reserve, Palia Khiri (UP) for treatment of one wounded Rhinoceros
19. Kanpur Zoological Park for treatment of a lioness

(2010-11)

20. MC Zoological Park Chhatbir, Panjab for treatment and control of leptospirosis in zoo animals
21. Jodhpur Zoo, Rajasthan, for treatment and control of leptospirosis in zoo animals
22. Chandipur Forest range, Haridwar for treatment of a lame wild elephant
23. Dudhwa National Park, Palia, Khiri for treatment of an ailing elephant
24. Van Vihar National Park, Bhopal for health checkup of ailing tigress
25. Social forestry Depatment Bareilly for surgery and treatment of a Sambhar
26. Deer Park IFFCO, Aonla, Bareilly for animal health evaluation
27. Gandhi Prani Udhyan, Gwalior for health evaluation of zoo animals
28. GB Pant High Altitude Zoo, Nainital for health evaluation of zoo animals (Fig 4 C)

(2009-10)

- 29. Nainital zoo to improve health status of animals.
- 30. Kanpur zoo for diagnosis and treatment of lioness suffering from kidney failure
- 31. Jim Corbett National Park for health evaluation of semi captive elephants
- 32. Nainital zoo regarding improvement of bird diet
- 33. Provided consultancy to Darjeeling zoo for improvement of diet of red Panda, snow leopard and Tibetan wolf
- 34. Bear rescue Centre Agra for improvement of health status in sloth bear (Fig 4 A)

(2008-09)

- 35. Lion Safari, Dadra and Nagar Haveli for diagnosis of adenocarcinoma in lion and improvement of health status of the rest of the animals
- 36. Nainital zoo regarding improvement of bird diet
- 37. Kanpur zoo for diagnosis and treatment of white tiger suffering from Hemangio-pericytoma
- 38. Tirupati zoo for health evaluation different animals for conservation breeding programme
- 39. Kanha Tiger Reserve for health evaluation of semi captive elephants
- 40. Jim Corbett National Park for health evaluation of semi captive elephants
- 41. Sikandra Agra for management of mortality in blackbuck.
- 42. Forensic services were provided for identification of meat on the basis of PCR RFLP using mitochondrial 12S rRNA as a molecular marker (Fig 1 A, B).
- 43. Thiruvananthapuram zoo for prevention of FMD

(2007-08)

- 44. Van Vihar, Bhopal for treatment of tiger and lion and also advised for weight reduction in bear from 28th August to 3rd Sep., 2007
- 45. Bear rescue Centre, Bhopal regarding diet schedule
- 46. Nainital zoo regarding improvement of bird diet
- 47. Lucknow zoo from 26th November to 1st December, 2007 for treatment of tuberculosis in bear and health screening of other animals
- 48. Kanpur zoo for diagnosis and treatment of hemangio-pericytoma
- 49. Hyderabad zoo 14th to 21st Nov. 2007 for health evaluation different animals for conservation breeding programme
- 50. Kanha Tiger Reserve from 28th January to 2nd February, 2008 for health evaluation of semi captive elephants
- 51. Forensic services were provided for identification of bones, meat sample and hide of tiger, leopard and deer on the basis of anatomical features and PCR RFLP using mitochondrial 12S rRNA as a molecular marker (Fig 1C, D)

104



Figure 1: Laboratory investigations A, B) Identified meat and hides of a hog deer PCR-RFLP; C, D) Identified hide of a leopard and bones of a tiger on the basis of anatomical features; E, F) Various assays in progress in NRC Lab at CWL

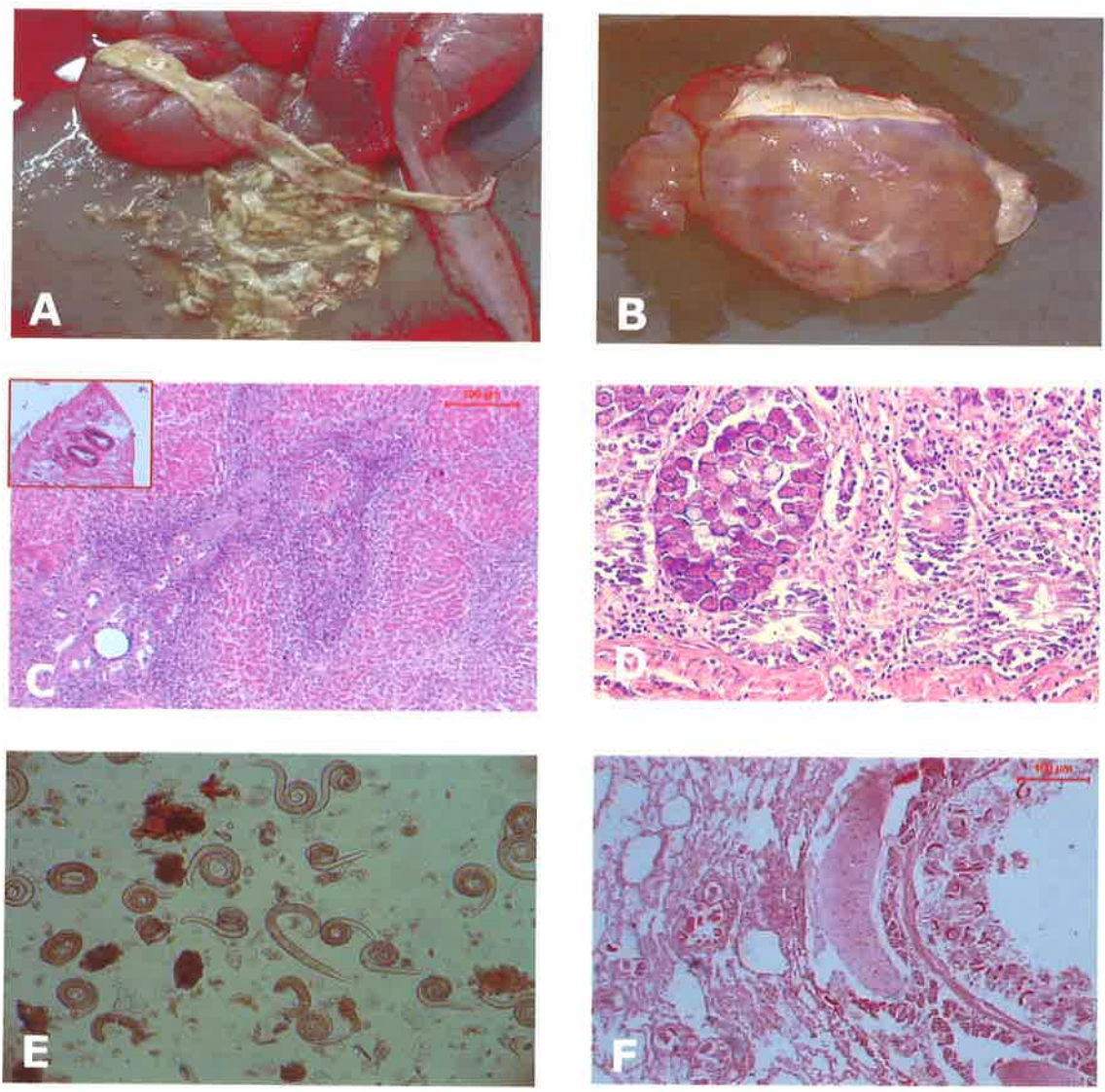


Figure 2: Various parasitic conditions diagnosed in wild animals
A) Severe tapeworm infestation in rhinoceros, B) Cirrhotic liver in blackbuck, C) Cirrhotic liver in blackbuck (Inset: Fasciola sp.), D) Intestinal coccidiosis in nilgai, E) *Aleurostrongylus abstrusus* sp. recovered from lung of leopard cat, F) *Aleurostrongylus abstrusus* sp. in lung of leopard cat,

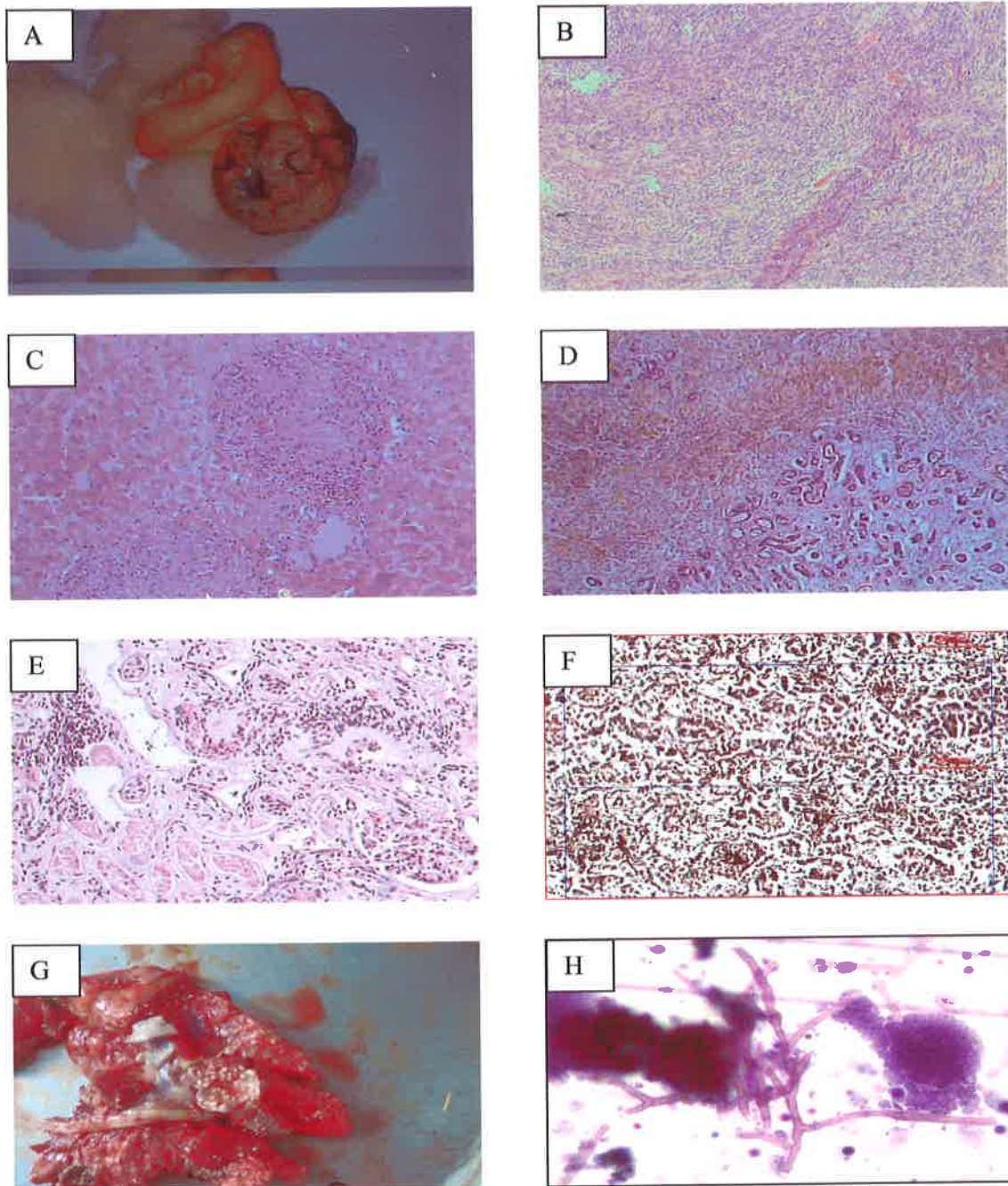


Figure 3: Various diseases/conditions diagnosed in wild animals

A, B) Mesothelioma in Wolf; C) Granulomatous Hepatitis in Sloth bear; D) Cholangiocellular adenocarcinoma in Sloth bear; E) Interstitial Nephritis in Tiger "Leptospirosis"; F) Urate crystals (De Galantha's Stain) in kidney of vulture with visceral gout; G) Multiple nodules scattered throughout the lungs in a vulture (Aspergillosis); H) Lactophenol cotton blue staining of *Aspergillus fumigatus* from Himalayan Griffon Vulture



Figure 4: Consultancy services A) Treating ailing bear at Bear rescue Centre; B) Conducting health evaluation at Satellite Zoo in Darjeeling; C) Conducting health evaluation at Nainital Zoo; D) Addressing leptospirosis in Tiger at Jodhpur Zoo; E) Attending vulture mortality at carcass dump in Bikaner; F) Addressing Rhino mortality at Dudhwa National Park; G) Conducting postmortem of blackbucks at Kanpur Zoo; H) Treatment of rhino at Dudhwa National Park

4. Publications

a) Books

- 1) Das A., Saini M., Datta N., Sharma K., Saha S.K., Das B.C., Swarup D., and Sharma A.K. 2013. Standardization of Animal Diets in Indian Zoos. Indian Veterinary Research Institute, Izatnagar and Central Zoo Authority, New Delhi. pp 303. (In Press)
- 2) Garg, A.K., Pattanaik, A.K., Das, A. and Kamra, D. N. 2013. Nutrient requirements of Companion, Laboratory and Captive wild animals. Book Number 9: A Series of Publications on "Nutrient Requirements of Animals". Indian Council for Agricultural Research. New Delhi.
- 3) Standards, Guidelines and Protocol on disease diagnosis and cure of wild animals in Indian zoos. (2009). Swarup D., Das A, Saini M, Kumar P., Sharma AK and Amar Pal, pp 1-140, CZA & IVRI Publication (Available at <http://www.cza.nic.in>)

b) Book Chapters

- a) Das A., Saini M. and Swarup D. (2012) Feeding and Nutrition of Wild Animals in Captivity In: Animal Nutrition – Advances and Developments, Mehra U.R., Singh P, and Verma A.K. (Eds) Satish Serial Publishing House, Delhi, India.
- b) Swarup D and Saini M (2009) Application of Molecular Markers in Wildlife Health and Forensics. In: Recent Advances in Zoo & Wild Animal Health & Management. (BM Arora, AK Srivastava, Rajeev Singh, Rajesh Aggarwal & Prabhakar Kumar Eds), pp 41-48, Vinayak Publishing House, Jaipur.
- c) Saha, S.K., Das, A., Dutta, N., Chaudhary, L.C. and Sharma, K. (eds) 2008. Emerging trends in nutrition of Wild and Zoo Animals, Centre of Advanced Studies in Animal Nutrition, Indian Veterinary Research Institute, Izatnagar, India

c) Research papers

- 1) Suresh C., Das A., Katole S., Saini M., Swarup D. (2013). Effect of concentrate supplementation on feed consumption, nutrient utilization and blood metabolite profile in captive spotted deer (*Axis axis*) fed oat (*Avena sativa*) and Berseem (*Trifolium alexandrinum*) fodders based diet. **Zoo Biology** 2013 25:1-9.
- 2) Kundu, K., Banerjee, P.S., Shukla, U., Sharma, A.K., Gupta, S.C., Saroj Kumar, Rajat Garg, and Hira Ram (2013). Concurrent babesiosis and hepatozoonosis in a leopard rescued from wild. **Indian Veterinary Journal** 90(6): 119-121.
- 3) Sharma A.K., Shivasharanappa N., Banerjee P.S., Saini M., Raut S.S., Chandratre Gauri A. and Das A. (2013) Intestinal coccidiosis in a Nilgai calf (*Boselaphus tragocamelus*). **Indian Journal of Veterinary Pathology** 36(2) 266-268.
- 4) Ghorpade P.B., Gupta P.K., Praksh V, Cuthbert R.J., Kulkarni M, Prakash N., Sharma A.K., Das A. and Saini M. (2012). Molecular sexing of threatened Gyps vultures: an important strategy for conservation breeding and ecological studies. **Springerplus**. 1(1):62. Epub 2012 Dec 12.

- 5) Verma R., Sharma A.K., Sangram Ramane P., Kidangam A., Mandal T. and Verma H. (2012) Generalized tuberculosis in Nilgai (*Boselaphus tragocamelus*) caused by *Mycobacterium fortuitum*. **Indian Journal of Veterinary Pathology** 36(1): 33-36
- 6) Saini M., Taggart M.A., Knopp D., Upreti S., Swarup D. Das A., Gupta P.K., Niessner R., Prakash V., Mateo R. and Cuthbert R.J. (2012). Detecting diclofenac in livestock carcasses in India with an ELISA: A tool to prevent widespread vulture poisoning. **Environmental Pollution** 160: 11-16
- 7) Ramesh D., Saini M., Swarup D., Singh V.K., Upreti S., Das A. and Gupta P.K. (2012). Molecular cloning of IFN-alpha in Goat (*Capra hircus*) and Blackbuck (*Antelope cervicapra*) and evaluation of its expression in Goat PBM cells. **Indian Journal of Animal Sciences** 82: 40-43.
- 8) Cuthbert R., Taggart M. A., Prakash V., Saini M., Swarup D., Upreti S., Mateo R., Chakraborty S. S., Deori P., Green R. E. (2011). Effectiveness of action in India to reduce exposure of Gyps vultures to the toxic veterinary drug diclofenac. **PLoS One** 6(5): e19069.
- 9) Cuthbert R.J., Prakash, V., Saini M., Upreti S., Swarup D., Das A., Green R.E. and Taggart M.A. (2011). Are conservation actions effective at reducing the threat to India's threatened vulture populations? **Current Science** 101(11): 1480-1484
- 10) Das A., Katole S., Kumar A., Gupta S. P., Saini M. and Swarup D. (2011). Feed consumption, nutrient utilization and serum metabolite profile of captive blackbucks (*Antelope cervicapra*) fed diets varying in crude protein content. **Journal of Animal Physiology and Animal Nutrition** 96(3):442-9
- 11) Das A., Katole S., Choubey M., Gupta S.P., Saini M., Kumar V. and Swarup D. (2011) Feed consumption, diet digestibility and mineral utilization in captive blackbuck (*Antelope cervicapra*) fed different levels of concentrates. Feed consumption, diet digestibility and mineral utilization in captive blackbuck (*Antelope cervicapra*) fed different levels of concentrates. **Journal of Animal Physiology and Animal Nutrition** 97(1):80-90.
- 12) Das, A., De, D. and Katole, S. (2011). Effect of partial replacement of concentrates with barhar (*Artocarpus lakocha*) leaves on growth performance of kids fed a mixed jungle grass-based diet. **Asian-Australasian Journal of Animal Science** 24: 45-55.
- 13) Ramesh D., Saini M., Swarup D., Singh V., Upreti, S, Das, A and Gupta, P.K. (2010). Interferon alpha characterization and its comparative expression in PBM cells of *Capra hircus* and *Antelope cervicapra* cultured in the presence of TLR9 agonist. **Molecular Biology International** Volume 2010, Article ID 573426, 6 pages. doi:10.4061/2010/573426
- 14) Das A., Choubey M., Gupta S.P., Saini M. and Swarup D. (2010). Feed consumption, nutrient utilization, faecal pellet characteristics and serum metabolite profile of captive spotted deer (*Axis axis*) fed diets containing different roughages. **Small Ruminant Research** 2010, 94 (1-3), 185-189
- 15) Singh, R., Singh, K.P., Sharma, A.K., Nandi, S. and Chauhan, R.S. (2010). Mortality due to infectious canine hepatitis in sloth bears (*Melursus ursinus*) in captivity. **Indian Journal of Animal Sciences** 80 (10): 961-964.

16) D.K. Das, M. Saini, A. Dhara, D. Swarup, Satish Kumar, P.K Gupta (2008). Molecular Characterization of Toll-like Receptor 2 of ruminants and comparative expression in Nilgai (*Boselaphus tragocamelus*) versus Buffalo (*Bubalus bubalis*) **International Journal of Immunogenetics** 35(3):227-34.

17) Saini M., Das D.K., Dhara A., Swarup D., Sharma A.K., and Gupta P.K. (2008). PCR-RFLP tool for differentiation of Nilgai, Cattle and Buffalo. **Indian Journal of Animal Sciences** 78 (6): 652-654

18) Gupta A.R., Patra R.C., Das D. K., Gupta P. K., Swarup D. and Saini M. (2008). Sequence characterization and polymerase chain reaction–restriction fragment length polymorphism of the mitochondrial DNA 12S rRNA gene provides a method for species identification of Indian deer. **Mitochondrial DNA** 19(4):394-400.

19) Das D.K., Saini M., Swarup D. and Gupta P. K. (2008). Comparison of nucleotide and amino acids sequence of Nilgai (*Boselaphus tragocamelus*) Interleukin-18 (IL-18) with other ruminants. **Indian Journal of Biotechnology** 7: 200-203

20) Dhara. A., Saini, M. Das, D.K., Swarup, D., Sharma, M. Kumar, S., Gupta, P.K. (2007) Molecular characterization of coding sequences and analysis of Toll-like receptor 3 expression in water buffalo (*Bubalus bubalis*) and nilgai (*Boselaphus tragocamelus*). **Immunogenetics** 59: 69-76.

21) Saini M., Das D.K., Swarup D., Yadav M.P. and Gupta P.K. (2007). Characterization of Peacock (*Pavo cristatus*) mitochondrial 12S rRNA sequence and its use in differentiation from closely related poultry species. **British Poultry Science** 48 (2) 162-166

22) Gupta A.R., Patra R.C., Saini M. and Swarup D. (2007). Haematology and serum biochemistry of chital (*Axis axis*) and barking deer (*Muntiacus muntjak*) reared in semi-captivity. **Veterinary Research Communications** 31: 801-808

23) Swarup D., Patra R. C., Prakash V., Cuthbert R., Das D., Avari P., Pain D. J., Green R. E., Sharma A. K., Saini M., Das D., Taggart M. (2007) The safety of meloxicam to critically endangered Gyps vultures and scavenging birds in India. **Animal Conservation** 10: 192-198.

24) Dhara A., Saini M., Das D.K., Swarup D. and Gupta P.K. (2007) Restriction analysis of the cDNA encoding toll-like receptor 3 of buffalo and nilgai. **Indian Veterinary Journal** 86: 123-126

25) Mohini Saini, Devendra Swarup, G.R. Singh, M.P. Yadav and Praveen K. Gupta. Bhediye ke mitochondrial 12S ribosomal RNA gene ki cloning aivam abhilalkashan. Anusandhan Patrika IVRI, 2007. (Best Hindi Research Paper in IVRI on 27th September 2007 awarded first prize).

d) Abstracts and papers presented in conference/symposia

Invited papers

1) Sharma, A.K. 2012. Field procedures for PM technique, collection, storage and dispatch of morbid samples for diagnosis. Proceedings of WII-NTCA sponsored workshop on “Health Management of large Carnivores” 10-11 Dec. 2012, Dehradun

- 2) Sharma A.K. 2012. Management of poisoning in wild carnivores. Proceedings of WII-NTCA sponsored workshop on "Health Management of large Carnivores" 10-11 Dec. 2012, Dehradun
- 3) Das, A. 2012. Feeding and nutrition of tigers in captivity including nutritional disorders. Proceedings of WII-NTCA sponsored workshop on "Health Management of large Carnivores" 10-11 Dec. 2012, Dehradun
- 4) Sharma, A.K. (2011). Occurrence of neoplasms in Indian Wildlife and their diagnosis. Lead Paper presented in National Symposium on "Recent developments in Diagnostics & Therapeutics including applications of nanotechnology in Veterinary Medicine" and 29th Annual Convention of Indian Society for Veterinary Medicine (ISVM), held at Mumbai Veterinary College, Mumbai (17-19, Feb. 2011), Compendium and Souvenir pp. 142-151.
- 5) Das A., Katole S., Saini M., and Sharma A.K. Emerging trends in feeding and nutrition of captive animal. In: Proceedings of 7th Biennial ANA conference on Animal Nutrition Strategies for Environment Protection and Poverty Alleviation held at Orissa University of AG. & Tech, Bhubaneshwar, Odisha, During Dec, 17-19, 2010, p99.

Abstracts

- 1) Cuthbert R., Green R.E., Prakash, V. Saini M., Taggart M.A. (2012). The impact and role of NSAIDs on vulture populations in the Indian subcontinent. *Toxicology Letters*, 211S: S31.
- 2) Singh V.K., Saini M., Ramesh D. and Gupta P.K. (2012) Comparative expression of innate immunity marker TLR9 in domestic ruminant goat (*Capra hircus*) and wild ruminant blackbuck (*Antelope cervicapra*). Compendium of National Seminar on "Future Challenges and Opportunities to Improve Health and Production of Small Ruminants" held at Central Institute for Research on Goats from 22-23 December, GIFG-C18, p88
- 3) Kumar, A. Das A., Saini M., Kullu S.S. and Sharma A.K. (2012). Comparative nutrient utilization in Indian rhinoceros (*Rhinoceros unicornis*) fed three season specific diets. Proc. 9th Biennial Conf. of Animal Nutrition Association of India on "Animal Nutrition Research Strategies for Food Security" Bikaner, India. November 28-30, p.119.
- 4) Das A., Saini M., Katole S., Kullu S. S. and Sharma A.K. (2012). Effect of feeding different levels wheat-roti on nutrient utilization and blood metabolite profile in semi-captive Asiatic elephants (*Elephas maximus*). Proc. 9th Biennial Conf. of Animal Nutrition Association of India on "Animal Nutrition Research Strategies for Food Security" Bikaner, India. November 28-30, p.120.
- 5) Katole S., Das A., Saini M. and Sharma A.K. (2012). Nutrient utilization in semi-captive Asiatic elephants (*Elephas maximus*) fed different types of supplements. Proc. 9th Biennial Conf. of Animal Nutrition Association of India on "Animal Nutrition Research Strategies for Food Security" Bikaner, India. November 28-30, p.121.
- 6) Sharma A.K., Sabrinath T., Chaudhuri P., Pawde A.M., Kumar P. Saini M., Das A. and Sharma M.C. Leptospirosis: An emerging threat to wild animals in Captivity.

Abstract in 5th Workshop on Asian Zoo and Wildlife Medicine/Conservation 2011 Held at Kathmandu, Nepal from October 21-22, 2011, page 81

- 7) Saini M. Supporting vulture conservation in India. Abstract in Souvenir of Golden Jubilee Symposium "Prospects and Perspectives in Biochemistry" cum Alumni Meet of Department of Biochemistry, Panjab Univeristy, Chandigarh, held at PU from Feb 10-11, 2011. pp 24-25
- 8) Singh V., Ramesh D and Saini M. Comparative expression of TLR9 gene in endometrium and fetal tissues of blackbuck (*Antelope cervicapra*). p125 In: Compendium of International Conference on Frontiers in Reproductive Biotechnology and 21st Annual Meeting of the Indian Society for the Study of Reproduction and Fertility (ISSRF) held from 9th to 11th Feb, 2011, at NDRI Karnal (Haryana) India.
- 9) Das A., Saini M., Gupta S.P., Katole S. and Sharma A.K. Feed consumption, diet digestibility, haematology and serum metabolite profile of captive clouded leopard (*Neofelis nebulosa*) p125 In: Proceedings of 28th Annual Convention of Indian Society for Veterinary Medicine and National Symposium on "Recent developments in diagnostics and therapeutics including applications of nanotechnology in veterinary medicine" held at Deptt of Medicine, Mumbai Veterinary College, MAFSU, Mumbai (M.S.) from 17th to 19th Feb, 2011.
- 10) Das A., Saini M., Gupta S.P., Sharma A.K. and Swarup D. Feed consumption, diet digestibility, haematology and serum metabolite profile of captive snow leopard (*Uncia uncia*) p126. In: Proceedings of 28th Annual Convention of Indian Society for Veterinary Medicine and National Symposium on "Recent developments in diagnostics and therapeutics including applications of nanotechnology in veterinary medicine" held at Deptt of Medicine, Mumbai Veterinary College, MAFSU, Mumbai (M.S.) from 17th to 19th Feb, 2011.
- 11) Katole S., Das A., Saini M., Sharma A.K. and Bhalla S.P.G. 2010. Effect of work on feed consumption, diet digestibility and blood metabolites in semi-captive Asiatic (*Elephas maximus*) elephant. p187. In: proceedings of VII Biennial Animal Nutrition Conference December, 17-19, 2010. Volume II, Animal Nutrition Strategies for Environment Protection and Poverty Alleviation, Bhubaneshwar, India.
- 12) Das A., Katole S., Saini M., Sharma A.K. and Swarup D. 2010. Feed consumption, nutrient utilization, faecal pellet characteristics and serum metabolite profile of captive black bucks (*Antelope cervicapra*) fed diets varying in crude protein content. p193. In: proceedings of VII Biennial Animal Nutrition Conference December, 17-19, 2010. Volume II, Animal Nutrition Strategies for Environment Protection and Poverty Alleviation, Bhubaneshwar, India.
- 13) Das A., Katole S., Saini M., and Sharma A.K. 2010. Feed consumption, nutrient utilization and blood metabolite profile in different age groups of captive Asiatic elephant (*Elephas maximus*). p195. In: proceedings of VII Biennial Animal Nutrition Conference December, 17-19, 2010. Volume II, Animal Nutrition Strategies for Environment Protection and Poverty Alleviation, Bhubaneshwar, India.
- 14) Katole S., Das A., Saini M. and Sharma A.K. 2010. Feed consumption, diet digestibility and blood metabolite profile fed on different roughages sources in Asiatic elephant (*Elephas maximus*). 196 pp. In: proceedings of VII Biennial Animal

Nutrition Conference December, 17-19, 2010. Volume II, Animal Nutrition Strategies for Environment Protection and Poverty Alleviation, Bhubaneswar, India.

- 15) Das A., Saini M., Gupta S.P., Ahmed R., Kumar P., Katole S. and Swarup D. Nutrient intake, digestibility, serum metabolite and mineral profile in semi-captive Asiatic elephant (*Elephas maximus*) Abstract In: Compendium of ANA World Conference on "Animal Nutrition-Preparedness to combat Challenges" held on Feb 16-18, 2009 at NASC Centre, New Delhi
- 16) Das A, Saini M. and Swarup, D. Nutritional health management of captive Asiatic elephant (*Elaphus maximus*). Chapter in National symposium on Elephant Healthcare and Managerial Practices held on 19-21 Feb, 2009 at Guwahati, pp64-74.
- 17) Sood R., Saini M, Das A., Shukla U and Swarup D. Estimation of toxic metals and trace element levels in feathers of pheasant as indicator of environmental pollution. Abstract In: Proceedings of the International Summit on "Advancing Veterinary Medical Care: Challenges and Strategies & 27th ISVM Convention Satellite Seminars on Veterinary Internal Medicine" organised by CAS, Veterinary Clinical Medicine, TANUVAS, Chennai from 19-21 February 2009. (Abstract ET-13)
- 18) Asit Das, Mohini Saini, Dhanjit K. Das, Somesh Singh and D. Swarup. Preliminary investigation on feeding schedule and gastric disorder in tiger (*Panthera tigris*) in some Indian zoos. In: International Conference on wildlife health management held at Shere-Kashmir University of Agriculture and Technology from April 26-28, 2007
- 19) Dhanjit K. Das, Mohini Saini, Animesh Dhara, Devendra Swarup, Bhaskar Sharma and Praveen K. Gupta. Cloning and characterization of Toll-like Receptor 2 cDNA in Nilgai (*Boselaphus tragocamelus*) In: International Conference on wildlife health management held at Shere-Kashmir University of Agriculture and Technology from April 26-28, 2007
- 20) Mohini Saini, Dhanjit Kumar Das, Amit Raj Gupta, Animesh Dhara, Ramesh Patra, Devendra Swarup and Praveen K. Gupta. Cloning and characterization of mitochondrial 12S rRNA gene of deer species and its use in wild life forensic. In: International Conference on wildlife health management held at Shere-Kashmir University of Agriculture and Technology from April 26-28, 2007
- 21) Animesh Dhara, Mohini Saini, Dhanjit. K. Das, Devendra Swarup, Bhaskar Sharma and P. K. Gupta. Characterization of Toll-Like Receptor-3 (TLR-3) cDNA from Dendritic Cells of Nilgai (*Boselaphus tragocamelus*). In: International Conference on wildlife health management held at Shere-Kashmir University of Agriculture and Technology from April 26-28, 2007

e) Chapters in Training manual/Compendium:

- 1) Das, A. 2013. Nutrition: The Key to Health Management of Wild Animals in Captivity. Compendium of In: Emerging Trends in Nutrition of Wild and Zoo Animals An advance short course held CAFT for Animal Nutrition, IVRI, Izatnagar from 1st March to 21st March,
- 2) Sharma, A.K. 2012. Field procedures for PM technique, collection, storage and dispatch of morbid samples for diagnosis. Proceedings of the Workshop on Health Management of Carnivores held at Wildlife Institute of India, Dehradun on 10-11th December, 2012

- 3) Sharma M.C., Sharma A.K., Saini M., and Das A. (2012). Veterinary Care of Animals in Zoos. *Ex-Situ* Updates (A quarterly Newsletter of CZA), July 2012, Volume 1, Issue 2, pp5-6
- 4) Das, A. 2012. Feeding and nutrition of tigers in captivity including nutritional disorders Proceedings of the Workshop on Health Management of Carnivores held at Wildlife Institute of India on 10-11th December, 2012
- 5) Sharma A.K. and Raut S.S. 2010. Status and Pathology of Neoplasms in Indian Wildlife. National Seminar on "Advances in Animal Cancer Research in India: Diagnosis, Treatment and Clinical Management" held at Division of Pathology, I.V.R.I., Izatnagar. IV.1, pp75
- 6) Saini M, Ramesh D. and Shynu M. 2010. Molecular Tools as an aid in diagnosis of diseases of wild animals. In: Compendium of ICAR winter school in Division of Pathology from 1.10.2010 to 21.10 2010.
- 7) Saini M. and Upreti S. 2011. Sex Determination and Vulture Conservation in India. In: Compendium of International training course on "Gene based techniques for research in Biotechnology" under TCS Colombo plan held at Biochemistry Division, IVRI from 3rd to 23rd March, 2011. pp 59-63.
- 8) Saini M. and Upreti S. 2009. Genomics in species identification In: Compendium of ICAR sponsored Winter School on "Genomics and metagenomics" at Division of Biochemistry, IVRI, Izatnagar
- 9) Saini M. and Upreti S. 2010. Vulture conservation in India, In: Compendium of training on TCS Colombo plan 2010 at Division of Biochemistry, IVRI Izatnagar
- 10) Swarup D. and Saini M. 2008. Declining vulture population in India: Role of non-steroidal anti-inflammatory drug diclofnac. In Compendium of Indian Society of Veterinary Pharmacology and Toxicology sponsored National symposium on "Emerging risks to wildlife due to drugs and toxicants and ameliorative measures" Held at Mathura Veterinary University, Mathura from 6-8th November, 2008, pp41-45
- 11) Saini M., Ramesh D., Singh V.K. and Swarup D. 2008. Biomarkers as diagnostic tools in wildlife forensics. In Compendium of Indian Society of Veterinary Pharmacology and Toxicology sponsored National symposium on "Emerging risks to wildlife due to drugs and toxicants and ameliorative measures" Held at Mathura Veterinary University, Mathura from 6-8th November, 2008.
- 12) Das, A. 2008. Nutritional management of captive animals: Direction for Research. In: Nutritional Strategies for Sustainable and Green Livestock Production An advance short course held CAS for Animal nutrition, IVRI, Izatnagar from 10th to 30th September, 2008 pp 123-126.
- 13) Das, A. 2008. Principle of zoo animal nutrition and feeding. In: Emerging Trends in Nutrition of Wild and Zoo Animals An advance short course held CAS for Animal nutrition, IVRI, Izatnagar from 28th November to 19th December, 2008 pp 4-8.
- 14) Das, A. 2008. Feeding behavior and general guidelines for feeding herbivores. In: Emerging Trends in Nutrition of Wild and Zoo Animals An advance short course held CAS for Animal nutrition, IVRI, Izatnagar from 28th November to 19th December, 2008 pp 22-25..

15) Das, A. 2008. General guidelines for feeding of carnivores with special reference to Tiger. In: Emerging Trends in Nutrition of Wild and Zoo Animals An advance short course held CAS for Animal nutrition, IVRI, Izatnagar from 28th November to 19th December, 2008 pp 31-33.

f) NCBI GenBank Accessions

- 1) Barik, S., Saini, M., Doreswamy, R., Palai, T.K., ChandraMohan,S., Shynu, M., Das, A., Sharma, A.K. and Gupta, P.K. (2013). *Antelope cervicapra* conglutinin 1 (CGN1) mRNA, partial cds, Accession KC505182
- 2) Chandra Mohan S., Ramesh D., Shynu M., Saini M., Das A., Sharma, A. K. and Gupta P. K. (2012). *Moschiola meminna* 12S ribosomal RNA gene, partial sequence; mitochondrial. Accession JX570670
- 3) Saini,M., Ghorpade,P.B., Swarup,D., Prakash,V., Cuthbert,R., Das,A., Sharma,A.K. and Gupta,P.K. (2010) *Aegyptius monachus* chromo-helicase-DNA binding protein (CHD-Z) gene, partial cds. bankit1388388 NCBI Accession HQ236382
- 4) Saini,M., Ghorpade,P.B., Swarup,D., Cuthbert,R., Prakash,V., Das,A., Sharma,A.K. and Gupta,P.K. (2010) *Gyps himalayensis* chromo-helicase-DNA binding protein gene (CHD W), partial cds. bankit1388454 NCBI accession HQ236383
- 5) Saini,M., Bhanudas,G.P., Swarup,D., Cuthbert,R., Prakash,V., Das,A., Sharma,A.K. and Gupta,P.K. (2010) *Gyps himalayensis* chromo-helicase-DNA binding protein gene (CHD Z, partial cds. bankit1388465, NCBI Accession HQ236384
- 6) Ghorpade,P.B., Gupta,P.K., Swarup,D., Prakash,V., Cuthbert,R., Das,A., Sharma,A.K. and Saini,M. (2010) *Gyps bengalensis* chromo-helicase-DNA binding protein gene (CHD W), partial sequence. bankit1388463 NCBI Accession HQ236385
- 7) Ghorpade,P.B., Gupta,P.K., Swarup,D., Prakash,V., Cuthbert,R., Das,A., Sharma,A.K. and Saini,M. (2010) *Gyps indicus* chromo-helicase-DNA binding protein gene (CHD W), partial cds. bankit1388525 NCBI Accession HQ236386
- 8) Ghorpade,P.B., Saini,M., Swarup,D., Prakash,V., Cuthbert,R., Das,A., Sharma,A.K. and Gupta,P.K. (2010) *Gyps indicus* chromo-helicase-DNA binding protein gene (CHD Z), partial cds. bankit1388530 NCBI Accession HQ236387
- 9) Ghorpade,P.B., Saini,M., Swarup,D., Prakash,V., Cuthbert,R., Das,A., Sharma,A.K. and Gupta,P.K. (2010) *Gyps bengalensis* chromo-helicase-DNA binding protein gene (CHD Z) partial cds. bankit1388533, NCBI Accession HQ236388
- 10) Saini,M., Ramesh,D., Shynu,M., Das,A., Sharma,A.K. and Gupta,P.K. 2010. *Boselaphus tragocamelus* conglutinin 1 (CGN1) mRNA, partial cds. Accession HQ330991
- 11) Ramesh,D., Saini,M., Singh,V.K., Upreti,S., Das,A., Swarup,D. and Gupta,P.K. (2009) *Antilope cervicapra* interferon-alpha (IFNA) mRNA, complete cds. FJ959075
- 12) Singh,V.K., Saini,M., Swarup,D., Das,D.K., Das,A., Dhara,A. and Gupta,P.K. (2008) *Boselaphus tragocamelus* toll-like receptor 9 (TLR9) mRNA, complete cds. EU747828
- 13) Singh,V.K., Saini,M., Swarup,D., Das,D.K., Das,A., Dhara,A. and Gupta,P.K. (2008) *Antilope cervicapra* toll-like receptor 9 (TLR9) mRNA, partial cds. EU747826
- 14) Saini, M., Dhara, A., Das, D.K., Swarup, D. and Gupta, P.K. (2007) *Capricornis sumatraensis* 12S ribosomal RNA gene, partial sequence; mitochondrial. NCBI Accession EF536971

Annexure I



केन्द्रीय चिड़ियाघर प्राधिकरण
Central Zoo Authority
 (STATUTORY BODY UNDER THE MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA)

Bikaner House Annexe VI,
 Shahjahan Road, New Delhi - 110011
 website : <http://www.cza.nic.in>

F. No. 26-2/2007-CZA (M)

DATE: 20.8.2007

To

The Director
 Indian Veterinary Research Institute,
 Izatnagar,
 Bareilly - 243 122 (Uttar Pradesh)


Sub:- Signing of MoU for establishment of National Referral Centre for Wildlife Healthcare at Indian Veterinary Research Institute, Bareilly.

Sir,

Please refer to Dr. D. Swarup (In-charge) letter No. 02/03/NRC/CWL/06 dated 17th August, 2007.

Thank you very much for submitting signed MoU for establishment of National Referral Centre for Wildlife Healthcare at Indian Veterinary Research Institute, Bareilly. Please find enclosed MoU on above mentioned subject signed by undersigned for your information and necessary action. The steps are being taken for the release of fund for the above mentioned project.

Yours faithfully,


 (B. R. Sharma)
 Member Secretary

Encl: as above

**MEMORANDUM OF UNDERSTANDING
BETWEEN
CENTRAL ZOO AUTHORITY
ANNEXE VI, BIKANER HOUSE,
SHAHJAHAN ROAD,
NEW DELHI-110 011
&
INDIAN VETERINARY RESEARCH INSTITUTE
IZATNAGAR, BAREILLY - 243 122
(UTTAR PRADESH)**

Whereas the Central Zoo Authority, a statutory body under Ministry of Environment & Forests, Government of India having its office at Bikaner House, Shahjahan Road, New Delhi herein after referred as 'CZA' working with the objectives of overseeing the management of zoos and provide them necessary technical inputs to come up to the desired level of management, is willing to establish National Referral Centre for Wildlife Healthcare at Indian Veterinary Research Institute, Izatnagar, Bareilly.

Whereas the Indian Veterinary Research Institute with its head office at Izatnagar, Bareilly - 243 122 herein after referred as 'IVRI' has agreed to take up the work and has submitted a proposal for National Referral Centre (NRC) for Wildlife Healthcare.

Whereas, the Central Zoo Authority is willing to extend financial support for the above said work.

MEMORANDUM OF UNDERSTANDING ARTICLE 1:

- (a) The IVRI will provide all its specialised services and diagnostic facilities to all the recognised zoos/rescue centers of the country pertaining to diagnosis and therapeutic measures for infectious and non-infectious disease and healthcare among the wild animals as and when required by the recognized zoos/rescue centers and/ or whenever requested by the Central Zoo Authority.
- (b) The IVRI will organize short term training programmes for Zoos veterinary personnel working in Indian Zoos, on the dates as suggested by CZA and agreed by IVRI. The training programme will cover the topics/ subject as well as faculty as suggested by CZA from time to time in consultation with IVRI.
- (c) The IVRI will conduct studies on captive animal health, animal nutrition and related issues or problems being faced by the zoos in this regards. Such studies will be identified by the Central Zoo Authority in consultation with zoo operators & managers and will be assigned to the IVRI.

BT

[Signature]

- (d) The Central Zoo Authority will provide recurring expenditure only for one year period from the date of creation of NRC or signing upon of this MOU whichever is earlier. During the period of one year the IVRI shall create all necessary data bank on zoos including the contact details and their address, list and Intensity of problems being faced by zoos on animal healthcare and other related issues.
- (e) After the period of one year no regular recurring expenditures shall be paid by the Central Zoo Authority, the same should be borne/ paid by the users/requesting parties only.
- (f) The amounts sanctioned by Central Zoo Authority for non-recurring purposes as per the details provided in Article 3 should not be diverted from the purpose it has been assigned/sanctioned without the prior approval of the Central Zoo Authority.
- (g) The expenditures to be incurred on the studies/ research and training etc. requested by the Central Zoo Authority will be borne by the Authority on case to case basis.
- (h) On signing of this MOU, the IVRI should come up with the standard rates to be charged for providing all specialised facilities and services and the same should be made available to the Central Zoo Authority and all recognized zoos of the country. The rates may be recurred by IVRI from time to time with intimation to the user agencies.
- (i) The asset/ infrastructure made by the IVRI, Bareilly from the grant total of Rs. 21.85 lakhs by the CZA for the establishment of Regional Centre under the National Zoo Animal Healthcare Programme of CZA should also be merged with the activity of the NRC.

ARTICLE 2:

- (a) The money released by CZA shall not be diverted by IVRI for any other work.
- (b) The Accounts of the grant released by CZA have to be maintained properly as per the audit requirement and shall be agreed to inspection by the Central Zoo Authority. Duly audited copies of the accounts shall be submitted to Central Zoo Authority.
- (c) Utilisation Certificate having unspent balance, if any, should be submitted to Central Zoo Authority annually after the close of financial year.

[Signature]

(d) Record of the all asserts acquired out of the grant released herewith by Central Zoo Authority, should be made available for scrutiny of audit. Such assets should not be disposed off encumbered or utilized for other purposes without the prior approval of CZA.

ARTICLE 3: Accounts and audit of the grant

Central Zoo Authority has agreed to provide financial assistance for the following items of works:-

S. No.	Particulars	Amount (Rs. in lakhs)
A.	Recurring expenditure (one/first year only)	
	Pay and allowances	
	RA (total 1 post) @ Rs. 11500/- pm (fixed) +HRA (total Rs. 13225/-)	1.60
	Office assistance on contractual basis @ Rs. 5000/- pm	0.60
	Traveling allowance	1.00
	Stationery, publication other misc. expenses	2.00
B.	Non-recurring (one time grant)	
	Equipments	
	Digital balance	1.00
	Inverted microscope	2.00
	Refrigerated centrifuge	5.00
	ELISA reader	3.00 ✓
	Still camera	0.50
	Deep freeze	0.50 ✓
	Kjeldatech – N estimation assembly	5.00
	Refrigerator	0.25 ✓
	Computer (lap top)	0.50
	Water bath	0.25 ✓
	Muffle furnace	0.25 ✓
	CO2 incubator	1.00
	Ballistic Bomb calorimeter	1.00
	Renovation of laboratory	2.15
	Sub-Total	27.60
	Institutional charges @ 10%	2.76
	Total	30.36
	(Rupees thirty lakhs and thirty six thousand only)	

25/10
25/10
11/10
✓
✓
✓
✓
✓
✓

B
[Signature]

ARTICLE 4 :

- (a) It will be the sole responsibility of the IVRI to provide specialised service & facilities of the IVRI to the recognised zoos/rescue centers of the country pertaining to diagnosis and therapeutic measures for infectious and non-infectious disease and healthcare among the wild animals as and when required by the recognized zoos/rescue centre and the Central Zoo Authority.
- (b) This agreement shall become effective when signed by both the parties but not later than 2nd October, 2007.
- (c) The expertise, services and consultancy to the Zoos/Rescue Centers on wild animal health care and management will be provided by IVRI on demand without any reasonable delay.
- (d) The IVRI should also submit project activities report every six months.

ARTICLE 5:

The terms of payment to IVRI shall be as follows:-

- (i) Salary for RA & Office Assistant will be released after signing of the MOU.
- (ii) Grant for purchasing of equipments will be released after signing of MoU.
- (iii) 50% grant for traveling, stationery, publication and other Misc. expenses will be released after signing of MoU.

ARTICLE 6:

The scientific output of the project will be intellectual property right of the CZA and IVRI. The Central Zoo Authority without any limitation will have the rights to use, publish, sell or distribute privately or publicly any item or part thereof, of the outcome of the National Referral Centre Project.

ARTICLE 7:

Disputes, if any, arising between the parties in respect of any matter arising out of this MOU or the relationship between the parties or the performance of their respective obligations under this MOU shall be settled between the Director, IVRI and the Member Secretary, Central Zoo Authority, whose decision shall be final and binding on the parties.

BR _____

[Signature]

ARTICLES 8:

Should there be any delay in performance of this contract or any part thereof, the IVRI shall notify the CZA in writing giving the reasons for delay. Such notification must reach the CZA before the date on which the final report is due to submission.

If the CZA feels, work is not progressing according to work plan. It shall be at liberty to withhold the financial assistance and withdraw the funds already granted. In such case, unspent amount as on the date of decision shall be immediately return to CZA.

20/08/07
SIGNED ON BEHALF OF
MEMBER SECRETARY
CENTRAL ZOO AUTHORITY
(with stamp)

16/08/07
SIGNED ON BEHALF OF
DIRECTOR
INDIAN VETERINARY RESEARCH INSTITUTE
(with stamp)

Name & Designation
Date of Signature Place

Director
IVRI, Izatnagar-243 122 (U.P.)
Name & Designation Director
Date of Signature Place 16th Aug 2007
Izatnagar

BRISHAMA
Member Secretary
Central Zoo Authority