



“WILDLIFE CRIME AND ILLEGAL WILDLIFE TRADE AND MOLECULAR AND FORENSIC APPROACHES”

Shekhar Kumar Niraj, Ph.D.

Former Director
Advanced Institute for Wildlife Conservation, Chennai
Former Country Head-TRAFFIC India and Asst. Mgt. Authority-
CITES

Present: PCCF and Chief Wildlife Warden Forests and
Environment, Govt of TN



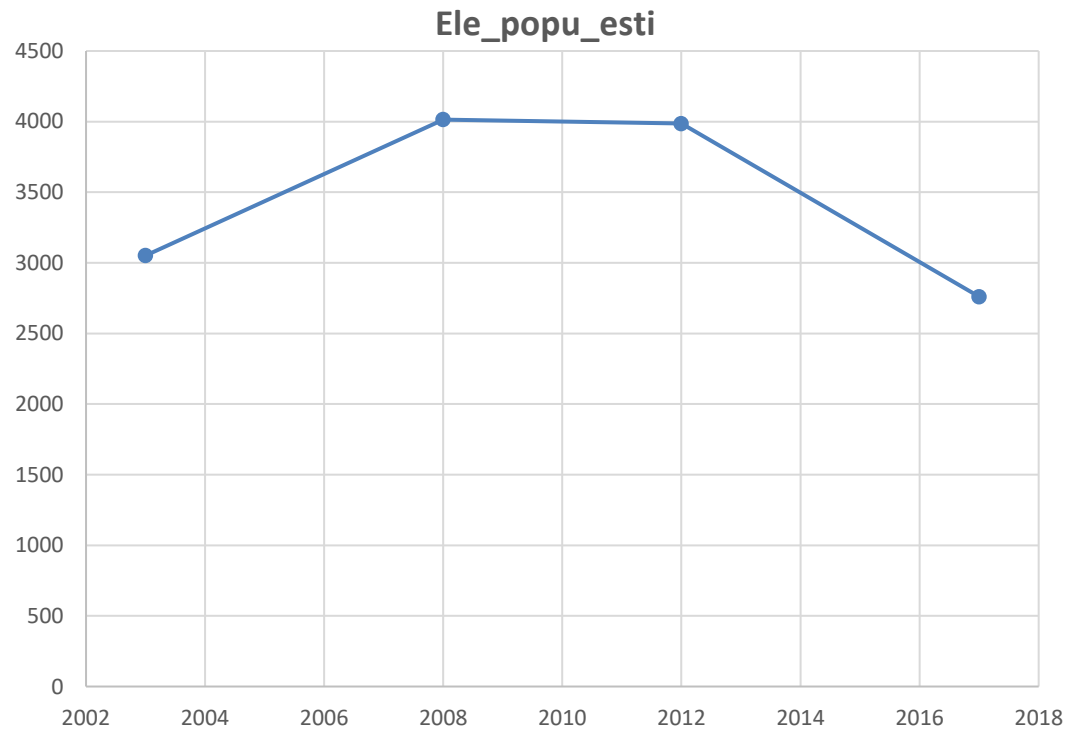
Genomics and
Morphology
in
Forest & Wildlife
Conservation and
Investigations







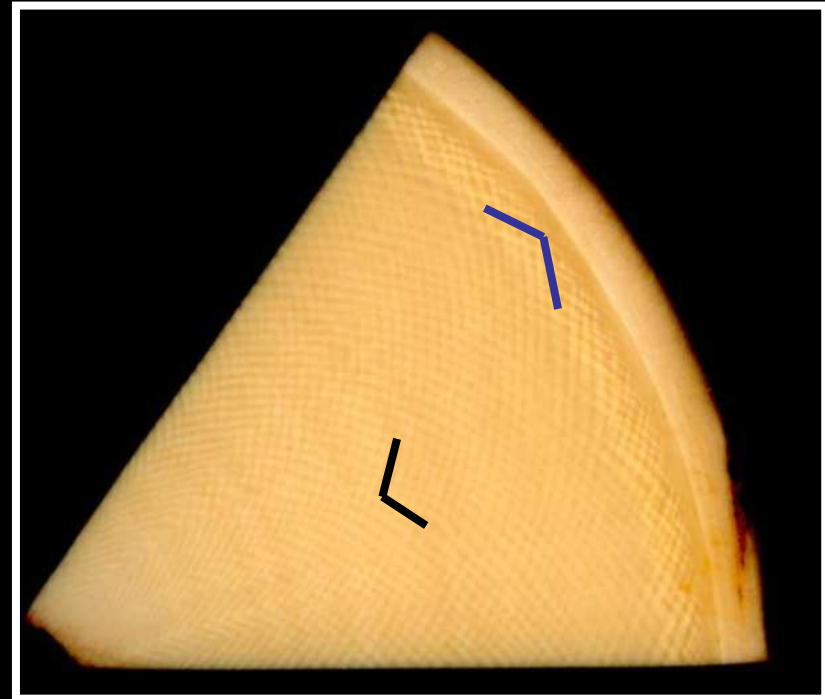
Elephant Population Estimated Decline in Tamil Nadu 2002-2018





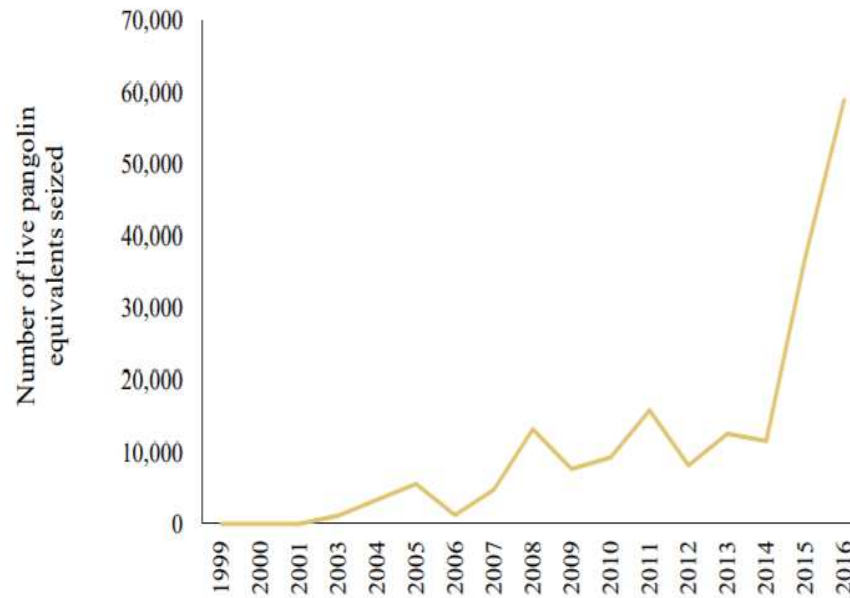
SCHREGER ANGLE

The Schreger pattern characteristic structural feature of dentine portion of elephant tusk. Espinoza & Mann (1993) describe the Schreger pattern as sets of intersecting “lines” radiating in spiral fashion from the tusk axis. These are formed when dentinal tubules, produced by odontoblasts move towards the tusk axis during dentine deposition (Miles & Poole, 1967). The “Schreger angle” is the centripetal and centrifugal angle formed by inter-section of these Schreger lines.

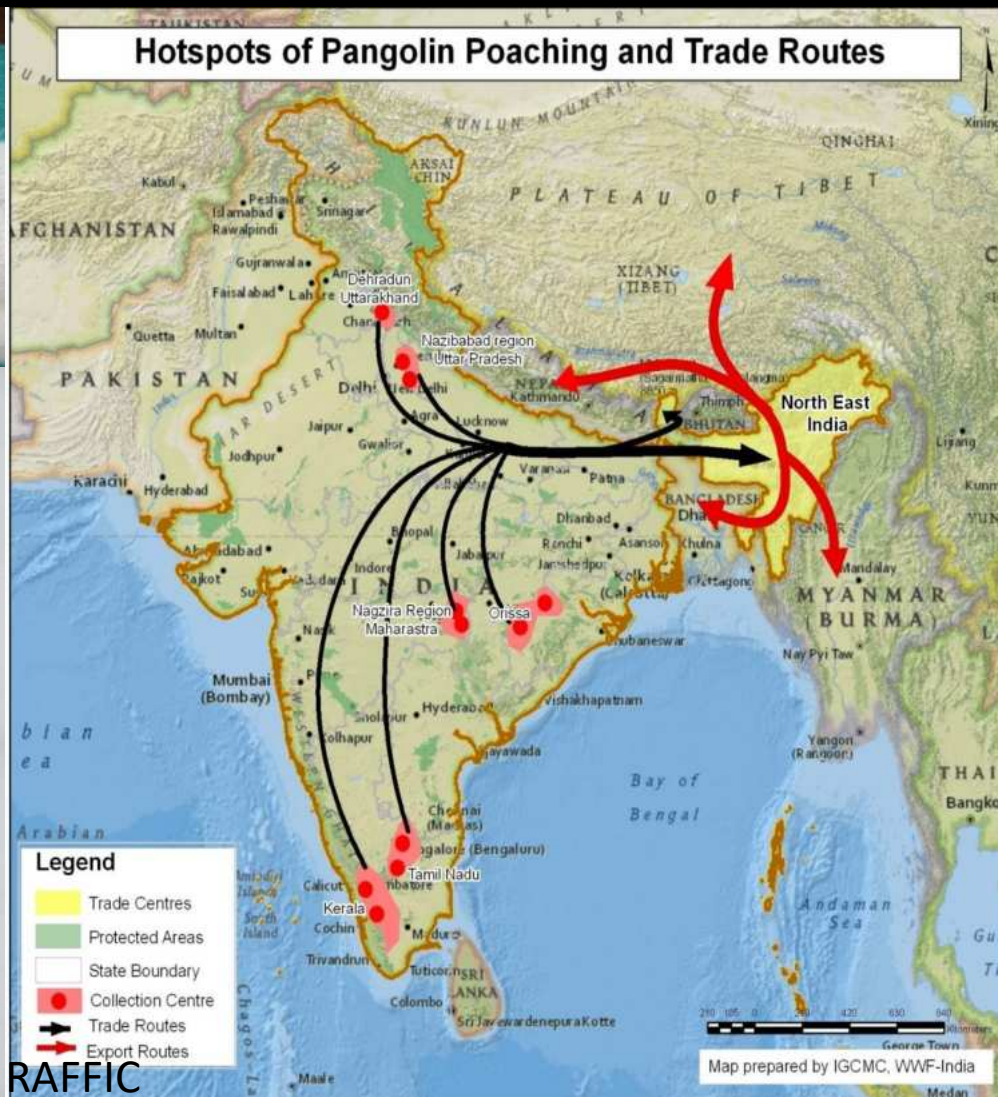




Live pangolin equivalents seized globally, 1999 to 2016



Source: World WISE, EIA, and CITES³⁵





Species in Illegal Trade



Mixture of Shawls for species identification





**TRADITION
LINKED**







**WHALE VOMIT ALMOST
AS VALUABLE AS GOLD**





Kuth
(*Saussurea lappa*)



Pitcher plant
(*Nepenthes khasiana*)



Beddome's cycad
(*Cycas beddomei*)

Plants of Schedule VI WPA 1972



Blue vanda
(*Vanda coerulea*)



Red vanda
(*Renanthera imschootiana*)

Source
: Dr
Manoj
Sarcar



Ladies slipper orchid
(*Paphiopedilum Spp.*)

Section 9

- No person shall hunt any wild animal specified in schedule I,II,III,IV except as provided under section 11 and section 12

Section 11

- Hunting of animals to be permitted in certain cases

Section 17 a

- Protection of specified plants

Section 33 & Section 35 (8)

- Chief Wildlife Warden shall be the authority to control, manage and maintain all sanctuaries and national parks

Section 38H

- Recognition of zoos by CZA

Section 38J

- Prohibition of teasing, molesting, injuring, feeding or disturbing any zoo animals or litter the zoo

Section 39 (1)

- Wildlife articles seized shall be the property of the Government as provided under section 11 and section 12

Section 49 (A.B.C)

- Prohibition of dealing with scheduled animals parts, derivatives or trophies declaration etc

Section 50

- Search, arrests, seizures, custody provisions

Section 51

- Penalties-For schedule-I or part II of Schedule- II , minimum imprisonment of 3 years which may extend to 7 years, with a minimum fine of Rs. 10,000.. For repeated offences 7 years and upto Rs 50 lakhs

Section 55

- Cognizance of offences

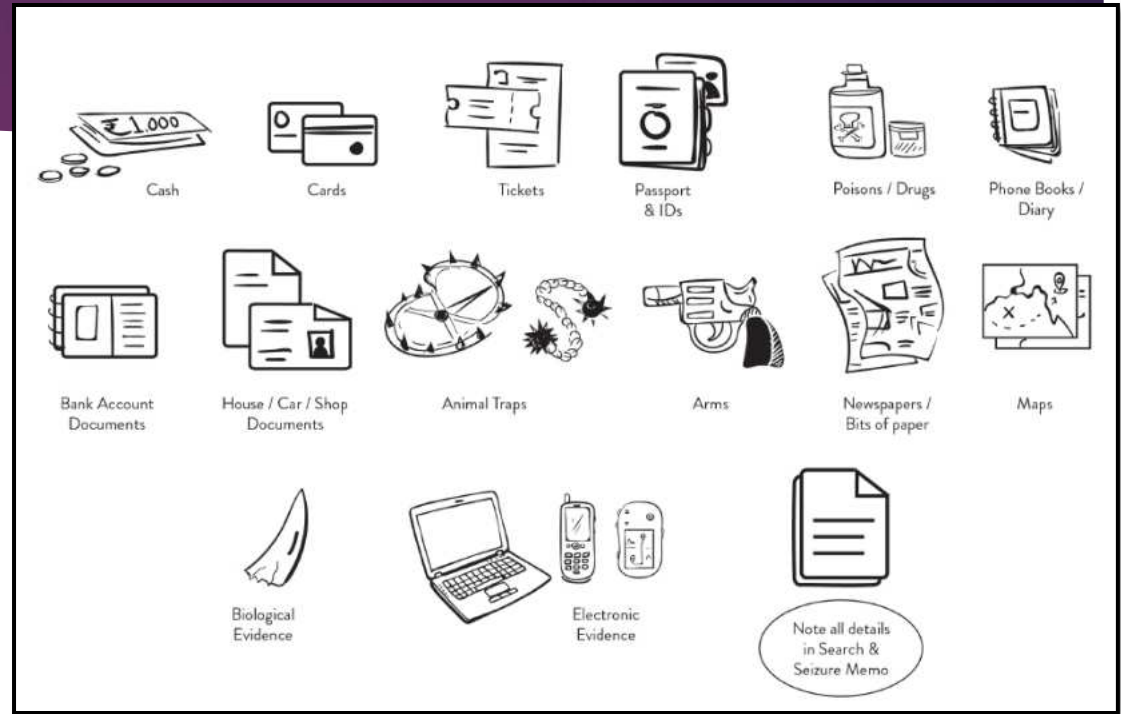
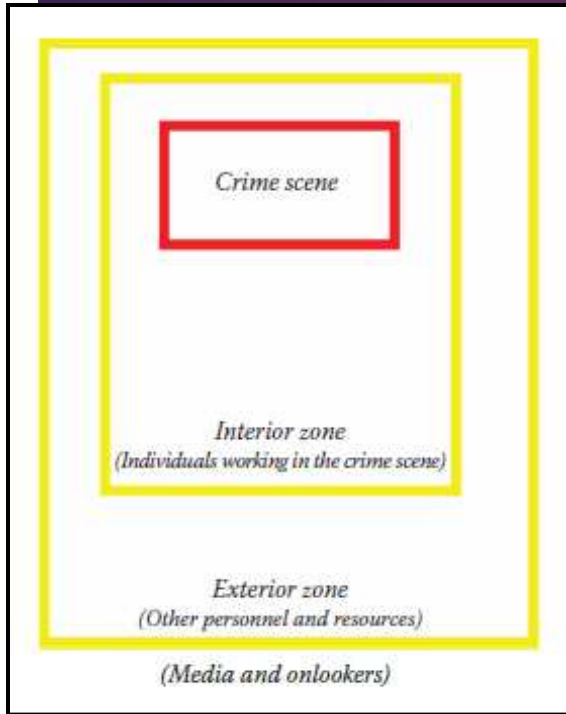
Schedules I-IV

- Species and subspecies

CRIME SCENE INVESTIGATION

- ▶ *Cordoning off an area / creating an exclusion zone to have an agreed access route*

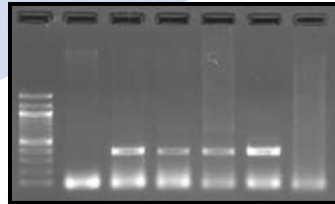
18



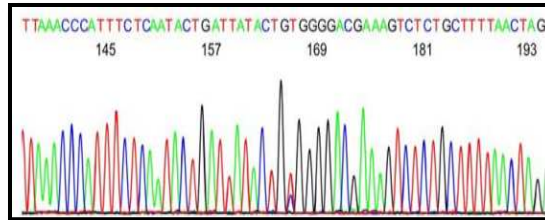
WILDLIFE FORENSICS USING MOLECULAR TOOLS



Sample preparation-
DNA isolation

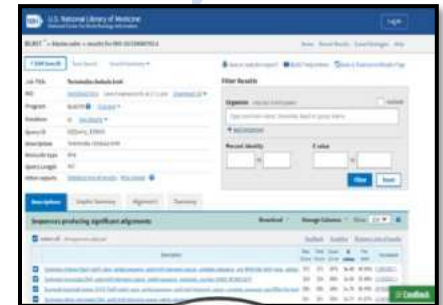


PCR amplification of region of
mt DNA



Gene sequencing of PCR
amplified product

Species identification
by matching against
nucleotide database



BIOLOGICAL EVIDENCES

- ▶ Blood
- ▶ Tissue (from any part)
- ▶ Skin piece
- ▶ Hair / feather samples



SAMPLE COLLECTION KIT



SPECIAL KIT

- Hand held metal detector
- Portable x ray scanner and
- Underground metal detector

MORPHOMETRIC APPROACH

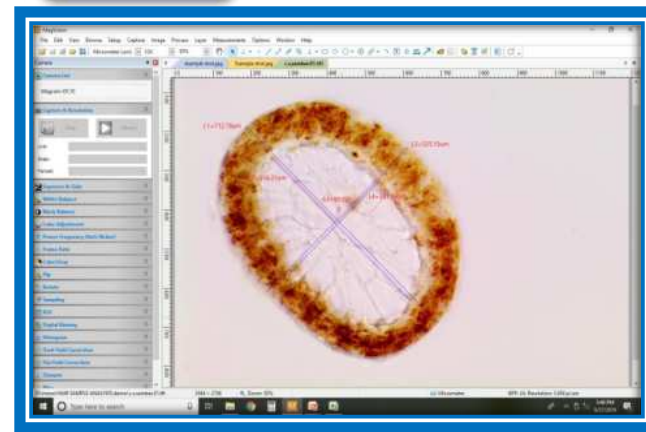
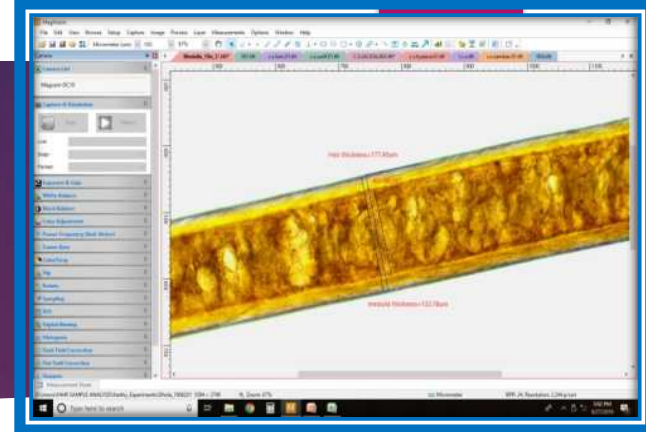
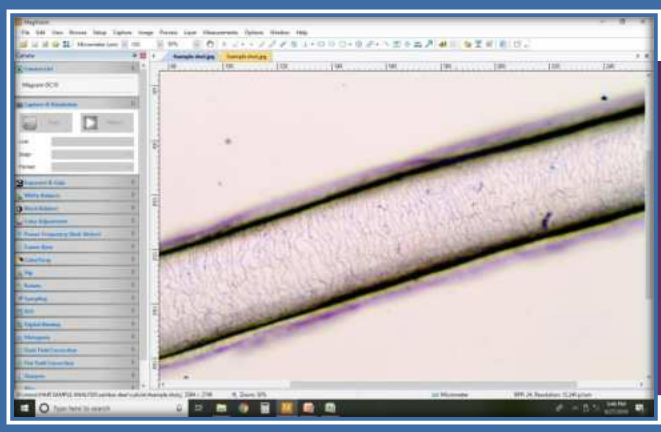
Cuticular
observation

Medullary
observation

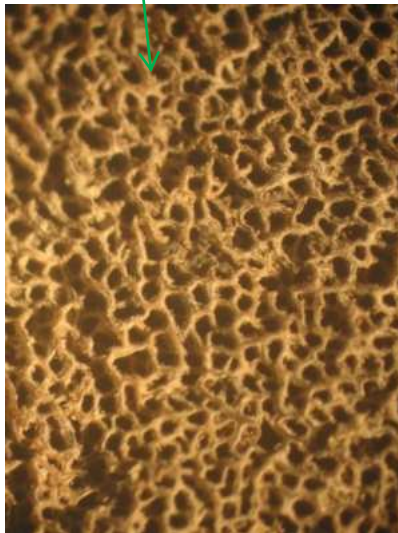
Physical
characters

Cross-
section

**SPECIES
ID**



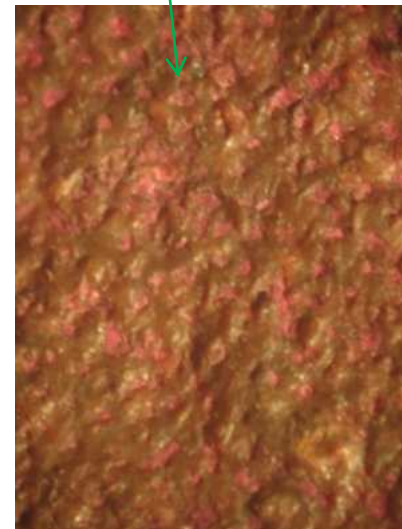
Characteristics of Basal portion of Rhino horn and Fake Horn using Stereo Microscope



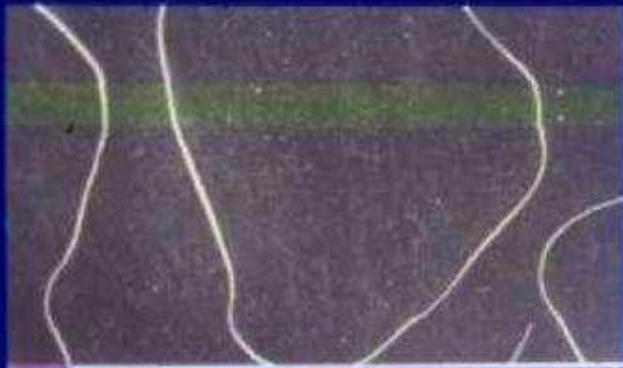
Case Rhino horn



Original Rhino
horn-Display



Fake horn-Display



PASHMINA



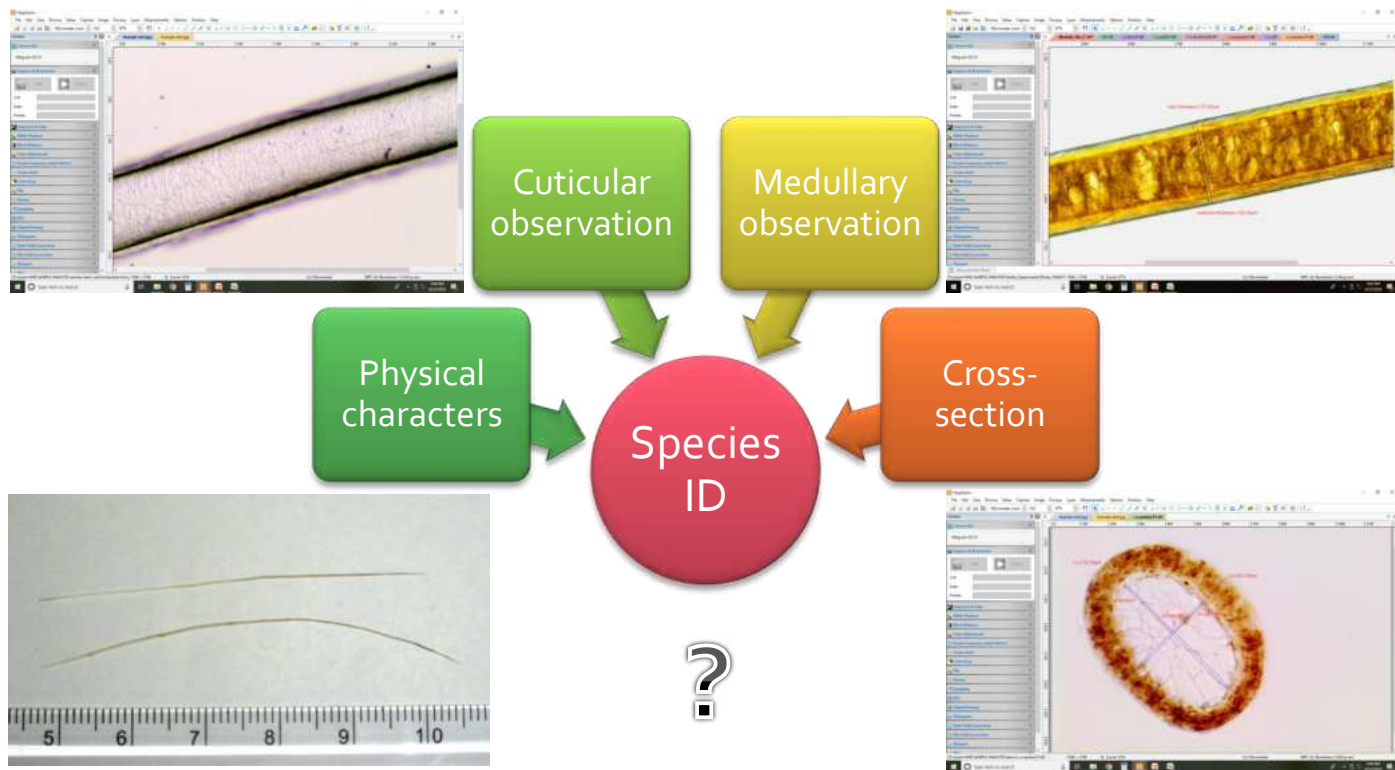
BLUE SHEEP

HAIR FEATURES

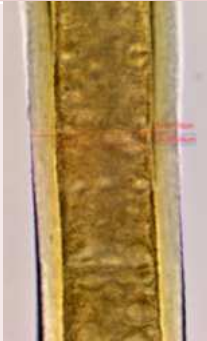


TIBETAN ANTELOPE

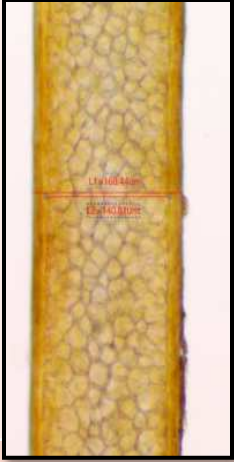
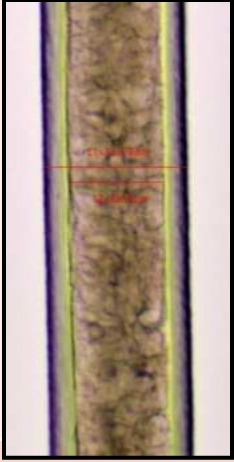
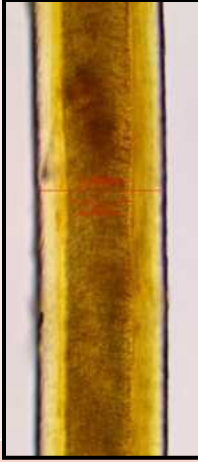
HAIR MORPHOMETRY



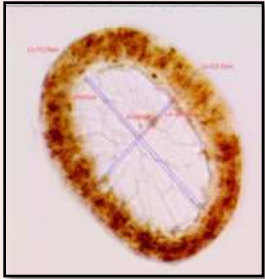
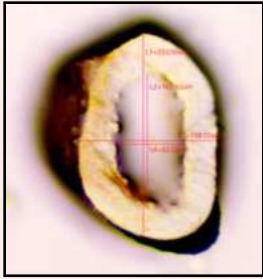
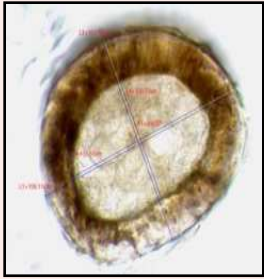
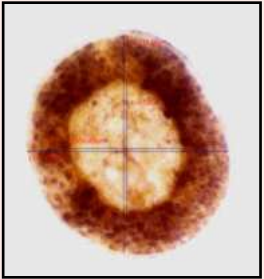
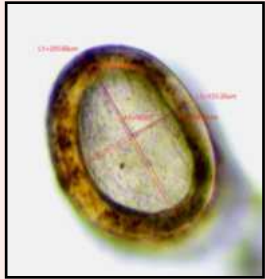
Key based on medullary characteristics

Specimen Name	Sambar deer (<i>Cervus unicolor</i>)	Striped hyaena (<i>Hyaena hyaena</i>)	Wolf (<i>Canis lupus</i>)	Dhole (<i>Cuan alpinus</i>)	Asiatic lion (<i>Panthera leo persica</i>)
Plate					
Type of Lattice	Wide medulla lattice	Simple, wide medulla	Simple, wide medulla	Narrow medulla with vacuoles	Simple, medium width medulla
Medullary percentage	83.60%	68.34%	65.96%	65.15%	50.59%

SPECIES ID BASED ON MEDULLARY CHARACTER

SPECIMEN NAME	Sambar deer (<i>Cervus unicolor</i>)	Striped hyaena (<i>Hyaena hyaena</i>)	Wolf (<i>Canis lupus</i>)	Dhole (<i>Cuan alpinus</i>)	Asiatic lion (<i>Panthera leo persica</i>)
PLATE					
TYPE OF LATTICE	Wide medulla lattice	Simple, wide medulla	Simple, wide medulla	Narrow medulla with vacuoles	Simple, medium width medulla
MEDULLARY PERCENTAGE	83.60%	68.34%	65.96%	65.15%	50.59%

SPECIES ID BASED ON CROSS SECTION

SPECIMEN NAME	Sambar deer (<i>Cervus unicolor</i>)	Striped hyaena (<i>Hyaena hyaena</i>)	Jackal (<i>Canis aureus</i>)	Wolf (<i>Canis lupus</i>)	Asiatic lion (<i>Panthera leo persica</i>)
PLATE					
TYPE OF C.S.	Oblong	Oval	Circular	Circular to oval	Circular to oval
MEDULLARY INDEX	0.68	0.59	0.65	0.58	0.71

Source: Species identification from Guard hair of selected Indian mammals: A Reference Guide, WII, 2010



Tiger



Leopard



Fake claw



Molecular approach to Wildlife Forensics

DNA Sequencing for Wildlife Forensic Research

Obtain DNA-bearing tissue samples: blood, saliva, hair follicles, feathers, scales

Extract DNA from Cells

Sequence DNA

Identify matching DNA sequence(s) in databases



...TTCAACCAACAGGCCACACA...

TTCAACAACAGGCCAC
TTCACCAACAGGCCAC
TTCATCTACAGCCCCAC



WCS, India

RESEARCH COMMUNICATIONS

DNA forensics in combating food frauds: a study from China in identifying canned meat labelled as deer origin

Mukesh Thakur^{1,7,*}, Ruheena Javed²,
Ved Prakash Kumar³, Malay Shukla⁴,
Neha Singh⁵, Aishwarya Maheshwari³,
Nipun Mohan⁶, Dong-Dong Wu¹ and
Ya-Ping Zhang¹

¹State Key Laboratory of Genetic Resources and Evolution and Yunnan Laboratory of Molecular Biology of Domestic Animals, Kunming Institute of Zoology, Chinese Academy of Sciences,

stores in airport premises. It is consumer's right to set the exact information on the products they buy. Manufacturers must honestly describe the constituents used/packed in processed and canned food items, as the information is liable to influence consumers' decision whether to buy or not to buy the product considering his/her lifestyle or religious belief (e.g. vegans prefer organic products, many Hindus, Muslims and Jews do not prefer to eat pork) or even health issues (e.g. people often avoid certain type of meat that can induce particular allergies). Therefore, description and labelling of food must be truthful and accurate, particularly for processed and canned food items where no morphological identity is provided leading to the identification of meat. Further, adding flavours in such canned foods change the essence of meat to make it

Wildlife crime investigations

Processed meat products purchased from the Pudong Shanghai Airport, China.



In-Vitro Pathogen Surveillance

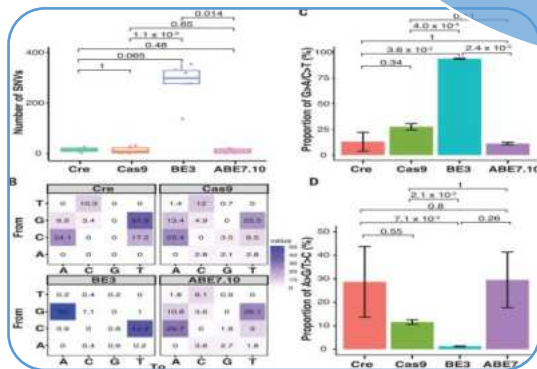


**Appropriate
Sample
Collection from
Wild Population**

**In-Vitro
Identification
of Pathogens
and Diseases**

**Analysis and
Communication**

**Information
Management**



APPLICATIONS OF CONSERVATION GENOMICS

1. Demography

(Black IV, *et al.* 2001)

2. Adaptive genetic variations

(Crandall, *et al.* 2000)

3. Inbreeding

(Steiner, *et al.* 2013)

4. . Hybridization

(Steiner, *et al.* 2013)

5. Disease diagnosis

(Hill, 1999)



Handheld Barcoding platform



Sample specimen
in field with hand-
held DNA analyzer



BARCODER

Analyzer generates
code and transmits to
barcode library



ID ENGINE

Library compares to
database and returns
ID and photo





Challenges....

Financial forensics

- Identification
- Preservation
- Analysis
- Documentation
- Presentation

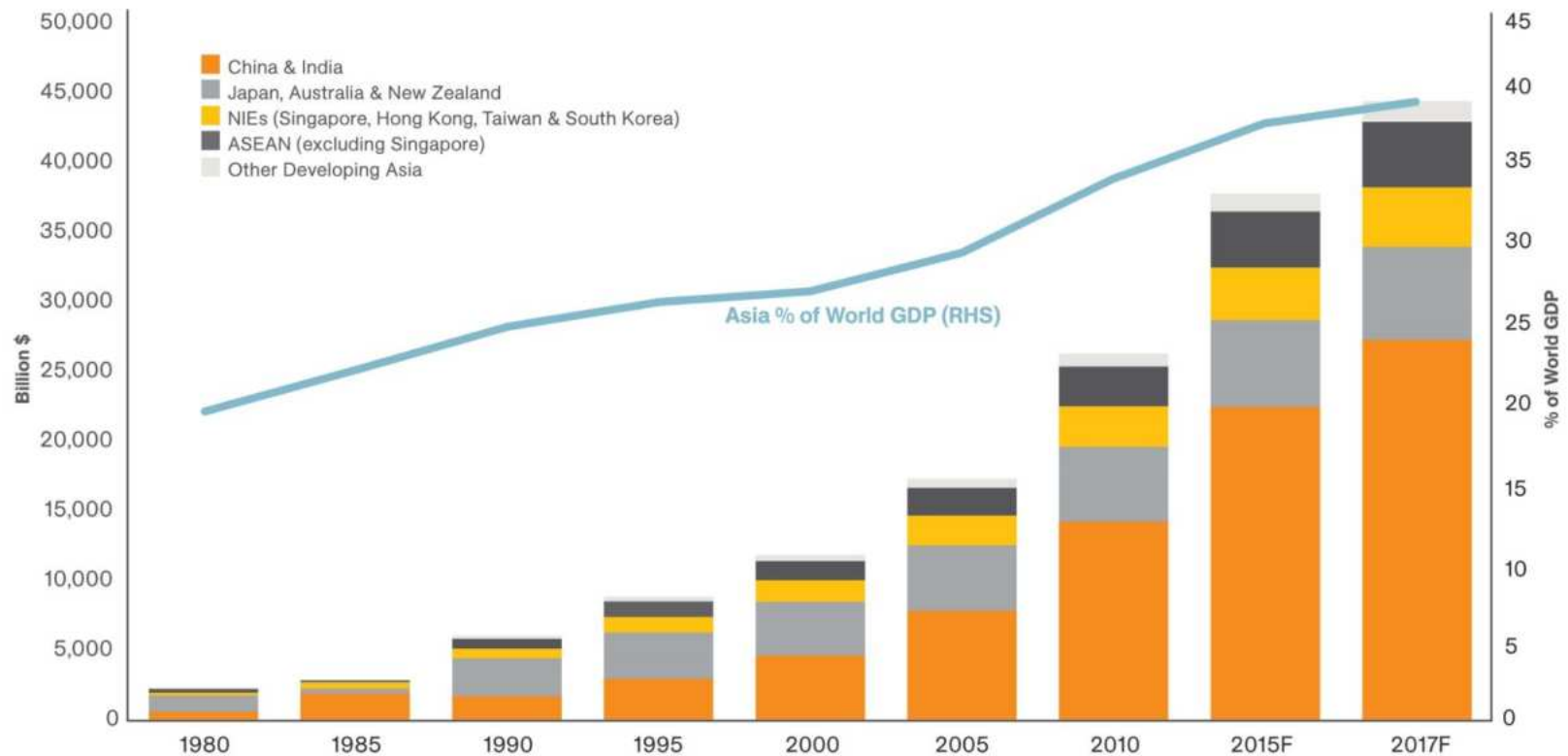
Digital forensics



Emerging Perspectives

Asian Economic Growth

GDP based on Purchasing Power Parity Valuation (Current International Dollar Billion)¹



1. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States.

Sources: International Monetary Fund, World Economic Outlook, October 2012; Austrade

AIWC role in Wildlife Conservation

- ▶ DNA forensics in Wildlife crime scene Investigation
- ▶ In situ and Ex situ breeding/ species survival
- ▶ Capture and translocation of animals
- ▶ Man animal Conflict Management Solutions
- ▶ Wild animal health monitoring
- ▶ Climate change impact (Including Marine seascapes)
- ▶ Conservation Education

Careers in Wildlife Conservation Research

– Major research based institutions in India, abroad



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**Indian Institute of Science
Bangalore**

[\(index.php\)](#)





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MoEF&CC, New Delhi

School of Natural Resources, University of Arizona, USA

Contact nos

+91-9445721157;

+91-9360281187

shekhar.niraj@gmail.com

shekhar.niraj@aiwc.res.in

<http://aiwc.res.in>

Dr Shekhar Kumar Niraj IFS
PCCF and Chief Wildlife Warden ,
Govt of Tamil Nadu, Chennai