

# **ESTABLISHMENT OF THE 'NATIONAL CENTRE FOR WILDLIFE FORENSICS' (NCWF)**

**WILDLIFE INSTITUTE OF INDIA  
DEHRADUN**



**भारतीय वन्यजीव संस्थान  
Wildlife Institute of India**

**Proposal for the  
Establishment of the 'National Centre for Wildlife Forensics' (NCWF)**

<b>Subject:</b>	<b>Wildlife Sciences</b>
<b>Sub-area:</b>	<b>Wildlife Forensic Science</b>
<b>Estimated cost:</b>	<b>Rs. 8282.8 Lakhs (~82.83 Crores)</b>
<b>Proposed for:</b>	<b>Strengthening wildlife forensic capacity in India</b>
<b>To be established at:</b>	<b>Wildlife Institute of India Dehradun, Uttarakhand</b>
<b>Collaborator:</b>	<b>Wildlife Crime Control Bureau (WCCB) New Delhi</b>
<b>Funding Agency:</b>	<b>Ministry of Environment, Forest and Climate Change (MoEF&amp;CC), Government of India</b>



## **Establishment of the ‘National Centre for Wildlife Forensics’ (NCWF)**

Worldwide illegal exploitation of wildlife and its derivatives strongly influence the levels of attrition of biodiversity. Over the years, illicit wildlife trade has emerged as a form of organized transnational crime that has threatened several wild species across the globe. Illegal trade on wildlife is the third-largest category of crime for illegal revenue generation after narcotics and illegal arms supply ([www.renctas.org.br](http://www.renctas.org.br)). There are "wildlife trade hotspots," where wildlife trade is intense. They include China's international borders, trade hubs in East/Southern Africa and South-east Asia, the eastern borders of the European Union, some markets in Mexico, parts of the Caribbean, parts of Indonesia and New Guinea, and the Solomon Islands. India has four internationally recognized hotspots of biodiversity i.e., Western Ghats, Eastern Himalayas, Indo-Burma, and Sundaland (<http://moef.nic.in/downloads/public-information/in-nr-04.pdf>). India's native wildlife is exploited for a product derived from them, which includes mongoose hair; snake skins; rhino horn; tiger and leopard claws, bones, skins, whiskers; elephant tusks; deer antlers; shahtoosh shawl; turtle shells; musk pods; bear bile; a wide variety of medicinal plants; timber and caged birds such as parakeets, mynas, munias; butterflies, moths and beetles (<http://www.traffic.org>). INTERPOL's recorded trade on tiger products and derivatives over 10 years indicates that poaching of 1069-1220 tigers has probably taken place, and in 481 cases, materials were seized from various countries holding the tiger population (<http://www.traffic.org/seizures/>).

The products derived from the body part of poached animals are used either in traditional Chinese medicine or the preparation of ornamental products. Trade-in over 1800 species of wild animals, plants, and their derivative is prohibited under the Wildlife (Protection) Act, 1972 of India; therefore, it becomes essential to develop expertise in identifying the part and products derived from protected flora and fauna species.

The wildlife trade monitoring network 'TRAFFIC' is a joint program of World Wildlife Fund (WWF) and International Union for Conservation of Nature (IUCN). The TRAFFIC is involved in arranging training programs for the enforcement agencies to control wildlife offense. However, it does not have any role in the legal implication of the wildlife protection laws. India is a member of the Convention on International Trade in Endangered Species (CITES) since 1976, and therefore, it is obliged to conform to the guidelines and recommendations it makes.

In India, Additional Director General (Wildlife), MoEF&CC is the CITES management authority, and the Regional Deputy Director, Wildlife Crime Control Bureau (WCCB) are the Assistant Management Authority (CITES). Additional Director, WCCB, is the Enforcement Authority to ensure the CITES in India.

It becomes essential to build capacity within the country to identify parts and products derived from all Indian wild species, which would help in the proper enforcement of the Wildlife (Protection) Act, 1972.

In 1995, the Wildlife Institute of India (WII) initiated in a modest way through a collaborative project with the U.S. Fish & Wildlife Service (USFWS) to develop protocols for identification of the wild species parts and products for assisting the examination of wildlife crime cases in India and over the years developed a basic research facility supporting decisions in legal cases related to wildlife forensics.

*Establishment of Wildlife Crime Control Bureau (WCCB) for Wildlife Law Enforcement:*

Wildlife Crime Control Bureau (WCCB) was established by the Government of India under the MoEF&CC through amendment in the Wild Life (Protection) Act, 1972 (WPA) of India (38Z) to combat organized wildlife crime in the country that became operational in the year 2008. Afterward, WCCB has been a leading central government agency in wildlife law enforcement in India. It provides field support to the State Forest Department, Police Department, Customs, and other Government agencies and coordinating with multi agencies for the effective implementation of the Wild Life (Protection) Act, 1972 (WPA) of India and CITES prohibited species. It is also involved in preparing and maintaining the database for wildlife offenders to share with the field level enforcement agencies. WCCB is also playing a key role in coordination with the South Asian country's enforcement agency to prevent transnational wildlife crime and illegal trade through the South Asia Wildlife Enforcement Network (SAWEN). One of the mandates of the WCCB is to develop infrastructure and capacity building for a scientific and professional investigation into wildlife crimes and assist State Governments in ensuring success in prosecutions related to wildlife crimes. Since its establishment, WCCB has played a vital role in the control of wildlife crime and illegal trade across the country. As per the provision of the act (WPA, 1972) in section 38Z (v), WCCB shall take measures to 'develop infrastructure and capacity building for scientific and professional investigation into wildlife crime and assist State Government to ensure success in the prosecutions related to wildlife crime'. Hence the proposed National Centre for Wildlife Forensics

(NCWF) will help in fulfilling the requirement of WPA 38Z (v). Therefore, NCWF will be in constant coordination with the WCCB in its activities and provide necessary support and seek guidance.

*World's leading Wildlife Forensic Centre as a model lab:*

One of the best wildlife forensic facilities of the world exists in the **National Fish and Wildlife Forensics Laboratory, Ashland, Oregon, USA**, which was established by U.S. Fish & Wildlife Service (USFWS). The role of this lab is to examine, identify, and compare evidence using a wide range of scientific procedures and instruments, in the attempt to link suspect, victim, and crime scene with physical evidence. USFWS has one of the best expertise in all disciplines of criminal science to deal with wildlife offense cases. It is for this reason that the present proposal draws heavily from the structure, set up and functioning of this lab. It is, therefore essential to understand further the facilities and capabilities of this lab.

National Fish and Wildlife Forensics Laboratory provides forensic assistance to the Office of Law Enforcement of the Fish and Wildlife Service (FWS). Office of Law Enforcement is composed of Special Agents and Wildlife Inspectors who enforce the criminal laws and U.S. Statutes that protect threatened and endangered species.

The Office of Law Enforcement of the Fish and Wildlife Service is primarily focused on compliance with criminal law that deals with crimes and their punishments. The lab seldom works on non-federal cases such as state poaching violations, or non-wildlife cases like animal abuse or food contamination.

The analytical assistance provided by the staff at the National Fish and Wildlife Forensic Laboratory can be grouped into four major categories:

1. Crime scene investigations
2. Cause of death determinations
3. Class character analysis (such as species identification or chemical analysis)
4. Individualization analysis

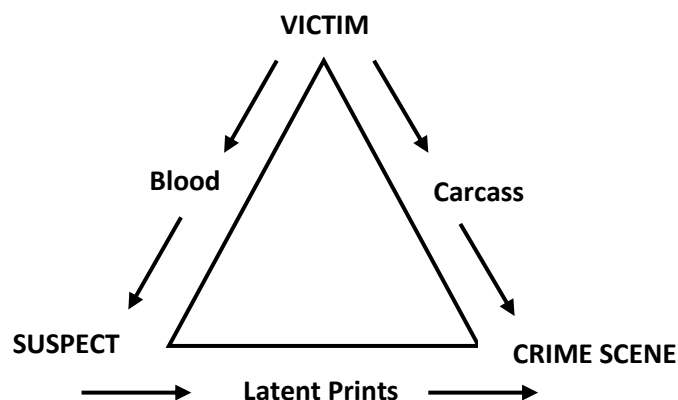
In many wildlife crime investigations, class category analysis provides the needed proof that a violation has occurred; for example, by documenting the presence of a protected species or a prohibited chemical. However, in some cases, further individualization analysis is required.

Individualization analysis:

The endpoint of many Office of Law Enforcement cases is to connect a suspect with the crime scene and the victim. For example, suppose

- **the victim (wild animal) is found dead at the crime scene** (links victim and crime scene)
- **a suspect's fingerprints are found at the crime scene** (links suspect and crime scene)
- **the victim's blood has stained the suspect's clothes** (links suspect and victim)

Therefore, individual characters (DNA extracted from blood and latent prints recovered at the scene) provide the basis for identity and linkage between victim suspects and the crime scene. While class character analysis can demonstrate that the victim is a tiger (*Panthera tigris*), individualization analysis is needed to prove that the blood of this particular tiger (the victim) is on the suspect's clothes.



This diagram shows the relationship between the victim, suspect, and crime scene. The victim is linked to the suspect via blood, the suspect to the crime scene via latent prints, and the crime scene to the victim via the carcass. USFWS has set an example, how a wildlife forensics laboratory should proceed for crime investigation by the use of multidisciplinary approaches.

## **ESTABLISHMENT OF WILDLIFE FORENSIC CAPABILITY IN INDIA**

### **Wildlife Forensics in India-Background**

In the case of wildlife crime, offenders caught with biological material (evidence) may not be sufficient for successful prosecution, until unless the court-defensible species-specific determination of the evidence provided. Forensic laboratories in the country have not paid attention to wildlife-related offenses, investigative and analytical procedures. In the late 1980s, it was felt that enforcement of the Indian Wildlife (Protection) Act, 1972, is often hampered due to the lack of

reference material and methods necessary to identify the animal and plant species used/affected in various wildlife offense cases. A strong need was felt to develop Wildlife Forensic capabilities for identifying parts and products derived from Indian wildlife for efficient implementation of the Indian wildlife laws and in controlling the illegal wildlife trade.

In order to overcome this long due vital requirement of wildlife law enforcement, the Wildlife Institute took an initiative way back in 1995. An Indo-US collaborative project entitled “Establishment of a wildlife forensic capacity at the Wildlife Institute of India” between U.S. Fish and Wildlife Services (USFWS), Ashland, Oregon, USA and WII was initiated in October 1995 with a sole aim to establish the Wildlife forensic capability at WII through research and development and ultimately disseminating the knowledge to the various law enforcement agencies. The project was funded under the US-Indian Fund (USIF). The project objectives included preparation of a perspective plan for wildlife forensics in the country, development of morphometric protocols for species identification, and create a repository of known species and tissue samples.

The Wildlife Institute of India provided the logistic support as well as the workspace for the forensic lab, while the infrastructure was developed through the collaborative project.

On completion of the major collaborative project, the Institute decided to establish a Wildlife Forensic Cell (WFC) at WII in 1999 with the support from Grant-in-Aid from the Ministry of Environment and Forests (MoEF&CC) for further research and development required for a functional wildlife forensic facility.

### **Initiatives - Other Agencies**

In the year 1998, the Centre for Cellular and Molecular Biology (CCMB), Hyderabad initiated a DBT funded project entitled “Laboratory for the Conservation of Endangered Species (LaCONES)”. The mandate of LaCONES was to establish a germplasm repository of Indian endangered animals and to develop a protocol for the assisted reproduction for them. Subsequently, CCMB-LaCONES started a DNA typing service for species identification of wild animals. However, the contribution by LaCONES is mainly restricted to DNA based approach to species identification for wildlife forensics. Concurrently, forensic laboratories also made an effort to contribute wildlife forensics by undertaking DNA based research viz. CFSL, Kolkata; Forensic Laboratory at Gandhi Nagar, Gujarat and CDFD, Hyderabad. Zoological Survey of India (ZSI), Kolkata, Biological Survey of India (BSI), Kolkata, and CMFRI, Kochi, has established a collection of the animal and plant

specimens of the country. The Veterinary Institute and Universities are also contributing substantially in the analysis of histological and toxicological samples.

### **Wildlife Forensic and Conservation Genetics (WFCG) Cell- Achievements and contributions**

After initiation of the WII-USFWS collaborative project in 1995 and the establishment of Wildlife Forensic Cell in 1999, the cell has done significant projects in the field of wildlife Forensics that is evident from its accomplishment and contribution. Wildlife Forensic and Conservation Genetics (WFCG) Cell was formed by merging the Wildlife Forensic and Conservation Genetics Laboratories in 2014.

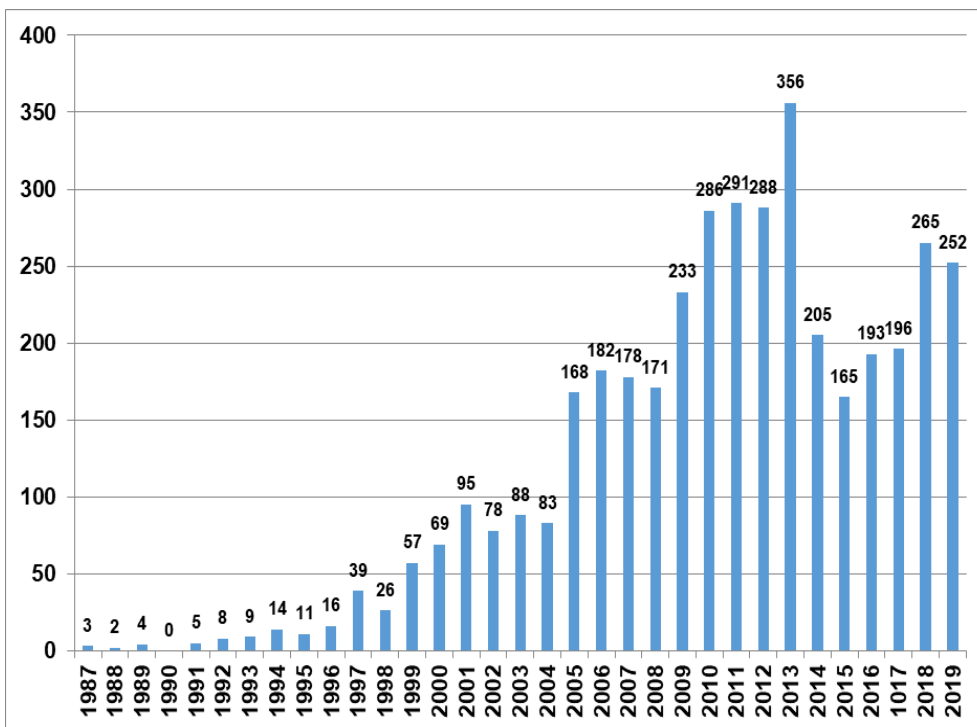
Following are significant achievements and contribution of WFCG Cell:

#### **(A) Achievements**

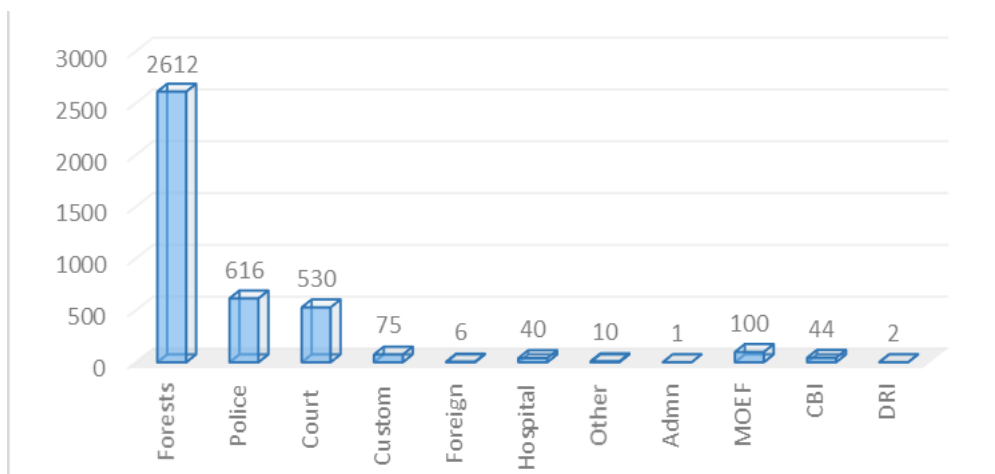
Over the period, more than 4000 legal cases (Fig. 1) have been forwarded to WFCG Cell pertaining to crime against wildlife species. The majority of the cases were sent from various forest departments (Fig. 2). WFCG Cell has developed the protocols for the identification of selected parts and products derived from Indian wild species and generated the repository for a few wild animals of India. Based on research and development carried out at WFC, various scientific protocols have been published, including more than 10 research articles, one computer-assisted hair identification program and two identification manuals (one for identification of Shahtoosh shawl and another for identification of species from the morphological feature of hairs).

Subsequently, WFCG Cell has set-up a state-of-art facility for DNA analysis for dealing with the cases related to the wildlife products, where identification of species will not be possible by morphometric analysis.





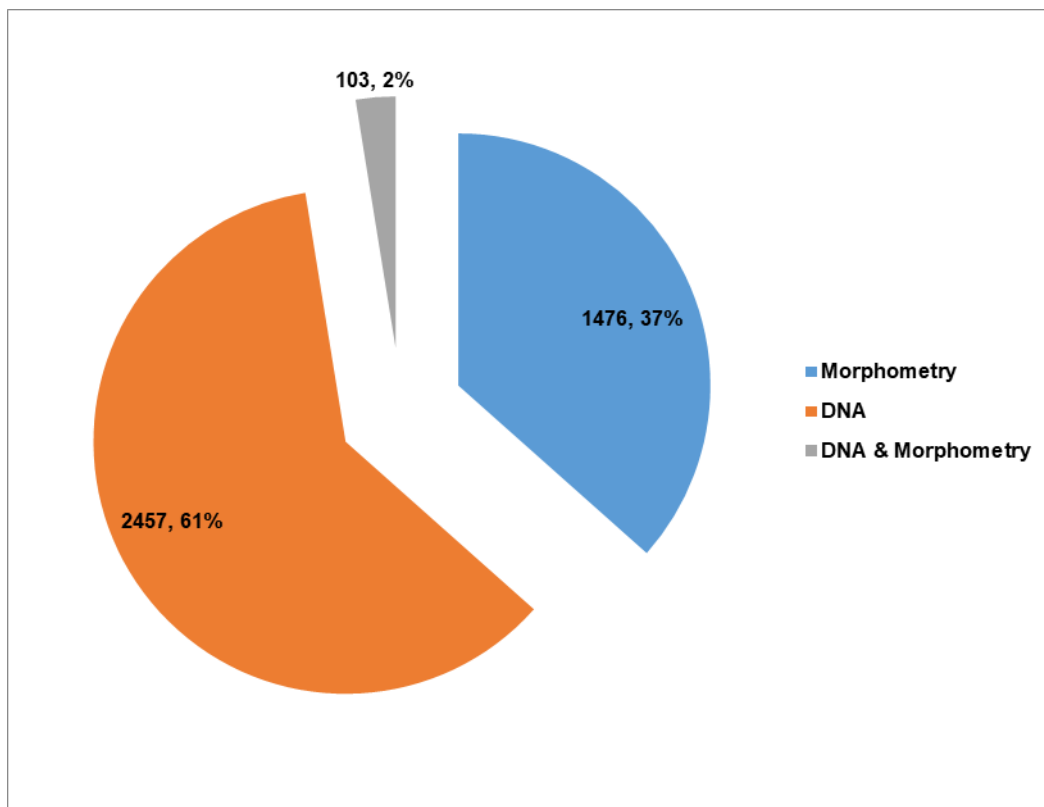
**Figure 1. Year-wise offense cases received at WFCG Cell (N=4036).**



**Figure 2. Involvement of enforcement agencies in the seizure of wildlife various objects.**

**(B) Contribution**

So far, about 3500 wildlife forensic cases have been addressed by the WFCG Cell. Approximately 63 % of cases can be solved based on the DNA and remaining by the morphometric protocols (Fig. 3).



**Figure 3. Involvement of DNA and Morphometry analysis in wildlife crime investigation for species identification in India (based on WII case records).**

### **Identified Gaps**

Although WII has established a basic facility to identify various parts and products of select Indian wild animals, certain limitations while developing further protocols and supporting wildlife crime investigation were felt.

Due to limited existing infrastructure, the cell is not able to expand the facility for creating a much-demanded repository of known specimens. A complete repository could not be developed on Indian wildlife species for want of required space and funds. At the present stage, we are able to support wildlife crime investigation only for species identification. WFCG Cell has developed the partial repository for only selected and commonly traded animals, which need to be expanding for a complete repository for all protected wildlife of India.

## **JUSTIFICATION FOR ESTABLISHMENT OF THE NATIONAL CENTRE FOR WILDLIFE FORENSICS (NCWF)**

In the present scenario of crime investigation species identification is an important aspect, but other part of crime investigation has not been addressed, which may help in expanding the vision of investigating teams. Preparation of well-documented repository requires the full support from all zoo park and all state forest departments for collection of the known carcass of the naturally dead animal species. These issues can be addressed by establishing a dedicated state-of-the-art center.

Hence, to fulfill the 38Z(v) of WPA, and actionable point No. 1.9 of the theme 'Control of Poaching and Illegal Trade in Wildlife' of the National Wildlife Action Plan (NWAP) 2017-31 of MoEF&CC, we propose to establish a 'National Centre for Wildlife Forensics' (NCWF) in collaboration with the WCCB in WII campus.

### **OBJECTIVES OF NCWF**

The aims and objective of NCWF will be to fill the gaps in forensic capabilities related to wildlife crimes by developing protocols for dealing with all aspects of criminal science. Finally, established protocols would be disseminated to crime investigation laboratories in the form of Standard Operating Procedure (SOP). The broad focus area of NCWF is given below:

- 1 To create the complete repository for Indian wildlife- which is the main gap in dealing with wildlife forensics.
- 2 To prepare a plan for the advancement of wildlife forensics India
- 3 To create the required infrastructure (workspace, storage facility, and database) for dealing with all aspects of criminal sciences.
- 4 To establish working relationships with a national and international institution of repute in the areas of wildlife conservation, zoological research, and wildlife forensics
- 5 To develop the complete schedule-wise database (as per WPA, 1972) for all protected Indian species.
- 6 To develop the proficiency for toxicology, morphology, pathology, genetics and ballistic science for dealing with a variety of wildlife offenses
- 7 To disseminate the acquired knowledge to users through training and manuals

### **Up-gradation of Forensic Capability at WII under NCWF**

A variety of wildlife crime invites the use of specific protocols. The following are the dedicated units required for dealing with all aspects of wildlife crime investigation.

## 1. Morphological Division

The laboratory for Morphology analysis uses the classic techniques of comparative morphology and anatomy to identify animal remains to species. “Identifying the victim species” is an essential first step in wildlife crime investigations. Identification of animal remains must be established to determine which, if any, laws have been violated.



**A Rhino Horn**

A dedicated morphology unit for dealing with the identification of part and product of wild animals based on morphologic features is required, which can solve around 40% of the total wildlife crimes based on WII’s forensic records. This unit should be equipped with the basic equipment for measuring the morphological feature, which may include a high-end microscope, digital calipers, and more importantly, a dedicated repository for different wildlife species. The repository consists of every body part of the entire animal along with a complete set of the skeleton, hide, and tissue sample for DNA analysis.

The morphologists are routinely asked to answer questions like these:

- Is this carving made from ivory or the bone of permitted animals?
- Is this fur coat derived from protected species?
- Are these feathers from protected bird species?

To answer the questions, the Forensics Lab need to develop expertise in three taxonomically-based disciplines:

- Herpetology: reptiles and amphibians
- Ornithology: birds
- Mammalogy: mammals

The recurring and non-recurring budget for the morphological division is explained below:

### Non-recurring Expenditure

S. No.	Equipment/Objects	No. of unit	Application/Use	Estimated Cost (in Lakhs)
1	Hitachi Compact SU1510 VPSEM	1	Fine surface analysis under various morphological study	50
2	X-ray diffraction (XRD) unit	1	For examination of 3D structure of molecules	50
3	MS-MS spectroscopy	1	For elemental analysis	100
4	GC-MS	1	For elemental analysis	50
5	SEM Electron Microscopy	1	For fine scale microscopy of biological surfaces	50
6	X-ray exposure	1	Analysis of Fine structure of Bones, claws etc.	5
7	Miscellaneous equipment	1	For associated uses	15
Total				320

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (Rs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	2	19.2	57.6	Two dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @60,000/ month	2	14.4	43.2	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.

<b>3</b>	Project Assistant @35,000/month	3	12.6	37.8	Each RA may be supported by one PA. Looking at present trends two PA would be required in each RA at morphology and Genetics unit.
<b>4</b>	Supporting staff @12,000/ month	10	14.4	43.2	Supporting staff will helped in day to day research activity and all activity of NCWF
<b>5</b>	Consumable Items		20	60	Purchase of chemical and wares
<b>6</b>	AMC for Equipments		3.00	9	Equipments maintenance
<b>Total</b>			83.6	250.8	

## 2. Analytical and Ballistic Division

The activities of the Analytical unit will be focused on casework for the elucidation of molecules that assist in answering questions concerning the cause of death and species identifications. It also takes up the research and investigation of the ballistic analysis. While the approaches to molecular elucidations are as varied as the molecules under investigation, many methods incorporate mass spectrometry as a vital component of the analyses performed. As such, the analytical unit requires equipments used in molecular characterizations along with a diverse array of mass spectrometers that include:

Analytical unit will assist in cause of the death determinations, which can focus on the identification of a particular agricultural poison (organophosphates or carbamates); a specific mammalian pest control agent (strychnine, anticoagulants, or sodium fluoroacetate); an avian pest control agent such as 4-aminopyridine; or the identification of petroleum hydrocarbons found on/in “oiled” birds. Support in the area of species identifications encompasses characterization of heme proteins from blood and tissue samples, characterization of bile acids from gall bladders and Asian medicinal products, or characterization of keratins from products made of rhino horn or tortoise shell.

Since the analytical unit will also be supporting the activity of other divisions, it will require the following essential equipments. The recurring and non-recurring budget for the morphological division is explained below:

### Non-recurring Expenditure

S. No.	Equipment/Objects	No. of unit	Application/Use	Estimated Cost
1	Nexus 470 FT-IR by Nicolet	1	For molecular inferences analysis	10
2	Energy dispersive X-ray spectrometry (EDX)	1	For X-Ray Fractionation analysis	10
3	Agilent 6890N gas chromatograph equipped with a 5975B mass select detector.	1	Chemical analysis of compounds	100
4	Varian CP-3800 gas chromatograph equipped with a Saturn 2200 ion-trap mass spectrometer and associated CTCAnalytics COMBIPAL automated injector with solid phase microextraction (SPME) capacity	1	Chemical analysis of compounds	150
5	ThermoFinnigan LCQ DecaXP ion-trap mass spectrometer	1	Chemical analysis of compounds	100
6	Applied Biosystems Voyager-DE PRO MALDI mass spectrometer	1	Chemical analysis of compounds	100
7	Ion Spec Fourier Transform mass spectrometer equipped with a 7.0T magnet	1	Chemical analysis of compounds	100
8	Agilent 1200 Series capillary high performance liquid chromatograph	1	Chemical analysis of compounds	100
9	ThermoNicolet NEXUS 470 Fourier transform infrared spectrometer equipped with a Centaurus microscope	1	Chemical analysis of compounds	100
10	EDAX Eagle II x-ray fluorescence spectrometer	1	Chemical analysis of compounds	100
11	Ballistic testing tank	1	Determining that a projectile was fired from the suspects	1
12	Ballistic fire unit	1 set	Determining that a projectile was fired from the suspects	5
13	Leeds comparison microscope	1	Determining that a projectile was fired from the suspects	10
14	Reichert comparison microscope	1	Determining that a projectile was fired from the suspects	15
15	Tescan Vega electron scanning microscope with a dual comparison stage	1	Determining that a projectile was fired from the suspects	15
Total				916

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	2	19.2	57.6	Two dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @ 60,000/ month	2	14.4	43.2	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
3	Project Assistant @ 35,000/month	4	16.8	50.4	Each RA may be supported by one PA. Looking at present trends two PA would be required in each RA at morphology and Genetics unit.
4	Supporting staff @ 12,000/ month	5	7.2	21.6	Specialized consultant may help in initial set up of specialized disciplines for Wildlife offence.
5	Consumable Items		20	60	Purchase of chemical and wares
6	AMC for Equipments		3	9	Equipments maintenance
<b>Total</b>			80.6	241.8	

### 3. Genetics Division

The importance of genetic techniques has been proven worldwide and these are vastly applied as tools. The modern forensic approach is revolving around this tool. Genetic analysis has proven to be a great asset in dealing with various complicated and intricate judicial cases, including wildlife crimes (Gupta *et al.* 2005, 2006, 2011a, 2011b, 2018). The genetics section uses the modern techniques of molecular genetics for the identification of wildlife evidence. Plant and animal remains and products need to be identified to determine those conservation regulations that may apply. Identifications include determining the taxonomic family,



species, sub-species, population origin, individual origin, gender origin and parentage of questioned evidence.

Nucleotide sequence analysis of mitochondrial, chloroplast and nuclear DNA identifies variants that are diagnostic markers for the taxonomic family, species, sub-species and population origin of questioned evidence. For the successful application of this tool, a vast DNA sequence repository of known Indian wildlife need to be prepared. Schedule wise collection of biological samples and generation of DNA database is compulsory for dealing with all the listed animals in Wildlife (Protection) Act, 1972 of India. Since a minimum of 60% of wildlife crime cases requires DNA analysis, therefore; such a database can be used in matching the DNA profile of unknown case samples with known victim species (Gupta *et al.* 2005). The developed infrastructure will also help in the development of the latest molecular markers and protocols for dealing with forensic cases and the development of the next-generation forensic approach.

The nuclear DNA of animals contains short tandem repeats (STR) comprised of 2-6 base pair units that are scattered along the autosomal and sex chromosomes. STR loci display high levels of polymorphism that are detected as length polymorphism by PCR amplification with locus-specific primers. The amplified DNA is analyzed by direct sizing with capillary electrophoresis. If two evidence samples exhibit the same alleles at a suite of different loci, the probability of the samples originating from the same individual is inferred from the frequency distribution of the observed alleles in a database of the species of interest. The genetics section performs STR analysis for purposes of individual identification, assignment of the population of origin, parentage determination (Gupta *et al.* 2011), and species identification. The genetics section also uses PCR amplification of the sex chromosome loci.



Skin of *Varanus species* used for making bag

Since the genetic unit will work on the development of next-generation analytical protocols, it will require the following essential equipments. The recurring and non-recurring budget for the genetic division is explained below:

### Non-recurring Expenditure

S. No.	Equipment/Objects	No. of unit	Application/Use	Estimated Cost (in Lakhs)
1	PAC Bio	1	For sequencing of whole genome of wildlife of India	800
2	Alumina NovaSeq (NGS Platform with accessories)	1	For Next Generation DNA Sequencing	700
3	3730 Genetic analyzer	1	For sequencing of short DNA fragment	100
4	Liquid Nitrogen Unit	1	For preparation of Liquid N <sub>2</sub>	50
5	Setup of animal cell culture facility	1	Study of functional genomics of wild animals	50
6	Setup of cold room facility	2	Preservation of samples and reagents	80
7	Setup of BSL IV facility	1	Handling of air born infectious agent	100
8	Gradient Thermal Cycler	3	For PCR amplification optimization	15
9	High throughput robotic liquid handling system	1	For sample preparation	75
10	Karyotyping unit	1	For karyotyping of wild animals	75
11	Bio-safety class-II laminar cabinets	3	For culture work in various dedicated facility	15
12	Laminar hoods	2	For media preparation	8
13	Incubator	3	For culture work in various dedicated facility	9
14	CO <sub>2</sub> Incubator	1	For cell culture lab	4
15	Incubator Shaker	2	Each for Cell culture and microbial culture lab	7
16	Vertical rotors	5	For all dedicated facility	2
17	Hybridization chamber	2	For Genetic unit	6
18	Various size Gel Electrophoresis unit	10	For Genetic unit	5
19	-20°C deep fridge	5	For all dedicated facility	4
12	-80°C deep fridge	5	For all dedicated facility	25
13	Autoclave	2	For sterilization of equipments	5
14	Drier Chamber	2	One for drying the sterilized equipments and second for drying biological samples	4
15	Oxford Nanophor (Minion)	1	For high read length DNA seq.	3
Total				2142

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @ 8 0,000/ month	2	19.2	57.6	Two dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @ 60,000/ month	2	14.4	43.2	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
3	Project Assistant @ 35,000/month	4	16.8	50.4	Each RA may be supported by one PA. Looking at present trends two PA would be required in each RA at morphology and Genetics unit.
4	Supporting staff @ 12,000/ month	5	7.2	21.6	

<b>5</b>	Consumable Items		40	120	Purchase of chemical and wares
<b>6</b>	AMC for Equipments		7	21	Equipments maintenance
<b>Total</b>			104.6	313.8	

#### **4. Toxicological Division**

Forensic toxicology is the use of toxicology and other disciplines such as analytical chemistry, pharmacology and clinical chemistry to aid medical or legal investigation of death, poisoning, and drug use. The primary concern for forensic toxicology is not the legal outcome of the toxicological investigation or the technology utilized, but rather the obtaining and interpreting of the results. Toxicological analysis can be done to various kinds of samples.

A forensic toxicologist must consider the context of an investigation, in particular, any physical symptoms recorded, and any evidence collected at a crime scene that may narrow the search, such as pill bottles, powders, trace residue, and any available chemicals. Provided with this information and samples with which to work, the forensic toxicologist must determine which toxic substances are present, in what concentrations, and the probable effect of those chemicals on the individual.

Determining the substance ingested is often complicated by the body's natural processes, as it is rare for a chemical to remain in its original form once in the body.

In many suspected wildlife crime cases, it is desirable to conduct the toxicological test from the gut of animals and match with the same toxic substance in the premises of the accused. Such a study requires a dedicated infrastructure of toxicological division along with the well-established chemical unit.

Since the toxicology unit will be supported by analytical division for equipments, it will may not requires any dedicated equipments. Therefore, non-recurring budget for the toxicological division is explained below:

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	1	9.6	28.8	One dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @60,000/ month	1	7.2	21.6	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
3	Project Assistant @35,000/month	1	4.2	12.6	To assist the RA & consultant for analysis
4	Specialized contractual consultant @80,000/ month	1	9.6	28.8	Specialized consultant may help in initial set up of specialized disciplines for Wildlife offence.
5	Consumable Items		15	45	Purchase of chemical and wares
<b>Total</b>			45.6	136.8	

### 5. Pathology Division

The objective of pathological evaluation of a carcass of an animal is to determine the cause of death, which for most pathologists, means providing a diagnosis. As we know, multiple diagnoses may be applied to any pathology report depending on the level of investigation, which is directly related to the post mortem condition of the carcass. In legal circles, we refer to the cause, manner, and mechanism of death, and we may also list contributory and incidental findings.

The medical examiner is expected to determine a “cause” of death, meaning the disease, injury or abnormality that alone or in combination is responsible for initiating the sequence of functional disturbances that ends in death. This is different than the “mechanism” of death, which infers more of the physiological consequence of the injury or disease. The “manner” of death relates more to the circumstances around the factors that initiated the cause of death with special reference to the social relationship and personal causation. As the investigating pathologist and an expert witness, you may be asked to explain your opinion on the above designations for the case at hand.

Other objectives that must be considered in a forensic evaluation include the recovery of trace evidence, reconstruction and documentation of the sequence of events where possible, and an estimation of the time of death. Trace evidence may include bullets or bullet fragments, tissue or organ samples, stomach and crop contents, carrion feeding insects, hair, etc. Proper procedures to document the association of the trace evidence items with the original carcass and appropriate preservation and packaging of the trace evidence are also the responsibility of the pathologist. A chain of custody must be established for each trace evidence item removed from the original carcass. Photo documentation of the items recovered to demonstrate the origin of the sample or item is an effective way to establish the connection between the carcass and the new trace evidence sample.

For example, a bullet might be photographed in situ with a pointer demonstrating a wound path before removing the bullet. Skin samples around a suspected bullet wound which are removed to illustrate lead residue or duration of the wound should be photographed before and after removal to establish the relationship of the “trace” evidence or sub-item to the original sample. Radiographs (x-rays) are an excellent way to document the presence of bullets, bullet fragments, and pellets. However, field radiographs of large animals are rarely practical. Metal detectors may be used to demonstrate and recover bullets from carcasses in the field.

Since the pathology unit will be supported by the equipments available at the analytical division and morphology division, it may not require any dedicated equipments. Therefore, non-recurring budget for the toxicological division is explained below:

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	1	9.6	28.8	One dedicated consultant/faculty may require to look after the facility
2	R A or PDF @60,000/ month	1	7.2	21.6	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.

<b>3</b>	Project Assistant @35,000/month	1	4.2	12.6	To assist the RA & consultant for analysis
<b>4</b>	Specialized contractual consultant @80,000/ month	1	9.6	28.8	Specialized consultant may help in initial set up of specialized disciplines for Wildlife offence.
<b>5</b>	Consumable Items		15	45	Purchase of chemical and wares
<b>Total</b>			45.6	136.8	

## 6. Marine and Invertebrate Division

Marine animals and invertebrates are also extensively involved in the illegal trade. These include Arthropod, Mollusc, Echinodermata, shark and turtle species. A dedicated Marine and Invertebrate Division in NWFC would establish a database and develop a protocol for the identification of the part and products derived from the invertebrates and marine animals. The analytical support to this division would be provided by the other division; however, a dedicated team of scientific personnel would be required to take up the analysis and investigation.

### Recurring Expenditure

<b>S. No.</b>	<b>Categories of personnel</b>	<b>No of personal</b>	<b>Annual Remuneration (in Lakhs)</b>	<b>Remuneration for three years (in Lakhs)</b>	<b>Job responsibility</b>
<b>1</b>	Consultant or Project Scientist @80,000/ month	2	19.2	57.6	Two dedicated consultant/ faculty may require to look after the facility
<b>2</b>	R A or PDF @ 60,000/ month	2	14.4	43.2	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
<b>3</b>	Project Assistant @ 35,000/month	4	16.8	50.4	Each RA may be supported by one PA. Looking at present trends two PA would be required in each RA at morphology and Genetics unit.
<b>4</b>	Supporting staff @ 12,000/ month	5	7.2	21.6	Specialized consultant may help in initial set up of specialized disciplines for Wildlife offence.
<b>5</b>	Consumable Items		20	60	Purchase of chemical and wares
<b>6</b>	AMC for Equipments		3	9	Equipments maintenance
<b>Total</b>			80.6	241.8	

## 7. Botanical Division

The establishment of this division will fill one of the essential lacunas in forensic investigation. Many rare and endangered plant species are being illegally overexploited worldwide. There is no proper protocol available so far to establish the identity from part and product derived from rare and endangered plants. This division will utilize the expertise of genetic and analytical unit to develop the protocols for the identification of endangered medicinal and aromatic plant species from part and products. One database will also be established from all endangered plant species with a known repository. This database and repository would be the basis for the development of plant forensic sciences at India.

The botanical unit will be supported by the equipments available at the analytical division, genetic division and morphology division; therefore, it may not require any dedicated equipments. Thus, non-recurring budget for the botanical unit is explained below:

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	1	9.6	28.8	One dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @60,000/ month	1	7.2	21.6	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
3	Project Assistant @35,000/month	1	4.2	12.6	To assist the RA & consultant for analysis
4	Consumable Items		5	15	Purchase of chemical and wares
<b>Total</b>			26	78	

## 8. Database & Dissemination Cell

Dissemination of the tools and techniques by means of teaching and training will be the main asset from NWFRF. This cell will establish close linkages between prospective forensic laboratories to disseminate the appropriate knowledge to the user lab. This cell will regularly conduct the workshop and seminars in recent development on wildlife forensic capabilities. It will also involve in the training field staff of the forest department for the collection and forwarding of the samples and organizing a workshop for the Judiciary, Staff of WCCB, Police Department, staff of DRI and other enforcement agencies.

Database Dissemination Cell will be supported by the equipments available at the analytical division, genetic division and morphology division; However, it will require following equipment for storage and discrimination of data and informations:

### Non-recurring Expenditure

S. No.	Facilities	No. of unit	Application/Use	Estimated Cost (in Lakhs)
1	High end sever system	2	To store the data and records of the centre	50
2	Workstation desktops	4	To work with the large size data	20
3	CCTV surveillance network system	1 set	To monitor the security of the centre	50
4	Desktop PC	20	For the user of the centre	10
5	High end color Printer	1	For color imaging	1.5
6	Xerox machine	1	For the user of the centre	1.5
7	Laser printers	4	For the user of the centre	2
8	Big screen for training room	1	For training & teaching classes	4
9	Power point projector	2	For training & teaching classes	1
<b>Total</b>				<b>140</b>

### Recurring Expenditure

S. No.	Categories of personnel	No of personal	Annual Remuneration (in Lakhs)	Remuneration for three years (in Lakhs)	Job responsibility
1	Consultant or Project Scientist @80,000/ month	1	9.6	28.8	One dedicated consultant/ faculty may require to look after the facility
2	R A or PDF @60,000/ month	1	7.2	21.6	R&D and forensic support in each department. Looking at present trends two RA would be required in each i.e. morphology and Genetics unit.
3	Project Assistant @35,000/month	1	4.2	12.6	Specialized consultant working in public relation matter may help in this activity
4	Workshop and Seminars	2/year	30	90	To disseminate the knowledge
5	Consumable Items		4	12	Purchase of chemical and wares
<b>Total</b>			<b>55</b>	<b>165</b>	

After completion of three functional years, the recurring expenditure of Rs. 521.8 Lakhs per year may be provided through a special grant to support the smooth functioning of the established NCWF facility.



## 9. Creation of a State-of-the-art Centre

The first and most important need is for one dedicated center with appropriate space for accommodating all the above units. Each unit requires one instrumentation room, one researcher's room and one working space. In addition to this, morphology and the genetic unit requires additional space for the storage of known repository. One DNA preparation room with controlled negative pressure will be required for the genetic unit. Three numbers of 4° C storage rooms (each with 400 square feet ground area and 10 feet in height) with modular self attach to the walls would be required for storage of case property. One -20° C strong room (400 square feet ground area and 10 feet in height) with modular self attach to the walls would be required for the storage of tissue and meat samples. One normal temperature strong room (600 square feet ground area and 10 feet in height) with modular self attach to the walls and with regulated negative pressure required for storage of dried case and reference samples. One dedicated repository preparation room will be required for the collection of various body parts from the carcass of the animal. One dedicated facility for cell culture lab with controlled negative pressure and to deal day to day activity of karyotyping unit along with media preparation room. One dedicated fumigation room will be required for handling the putrefied and bad-smelling samples. One planned flesh-eating beetle (family *Dermestidae*) room requires preparation of the skeleton from the carcass of the animal. One dedicated washing and sterilization room will be set for taking care of all the basic needs of the building. One dedicated generator room and central AC plant will be attached to this building. The base of the building will be a minimum of 800 sq. m and will be constructed by CCU. The land for the location of this building within the Institute's campus in Chandrabani, Dehradun, is already available, for which no cost is to be paid. Therefore, non-recurring budget for the creation of the State-of-the-art centre is explained below:

### Non-recurring Expenditure

S. No.	Facilities	No. of unit	Application/Use	Estimated Cost (in Lakhs)
1	Creation of a New Centre	1	To house various facilities of the NCWF	800
2	Automated management of cryopreserved tissue samples	1	For easy and accurate access of the long term preserved samples	800
3	Movable (motorized) metal racks and space optimizer	1	For space economic and safe storage of case properties and files	300
4	Electronics & equipment safe network of fire extiguser	1	For fire safety of the centre	300
5	Furning of facility to house BSL IV lab	1	Handling of air born infectious agent	300
6	Furning of negative pressure lab	2	For contamination free DNA isolation and sample preparation	300
7	Furning of positive pressure lab	2	Post PCR handling of samples	200
8	Furnishing of training centre with isolated equipments	1	For delivery of hands on training	160
9	Set up of 50 KV Digi Set	1	For power Backup	40
Total				3200

**Total Budget**

<b>1. Morphology Division</b>	<b>Cost (in Lakhs)</b>
Equipment	320
Manpower & Consumables	250.8
<b>2. Analytical and Ballistic Division</b>	
Equipment	916
Manpower & Consumables	241.8
<b>3. Genetics Division</b>	
Equipment	2142
Manpower & Consumables	313.8
<b>4. Toxicological Division</b>	
Equipment	0
Manpower & Consumables	136.8
<b>5. Pathology Division</b>	
Equipment	0
Manpower & Consumables	136.8
<b>6. Marine and Invertebrate Division</b>	
Equipment	0
Manpower & Consumables	241.8
<b>7. Botanical Division</b>	
Equipment	0
Manpower & Consumables	78
<b>8. Database &amp; Dissemination Cell</b>	
Equipment	140
Manpower & Consumables	165
<b>9. Creation of a State-of-the-art Centre</b>	3200
<b>Grand Total</b>	<b>8282.8</b>

**Budgetary outlay (in Lakhs)**

<b>S. No.</b>	<b>Head</b>	<b>I<sup>st</sup> Year</b>	<b>II<sup>nd</sup> Year</b>	<b>III<sup>rd</sup> Year</b>	<b>IV<sup>th</sup> Year</b>	<b>Total</b>
<b>1</b>	<b>Non-recurring</b> (Equipment and Centre)	6718	-	-	-	6718
<b>2</b>	<b>Recurring</b> (Manpower & Consumables)	-	521.8	521.6	521.6	1564.8
<b>3</b>	<b>Total</b>	<b>6718</b>	<b>521.8</b>	<b>521.6</b>	<b>521.6</b>	<b>8282.8</b>

### **Potential Target Species of NCWF**

NCWF will establish a protocol and SOP's for all the Mammalian species listed in WPA and other highly traded non-mammalian and marine species. NCWF would also prioritize the target species for urgent development of the protocol in consultation with the WCCB to meet the immediate requirement of the investigation.

### **Scope of NCWF and Responsibility**

Though WII's NCWF will be a focal agency for undertaking research and development work for strengthening wildlife forensics, it will also be dissemination/sharing developed/validated SOP/database and methodologies with the various forensic science laboratories across the country. It will work in collaboration with the WCCB, New Delhi, to assist in wildlife crime investigation. This center will be involved in developing easy-to-use protocols in the field for the identification of parts and products of the highly traded species for taking immediate action. Such a protocol will assist in taking on the spot decisions regarding the confiscation of the material. This center will serve as a comprehensive 'Wildlife Forensic Investigation Centre' in India, and based on funding support, three regional centers in Northeast, Western, and Southern/Central may be established under the NCWF in the future. It will also collaborate with the various veterinary research centers to bring expertise and SOP's in place for wildlife crime investigation. This center will collaborate with the laboratories working at the regional level e.g., ZSI, BSI, CCMB-LaCONES, CMFRI, Gandhinagar Forensic University, to disseminate the synchronized protocol through the regular workshop and to provide the secure access to the DNA data bank available in NWFC for casework. All the regional laboratories working in the country for wildlife crime investigation will be associated with the NWFC through the Memorandum of Understanding (MoU). Thorough MoUs, all the laboratories will be linked with the NCWF, and the protocol and resources available at this center will be legally accessible to them for forensic casework. NCWF would also relink with the USFWS, Oregon, the USA for the technology transfer and to develop new technology in wildlife crime investigation.

### **Role of other Centres working for Wildlife Crime analysis**

The regional laboratories working in solving the wildlife offense case would transfer an aliquot (part) of the case property as a reference repository of the case that will act as a 'safe

wildlife forensic repository' and standard samples, which can be revalidated at NCWF whenever required. Each laboratory working in the region would primarily establish a 'Species Identification Centre' and 'Report Section' so that the earliest response could be provided to the enforcement team that will avoid the delay in the availability of the forensic report for legal procedure.