A COMPENDIUM OF FIELD SAMPLING TECHNIQUES FOR MONITORING OF VERTEBRATE FAUNA IN INDIAN HIMALAYAN REGION

TRAINING PROGRAMME FOR STAKEHOLDERS on 13th – 14th, February, 2019 at

Darjeeling College, Darjeeling, West Bengal



ZOOLOGICAL SURVEY OF INDIA, KOLKATA MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE GOVERNMENT OF INDIA



Ministry of Environment, Forest & Climate Change





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MONITORING OF VERTEBRATE FAUNA

Himalaya harbours an immense diversity of endemic flora and fauna. Biodiversity of Himalaya along with its variable range of ecosystems holds a large dimension of services to mankind like various ecosystem services, protection of water resources, nutrient storage and recycling, soil formation, pollution breakdown and absorption, contribution to climate stability etc. However, biodiversity in this region is poorly studied. In this context, it is evident that a monitoring protocol is needed to study faunal diversity of Himalayan region. Thus, under National Mission on Himalayan Studies it is envisaged to develop a compendium for forest staff to enhance their capacity for Long Term Monitoring of this rich vertebrate fauna in this region which is under large threat due to anthropogenic destructions, habitat degradation and fragmentation and climate change etc.

1 METHODS FOR SURVEYING VERTEBRATES IN HIMALAYAN REGION

There are different methods for recording data for different groups like mammals, birds, reptiles, amphibians and fishes. Basic type of data is on their presence/ absence and then on their population and demographic structure etc.

1.1 Methods for Surveying Mammals in Himalaya Region

a) Sign survey: Sign survey means recording sign of mammals on the forest trails (one to two km long) along the ridges or small streams covering the elevation gradients of the study areas. During the sign survey, direct sightings, tracks and signs of ungulates, carnivores (Figure 1) and small mammals needs to be recorded.



Figure 1: Snow leopard trail (Image source: Google image)

Den sites of carnivores are also to be taken into account for recording their presence. The sign includes pugmarks of felids, canids, primates and ursids and hoof marks of ungulates. The other sign includes scratch and scrape marks on trees and the trails and pellets, scats and faecal matter etc. Direct sightings of mammals during sign survey also to be recorded along with GPS location, habitat types and other special observations, if any.

b) Trail sampling: After the sign survey, several (at least three in each 500 m elevation difference covering each aspect e.g., North, south, east, west) trails has to be selected for survey. Direct sightings of mammals (particularly primates, ungulates and small mammals) will be recorded. Number of individuals, sighting distance and angle and the adjacent habitat features will be recorded along with the geo-referenced location of the sighting. Encounter of pellets or scats or any other signs of mammals will also be recorded (Figure 2).



Figure 2: Trail sampling, sighting angle and distance from the animal needs to be recorded



Figure 3: Transect sampling; the key measurement is the perpendicular distance (x). If the sighting distance (r) is easier to record in the field, the sighting angle (θ) must also be measured. The perpendicular distance x = r sin θ . Note that not all individuals need to be seen for this method to work.

However, when flat area is available straight transect of 2 km will be laid to record abundance of mammals (Figure 3). Sighting angle and distance from the observer data will be recorded same as in trail sampling.

c) Scanning: Scanning from vantage points will be carried out for open slope dwelling mountain ungulates such as Himalayan tahr, blue sheep and for goral in mid-elevation zones. Scanning an open meadow/ cliff will be carried out using spotting scopes (Figure 5) or binoculars and sighting of ungulates will be recorded (Figure 4). Number of individuals, age, sex and other demographic parameters of a group will be recorded. The habitat features will also be recorded as observed from the distance and/or if possible by visiting the areas when the group is not there.



Figure 4: Scanning for mammals using binoculars (Image source: Google images)



Figure 5: Scanning for mammals using spottingscope (Image source: Google images)

d) Camera trapping: Camera trapping for carnivores and elusive forest ungulates such as musk deer and serow may be carried out following a grid structure. The results of sign survey and trail sampling are used to select the camera location in each grid, and information on the habitat and climatic variables around the camera location may be collected (Figure 6).



Figure 6: Placing camera traps on the trail (Image source: Google images)



Figure 7: Camera trap picture of snow leopard

Cameras are placed using double flanking design with two units at a particular location facing each other and standard monitoring protocols for mammals using camera traps in mountains are followed.



Figure 8: Sherman traps that are used to capture small mammals (Image source: Google images)

e) Physical trapping: Small mammals particularly rodents, pika and shrews can be physically trapped using Sherman traps and pitfall traps (Figure 8). Baited traps have to be placed in a systematic manner, following a web-like design.

f) Opportunistic records: Mammal species presence also needs to be documented wherever found other than the standard sampling (Figure 9). It means accidental sightings/ records also to be documented along with all necessary information like GPS location, habitat, time etc. Special remarks on behaviour may also be noted down, if differs from the general.



Figure 9: A Himalayan flying squirrel: an opportunistic record most of the time (Image source: Google images)

1.2 Methodology for Threatened Birds in Himalayan Region

a) Spot-mapping: Spot-mapping (Ralph et al. 1993) is carried out in a 1 ha plot (200 m x 200 m plot) at every 500 m interval on a trail selected for sampling in a study site. Spot-mapping is be targeted for the threatened birds in forest and open habitats as this is based on the territorial behavior of the birds (Ralph et al. 1993).

b) Variable radius point count: Along the elevation gradient, variable radius point count (Bibby et al. 1992) is carried out to detect species distribution and community composition at every 200 m interval on the selected trail for sampling in a particular study site (Figure 10). Birds are be counted for 10 minutes duration and the sighting distance (at which the individual will be first observed) is recorded using range finder.

c) Call count: Call count (Gaston, 1980) is used for galliformes, particularly pheasants which call distinctively (only male) during the breeding season (March – May) as part of display and territory defence. Call count for pheasants may be carried out only in March – May, both morning and evening sessions, following the similar framework of variable radius point count.



Figure 10: Variable radius point counts is a method to record birds abundance based on the visibility in the habitat

d) **Scanning:** Scanning from vantage points is used to detect and quantify the raptors. Scanning is done using a spotting scope/binocular, and if nest of any raptor species can be identified then nest monitoring can also be tried.

e) **Trail sampling:** Trails of 1 to 1.5 km length are selected to conduct trail sampling to detect the presence of galliformes. Camera trapping can be carried out to detect the presence of galliformes in the study area.

f) **Opportunistic records:** Records of bird species presence and abundance before and after sampling period is also documented and daily logs are maintained where information on species, number, timing, habitat and observations on behavior is recorded.

1.3 Methodology for Threatened Herpetofauna in Himalayan Region



Standard methods are to be use detect species and record herpetofauna presence/abundance (Table 1). Nocturnal stream Visual Encounter Surveys (NVES) – it involves three, one hour Visual Encounter Surveys (VES), formalized by Crump and Scott (1994), at each of the sites. Each site is a 100 m marked segment along stream

courses. Previous studies have shown that frogs aggregate along watercourses and this method yields substantial detections of amphibians. Hence, all the sampling effort for amphibians is concentrated along the stream courses. The sampling involves two people walking abreast with torches along the stream course looking for amphibians. Such surveys are carried out post sunset between 18:30 - 21:00 hrs. Similarly, in the high elevation Himalayan lakes, the same methods as mentioned above are also followed to detect amphibians and reptiles. Diurnal VES (DVES) in each elevation zone (ca. 200 m bins), two persons search four to six belt transects (50 m x 2 m) for

amphibians and reptiles by raking the leaf litter, turning logs and rocks, peeling bark and by opening fallen logs. This technique targets litter dwelling herpetofauna. The starting point of each belt is positioned randomly between the edge of the water and 50 m up-slope in the riparian zone. In each belt, altitude, microhabitat features including soil pH, moisture and temperature are measured using a soil pH and moisture tester and a soil thermometer, respectively. Litter depth is measured with a metal ruler from the top of the soil to the top of the leaf litter. A canopy densiometer is used for measuring canopy cover. These microhabitat features are recorded at every 10 m interval along the belt. All belts are searched for herpetofauna from 09:00 hrs to 14:00 hrs.

Figure 11: A Himalayan agama basking in sunlight (Image source: Google images)

Method	Snakes	Lizards	Crocodilians	Turtles and tortoises
Hand capturing	*	*	*	*
Noosing		+		
Trapping	?	+	?	+
Marking individuals	*	*	*	*

Table 1: A summary of methods used for recording various reptile groups

* Method usually applicable, + method often applicable, ? method sometimes applicable

1.4 Methodology for Threatened Fishes in Himalayan Region

Sampling for fishes in a study site can be carried out over a 500 m stretch at every 5 km (except for 1st and 2nd order streams as they could vary in length). Sampling is done in all orders of streams. Seasonal sampling may also be conducted, (i.e. over 3 seasons - winter, summer and monsoon (with limitation). Sampling for fish species can be conducted at each 500 m reach; and fish diversity and abundance is assessed based on catch per unit effort (CPUE) and by underwater observation (if the conditions permit). Various fishing gears are used, (i.e., monofilamentous gill nets, cast nets, drag nets and scoop nets). Fish species recorded are photographed and confirmed using standard protocols. Standard body length (mm) and weight (g) of the fishes is measured for analyzing growth and condition factor. Current conservation status of the fish species adopted from the IUCN Red List (2014) is also maintained in records. Physio-chemical properties of water also be recorded at each site, (i.e. water temperature, conductivity, pH, total dissolved solids (TDS), dissolved oxygen (DO), alkalinity, hardness, nitrogen, and phosphorus).

1.5. Wildlife crime, tools, and wildlife forensics

Wildlife crime can be defined as taking, possession, trade or movement, processing, consumption of wild animals and plants or their derivatives in contravention of any international, regional, or national legislation(s). Infliction of cruelty to and the persecution of wild animals, both free-living and captive are also at times added to this definition. Though wild animals and plants are the victims of any wildlife crime at first place, it has got a cascading effect on the ecosystem of particular country or region. It is clear from the constitutional mandate that wildlife is our national wealth. Therefore, the country is also a victim of wildlife crimes. As illegal wildlife trade involves huge amounts of money, it is, also to be treated as a serious economic offence. Hunting and illegal trade are the major wildlife offences. All other offences like preparation, possession, transportation, processing etc are ancillary offences. That being so, wildlife offenders can be divided into two groups - (a) the poachers or hunters who kill or capture wild animals or collect wild plants and (b) persons buying hunted and/or captured animals or its body parts or derivatives or collected plants or its parts or derivatives, for own consumption or for trade. The traders of wildlife materials constitute the most influential group of wildlife offenders and they operate in highly organised manner. Networks of such organized.

1.5.1. Wildlife Forensics

With the increased rate of illegal wildlife trade can cause a species to reach a point where its survival is uncertain. In fact, illegal wildlife trade is one of the main reasons that many species are endangered. Illegal hunting of wildlife is a serious worldwide concern for wildlife management. The ornamental body part and other traditional uses of the body part of wildlife are the major challenge in control of wildlife poaching. Moreover, the effective identification of the species from available biological material is a key parameter in fixing the accurate wildlife offence. Hence, wildlife forensics is a vital branch of forensics, which deals with the identification of the species from biological remnant. This science has evolved very rapidly and has enormous scope in biodiversity conservation. When intact morphological feature are available in the seizer, the examination of the morphological character of the sized biological material is one of the rapid mode of the delivering the report. The comparison of hair morphometry and morphological osteology are the important scientific protocol for identification of the source of the origin of unknown sample. Where the morphological examination has some limitation and fail to identify the species. At this space, DNA based techniques have broadly used to identify the species, source of the poached animals and body parts from the diverse range of the animals.

Some key procedure to deal with the wildlife crime and wildlife forensics:

a. Crime Scene investigation: In wildlife crime scene work, as in other areas of forensic endeavour, it is vital that the investigations are meticulous, that detailed records are kept and that a proper 'chain of custody' (the continuity of evidence) is maintained for each item of evidence.

ANNEXURE – XII Flow Chart on Wl Crime Investigation Process

Wild Life (Protection) Act, 1972, was enacted to prevent, control and conserve biodiversity of the country. It extends to the whole of India except J & K.



(B)



Person arrested and things seized are to be produced before the magistrate under intimation to the Chief Wildlife Warden of the State or officer authorized by him under Section 50(4) of the WLP Act





Source: Wildlife Crime Control Bureau

- **b. Documentation:** Each seizure should be maintained with following check list for preparing Wildlife Offence Report (WLOR):
- i. Every WLOR should be assigned a serial number maintained year wise eg: WLORNo. 1/2012 of _____, dated_____,Forest Range, Division/TRs)
- ii. Date and time of receipt of information at the Forest Range or detection of the offence should be mentioned in the WLOR.
- iii. WLOR should be prepared only on the standard format.
- iv. All columns in the WLOR should be duly filled.
- v. Correct Sections of law should be applied.
- vi. Address, present and permanent, parentage, age, sex etc of all the known accused/suspects are to be mentioned in the WLOR.
- vii. If the accused/suspects are not known, the same should be mentioned in the WLOR.
- viii. In case of involvement of unknown accused, the words "and other unknown accused" should be mentioned after the list of the known accused.
- ix. Information part of the WLOR should be in simple language and without any ambiguity. It should provide sufficient grounds for proceeding against the accused.
- x. Details of the wildlife involved, both common name and scientific name, Schedule under which the animal is listed in the WL (Protection) Act, quantum of punishment for the offence etc., should be incorporated in the information part.
- xi. Name and rank of the Investigating Officer, officer who made the seizure and the officer who wrote the WLOR should be mentioned in the WLOR.
- xii. Delay in lodging of the WLOR should be avoided. In exceptional circumstances, if delay occurs, reasons for the same should be explained in the WLOR.
- xiii. Copy of the WLOR should be sent to the immediate supervisory officer and CWLW or officer authorised by him, without delay. This is needed so that immediate supervisory officer is aware of the commission of the offense under his jurisdiction and also enables him to advise/ monitor the progress in its investigation.
 - **c. Sample collection:** Sample collection is important part to solved the wildlife offence cases and should be collect and preserved according to the flow chart

COLLECTION OF TISSUE / SKIN / BLOOD / SCAT SAMPLES



d. Samples forwarding for the Laboratory analysis:

Based on the recommendation of the made by Wildlife Crime Control Bureau Ministry of Environment and Forests and Climate Change, Government of India. Seizures can be sent to for further identification of species source of the individual and other analysis to different authorized Institute.

Sl. No.	Name and address of the Institute	Facilities available
1	Zoological Survey of India PraniVigyanBhawan, M- Block New Alipore, Kolkata - 700053 Director - 033- 24986820 FAX: 033-24006893 FAX: Head of Office - 033-24008595 EPBAX - 033-24006892 / 0901 / 6092 / 0646.	Identification of all species of animals. Identification of blood, tissue, hair, bones, nails, claws, teeth other body parts and derivatives.
2	Wildlife Institute of India Post Box No. 18,Chandrabani Dehradun - 248 001 E- mail: <u>wii@giasdl01.vsnl.net.in</u> Phone 0135-640112 – 115 Fax # 91-135-640117	Identification of selected species (large animals). Identification of all species of animals. Identification of blood, tissue, hair, bones, nails, claws, teeth other body parts and derivatives.
3	Botanical Survey of India CGO Complex, 3 rd MSO Building Block F (5 th & 6 th Floor), DF Block, Sector I Salt Lake City, Kolkata - 700 064 Phone: 033 23344963 (Director) 033 23218991, 23218992 Fax : 033 23346040, 23215631	Identification of plant species
4	Centre for Cellular & Molecular Biology Uppal Road, Habsiguda, Hyderabad - 500 007, Andhra Pradesh Telephone: 040 27160222-31 : 040 27160232-41 Fax: 040 27160591, 27160311	DNA profiling
5.	Wood Properties and Uses Division Institute of Wood Science & Technology Malleswaram, Bangalore – 560 003 Tel: 080 22190100, 080 22190200 FAX : 080 23340529.	Identification of Timber and wood properties.

6.	Gujarat Forensic Science University, Near Police Bhawan, Sector 18 – A, Gandhinagar, Gujarat. Phone – 079 – 2325650 - 079 - 2325649	Various capacity building courses on Forensic Science including WL Forensics.
7.	State Forensic Science Laboratories (SFSL). Almost all States in the country have their SFSLs under respective Home Departments, for forensic examinations of the samples in conventional crimes. These Laboratories can be approached for Wildlife Forensic Tests as well.	Toxicological examinations. Other facilities available may vary from State to State; hence, it may be checked at the local level.

1.6. <u>STANDARD OPERATING PROCEDURE FOR DISPOSING THE TIGER/</u> <u>LEOPARD/ AND OTHER SECHEDULE-1 ANIMALS</u>

In the 2013, Ministry of environment and forests government of India, National tiger conservation authority has developed a developed a standard operating procedure (SOP)for the disposal of body parts of tiger leopard and other Scheduled-I species in the all Tiger Reserved, Protected and Non protected areas with the presence of the responsible persons of respected forest areas. The Copy of the SOP is attached below:

Standard operating procedure for disposing the tiger/ leopardcarcass/body parts

1. **Title :** Standard Operating Procedure for disposing the tiger/ leopard carcass/ body parts.

- 2. **Subject:** Tiger death/seizure of body parts
- 3. **Reference:** Advisories of the Ministry of Environment & Forests/ Project Tiger/ NTCA on the subject (Advisory No: 1-60/89-WL I dated 04-11-1994 from the Addl. IGF (wildlife) Ministry of Environment and Forests)
- 4. **Purpose:** To ensure that the carcass/ body parts of tiger/ leopard are disposed of in a transparent manner to prevent any pilferage for illegal market.
- 5. Short summary: This Standard Operating Procedure (SOP) provides the basic, minimum steps, which are required to be taken at the field, level (tiger reserve or elsewhere) for disposing of tiger/leopard carcass/ body parts where carcass is available or the body parts have been seized.

6. **Scope:** The SOP applies to all forest field formations including tiger reserves besides other areas where the incident has occurred.

7. **Responsibilities:** The Field Director would be responsible in the case of a tiger reserve. For a protected area (National Park / Wildlife Sanctuary), the concerned protected area manager would be responsible. In the case of other areas (revenue land/conservation reserve/community reserve/village/township) the Wildlife Warden, as per the Wildlife (Protection) Act, 1972, or Divisional Forest Officer/ Deputy Conservator of Forests (under whose jurisdiction the area falls), would be responsible. The overall responsibility at the State level would rest with the Chief Wildlife Warden of the concerned State.

8. Detailed instructions for the procedure to be followed for disposing of the tiger/ leopard carcass/ body part(s) where body part(s) / carcass is available

- (i) At Scene of crime (SoC) / incident: when carcass or parts available:
- Follow the SOP issued by the NTCA on dealing with the tiger mortality/ seizure of body parts.
- Dispose of the carcass by incineration in the presence of the Field Director or an officer not below the rank of the Conservator of Forests besides the Post Mortem

(PM) Team having representation from the civil society institution

 \succ While incinerating the carcass, the sequence must be photographed and video recorded.

- > Before leaving the site, ensure that the whole carcass including bones are fully burnt.
- After ensuring the complete incineration of the carcass, prepare a 'Panchnama (Memo) on disposal of the carcass, duly signed by the PM Team and officer incharge, and send a final report (Annexure-I) to the CWLW under intimation to the NTCA with supporting photographs/documents.

(ii) In case of seizure of body parts (Skin – dry or fresh/ bones/meat or other body parts):

- Follow the SOP issued by the NTCA on dealing with the tiger mortality/ seizure of body parts.
- In case of seizures of body parts, the same may be required as evidence for prosecution in the courts of law and hence in such situations do not dispose the same till the orders of the concerned court for such disposal are obtained.
- Once orders have been obtained by the competent authority, dispose of the body part (s) by incineration in the presence of the Field Director or an officer not below the rank of the Conservator of Forests besides the Team (same as prescribed for the Post Mortem) having representation from a civil society institution
- While incinerating the body parts, the sequence must be photographed and video recorded.
- > Before leaving the site, ensure that the whole/ all body parts are fully burnt.
- After ensuring the complete incineration of the body part (s), prepare a 'Panchnama' (Memo) on disposal of the body part (s), duly signed by the said Team and officer incharge, and send a final report (Annexure-I) to the CWLW under intimation to the NTCA with supporting photographs/documents.

(iii) In cases of seized stock of wildlife trophies obtained during seizure/confiscation:

- All seized stock of wildlife trophies, where no case is pending in a Court of law, should be destroyed through incineration in the presence of the Field Director or an officer not below the rank of the Conservator of Forests besides a team (same as prescribed for the post mortem) having representation from a civil society institution.
- While incinerating the body parts, the sequence must be photographed and video recorded.
- > Before leaving the site, ensure that the whole/ all body parts are fully burnt.
- After ensuring the complete incineration of the body part (s), prepare a 'Panchnama' (Memo) on disposal of the body part (s), duly signed by the said Team and officer incharge, and send a final report (Annexure-I) to the CWLW under intimation to the NTCA with supporting photographs/documents.
- The provisions of the Wildlife (Protection) Act, 1972 must be followed before destroying such stock.

ANNEXURE - 1

FINAL REPORT

To be submitted for disposal of each case of tiger/ leopard carcass/ body part (s)/ trophy

1	Name of Office	
2	Location details of the mortality: description, GPS, Compartment /Block/Range /Sub-Division/Forest Division/ Tiger Reserve or place/time	
3	Date of Mortality/ carcass report	
4	In case of seizure of body parts details indicating the status of carcass or seized material	
5	Details of the person (staff/ Others) who reported the incident first: name/address/ contact details/ telephone numbers/e-mail	
6	For carcass: Date, time and Place of Post Mortem (PM)	
7	Details of PM Team (names/designation/ address/ contact)	
8	Details of the missing body parts, if any	
9	Cause of death as ascertained after the PM	
11	Colour photographs of the carcass/ body part (s)- (close ups, indicating injury, if any); details of comparison with camera trap photo data base	
12	Cause of death: Natural/ Poaching	
13	 In case of poaching/ seizure of body parts: i. further action taken/proposed: ii. attach colour photographs of the seized body part/s iii. attach certification regarding species identity (for bone pieces/ meat/ other body parts which are not physically 	

	identifiable) iv. action taken with respect to offenders/ suspects (if arrested) v. status of Case/ complaint: number, date of filing the complaint, Sections of law, name of Court where filed	
14	Panchnama/memo of disposal of carcass/ body part (s)	Enclosed/ not-enclosed
15	Remarks if any	
16	Signature of the Officer In-charge with name, designation, date and stamp	

SOP prepared with inputs from Field Officers of Tiger Reserves)

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