

# *STANDARDIZATION OF RECORDS KEEPING IN INDIAN ZOOS AND MARKING ANIMALS FOR IDENTIFICATION*



**Padmaja Naidu Himalayan Zoological Park, Darjeeling  
West Bengal-734101, India**



## THE PROJECT IN BRIEF

1. **Name of the Project:** “Standardization of Records Keeping in Indian Zoos and Marking Animals for Identification”
2. **Name of the Zoo/Organization:** Padmaja Naidu Himalayan Zoological Park, Darjeeling
3. **Project Leader:** Shri A.K. Jha, IFS, Director, PNHZP
4. **Duration of the Project:** From 22/09/2007- 21/09/2009
5. **Location of the Project:** Padmaja Naidu Himalayan Zoological Park, Darjeeling
6. **Region/ State:** West Bengal
7. **Closest main city:** Darjeeling
8. **Principal Investigator:** Mr. A.K. Jha
9. **Research Associate:** Miss Barkha Subba
10. **Period to be spent on the project:** 48 hrs/week for two years  
( day/month/year)
11. **Total cost of the Project:** Rs 4,03800.00

## 12. SIGNATURE

Director  
PNHZP,  
Darjeeling

Project Leader

Research Scholar

Signature  
Date  
Seal

Signature  
Date

Signature  
Date

## Acknowledgements

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Director  
PNHZ Park,  
Darjeeling, W.B.

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*Disclaimer:*

This report is prepared by the Padmaja Naidu Zoological Park Darjeeling and views expressed in the final report may not necessary reflect those of the Central Zoo Authority. The Padmaja Naidu Zoological Park may be contacted for more information or clarification on the content described in the report.

## **Executive Summary**

The present report focuses on the different methods for keeping records of animals in Indian zoos and various marking methods for identification of individual animals. In Indian zoos most of the records like basic inventories- births, deaths, acquisition and disposition and the medical reports are maintained manually hence the ability to retrieve information is highly reduced. This paper outlines the standard method for manual/electronic record keeping for all the Indian zoos. This consistency in recording data facilitates understanding of another institutions records and if maintained properly will greatly enhance the incorporation of data into ARKS software, and later on into SPARKS and MEDARKS. For effective records keeping recognition of individual animal is of utmost importance so, in this report I have also reviewed various marking techniques for different classes of animals.

## **Aims and Objectives**

- To standardize the records keeping system in Indian Zoos on the lines of records being maintained Internationally
- To recommend methods for marking of different classes of animals for identification.

## **Methods**

Following methods were used

1. Literature survey
2. Questionnaire survey
3. Visit to selected Indian zoos for collection of information
4. Direct interview with the zoo personnel
5. Hands on training on ARKS software

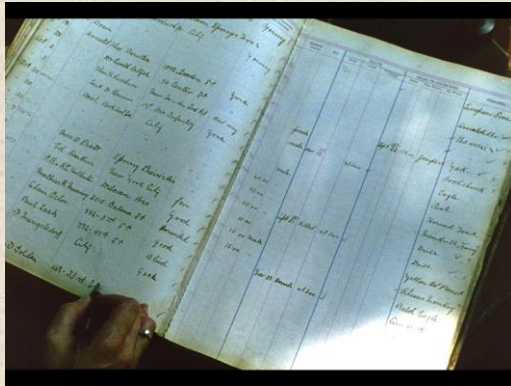
## **1. INTRODUCTION**

Modern zoos are evolving institutions in respect to the conservation of biological diversity. It is no longer only exhibit and education centre for wildlife but is fast becoming conservation centre and a base for reintroduction of wildlife throughout the world. India is a country with a vast faunal diversity. Conservation of the diverse forms of life has become one of the major challenges to our country. An increasing proportion of the total number of animal species in Indian zoos is made up of individuals belonging to endangered species. Keeping records and identification of these animals forms a basis for the conservation planning and management of these species. Record keeping begins with individual animal identification. Maintaining accurate records, providing accurate medical care, applying genetic principles in breeding plans, and analyzing captive population dynamics depend on accurately and consistently recognizing individual animals.



The objective of this paper is to provide comprehensive review of the different techniques for marking different species of animals and their subsequent record keeping. I hope this paper will act as a guide for the selection of effective marking system for animal identification and also an effective way of keeping records of individual animal.

## History and Evolution of Records Keeping



**Historically:**  
**Basic inventory – births, deaths, acquisitions and dispositions kept in log books**

**Little ability to retrieve information**

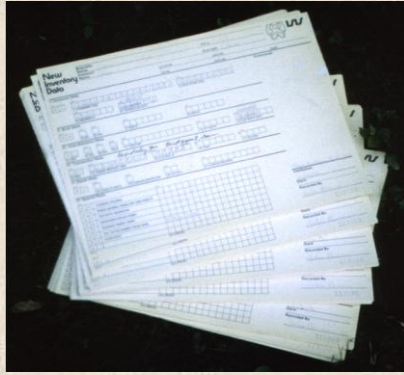


Cooperative animal records keeping is a relatively new process evolving into a global collection of captive animal information. Few animal collections kept animal records when the first zoos were established. Records were limited to basic inventory information: the numbers of animals that came in or went out, died or were born. This is a Milwaukee County Zoo collection log dating back to the 1800s.

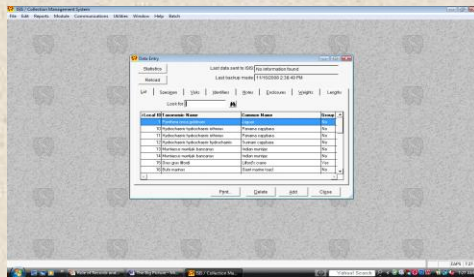
Rarely were records kept on individual animals. Written records were kept in logbooks and daily reports, and were primarily for archival purposes rather than applied animal management use.

Paper records were not conducive to information retrieval largely due to inconvenience - storage, sorting, and collating.





**ISIS started in 1973  
with 51 zoos in 2 continents -  
used paper records**



**Computerized ARKS in 1985**

**Now 735 institution  
members  
in 73 countries**

Advances in technology improved records-keeping procedures. ISIS was initiated in 1973 with fifty-one zoos in North America and Europe initially joining the response to the invitation to participate. ISIS now has 735 member institutions in 73 countries. Originally, paper forms were filled out on each specimen, which were then sent to ISIS for key-punch entry. All information was by and if you didn't have the key the records would mean nothing to you.

In 1985, the initial version of the Animal Records Keeping System (ARKS) software was made available to members so that each institutional representative could enter their own institutional data and send it in to the central database. The ARKS program has undergone a number of major revisions and is now in its fourth version. Development of the ISIS website as well as the Specimen Reference DVD that contains the information in the central database, it is now possible to access worldwide information on any animal in the system worldwide, facilitating the management of captive species as a global cooperative effort.

On the horizon is the new Zoological Information Management System (ZIMS) (A.Miller 2009)

## **2. PART 1- RECORD KEEPING IN INDIAN ZOOS**

*Keeping records enhances the pleasure of the search.*

Records Keeping of animals in a zoo refers to maintaining details of each animal in a systematic way so the information can be easily retrieved as and when required.

Today zoos and aquariums are leaders in the effort to breed endangered animals. Aquariums and zoos are the “gene bank” of the web of life. Some species have been rescued from extinction, bred in zoos and returned to the wild, for example, the Black Footed Ferret, Californian Condor, Przewalski’s Horse, Red wolf, Micronesian Kingfisher and Arabian Oryx. This work needs a lot of scientific expertise, genetic research, co- ordination, co-operation – and all of this relies on collecting and exchanging accurate animal data. Breeding and population management rely on knowing information about animals across the region, especially pedigree history and demography (births and deaths). Accurate record keeping is essential for managing endangered species in a single collection or across several collections.

The CZA (Central Zoo Authority) of India has sponsored membership of 57 zoos and 4 Institutions to ISIS (International Species Information System) from 1<sup>st</sup> Jan 2009. One of the software produced by ISIS, ARKS (Animal Record Keeping System) is the globally accepted standard for zoos. The CZA has already organized hands on training on ARKS for the record keepers of the sponsored zoos and Institutions.

This paper outlines the standard method for manual/electronic record keeping for all the Indian zoos. This consistency in recording data facilitates understanding of another institutions records and if maintained properly will greatly enhance the incorporation of data into ARKS software, and later on into SPARKS and MEDARKS.

### **2.1 TYPES OF RECORDS**

Animal records contain the information that is used to help provide the best possible care for these animal populations and assist with scientific genetic management to ensure a healthy population for the future.

#### **A. ACCESSION LOG/ STOCK OR INVENTORY REGISTER**

An accession log or stock register keeps track of all births, acquisitions, deaths and dispositions. Each zoo should maintain a stock register preferably a large bound ledger. The register will include the Locall ID # that you assigned, the species (both common and scientific name), the sex, the date, the sending Institution, the reason for accessioning (either birth or acquisition) and the terma. A complete log will also keep track of Deaths and Dispositions as they occur. An Accession log is a quick and easy reference for your collection and should be kept updated in a timely fashion.

- **ACCESSION NUMBER**

Accession No.= Local ID # = Specimen # is the number you provide to your animal for individual logical identification. There are many ways of assigning a Local ID# to the animals. Some authors have suggested the use of 8 character long Local ID. Which gives added information about the class, year of acquisition and the order of arrival of the animal. But as the ARKS system accepts only 6 characters for Local ID this method cannot be used.

The best way to assign a Local ID # to your collection is to keep it simple, just start at “1” and go from there. An accession number should not be used to indicate anything about the animal. You will notice some of the animals are coded, for e.g. 98MO34 to indicate that the animal was received in 1998, it was a mammal (M) and it was the 34<sup>th</sup> mammal received in that year. Coding by years fell apart when the year 2000 came around because then you would have to start with leading zeroes which is discouraged because many people disregard the leading zeroes in data entry.

#### **When to give an accession number to an animal?**

- Every animal in your zoo gets a unique accession number
- You choose this number
- You accession an animal

A. When it is born

Mammals :

- ✓ Accession all births, premature births, still births and abortions
- ✓ For stillbirths and abortions, etc., enter birth and death on the same day. It is very important to keep accurate records of these events – they can have huge effects on successful breeding programs.

Birds:

- ✓ Accession all chicks on the day they hatch

Reptiles and Amphibians

- ✓ Accession all reptiles and amphibians when they hatch (do not wait for metamorphosis).

Fish

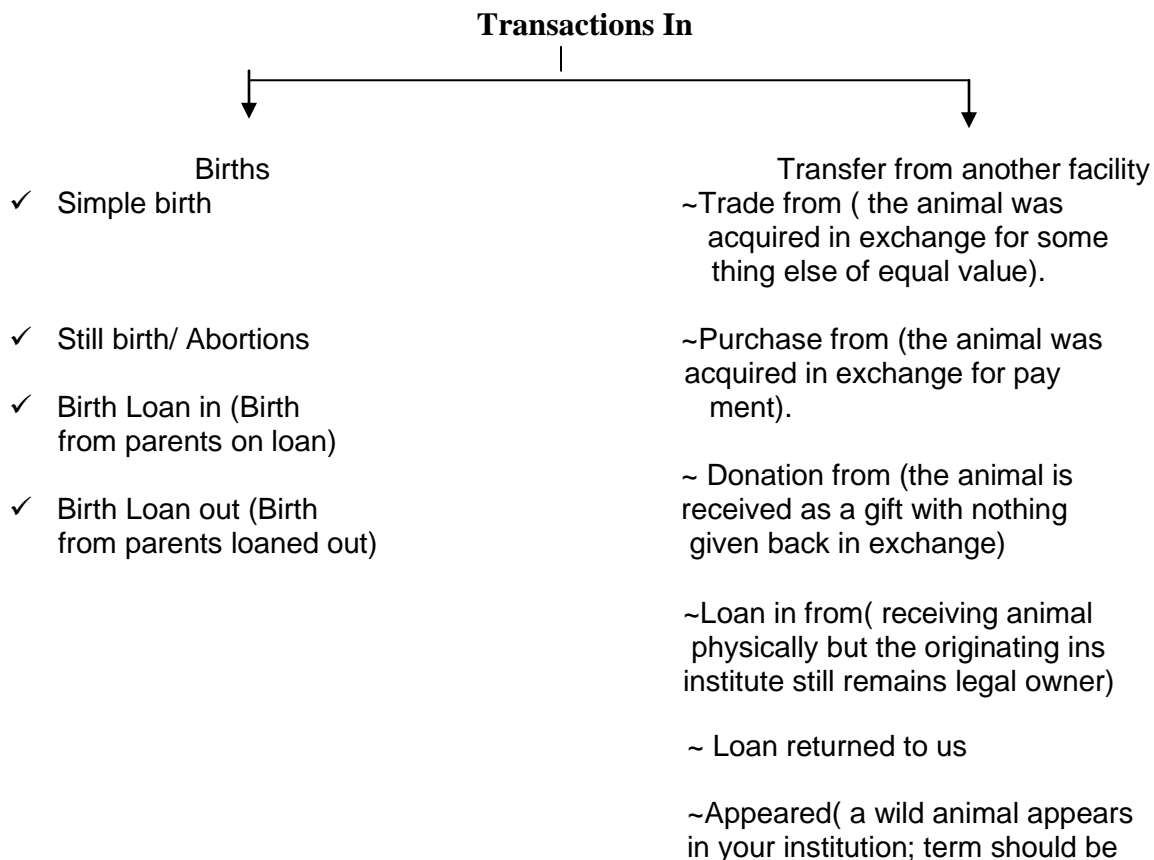
- ✓ Viviparous – accession when born
- ✓ Larval stage – accession when recognizable as fish

- B. When you get an animal from the wild
- C. When you get an animal from another Institution, you will give it your own accession number (even though the other zoo has given it an accession number as well).
- D. When you get an animal from another Institution, you must contact them and tell them the accession number you have given it. They will enter your number as part of their records. You will enter the number as part of your records.
- E. Both zoos will have both numbers.

Accession number must not be duplicated within an institution, for e.g. if a lion is given an accession number 50 in your zoo it should stay the same during its lifetime in that zoo. This number cannot be allotted to any other individual even after its death or transfer. An individual can have several identifying numbers during its lifetime if it is transferred very often from one institution to other. It will have different accession number at each institution where it was held.

## • TRANSACTIONS

Transactions record animals coming into, and going out of, your collection.



used only if you decide to add the animal to your collection)

~Term Free Acquisition (there are no terms to the transaction)

~ Wild Caught (Animal that have been collected from the wild under license, permit or from a free ranging state “ex-situ” with the specific purpose, (e.g. Captive breeding program ) of being added to the institution’s collection)

~ Recapture from wild (Retrieval of an animal previously released or escaped to the wild)

~ Retrieval of theft (Stolen animal is recovered).

### Transactions Out



#### Death

- ~ Simple Death

- ~ Death in Transit

- ~ Traded To (animal sent to another institution in exchange for something else of equal value)

- ~ Sale To

- ~ Donation To

- ~ Loan out to

- ~ Loan Return To

- ~ Theft

- ~ Escape To Wild (Animal leaves an institutions collection and unintentionally ends up in th wild)

- ~ Release to Wild (animal is intentionally released from captivity into the wild)

- ~ Term Free Disposition (there are no terms to the transaction)

- ~ Disappeared (animal has gone missing from its enclosure and there is no indication how they left the enclosure)

- **DEACCESSION** – The process by which a specimen is permanently removed from the collection due to death or title transfer, and its record file closed and archived (files are never discarded)
- **TO ARCHIVE** – to move non –current (inactive) files to a safe storage place where they may be consulted as necessary.

The accession log should be a large bounded ledger so that it cannot be misplaced. If possible individual ledger should be maintained for each class of animal. Otherwise one ledger with different sections assigned to each class of animal. All pages of the ledger should have printed format.

**The sample of the Accession Log with data from Darjeeling zoo is given below;**

Local ID #	Common Name & Scientific Name	Sex	Acquisition		Disposition	
			Date	Institution Terms	Date	Institution Terms
1	Snow Leopard (Uncia uncia)	M	19-Mar-86	HELSINKI Donation	17-Jul-93	DARJEELIN Death
2	Goral Naemorhaedus goral	F	01-Apr-86	NAINITAL Trade	01-Dec-90	DARJEELIN Death
3	Red Panda (Ailurus fulgens)	F	25-Jun-86	Wild Caught	01-Apr-90	GANGTOK Traded to
4	.....	.	.....	.....	.....	.....
5	.....	.	.....	.....	.....	.....
6	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....



Thus an Accession Log/ Stock Register is a quick and easy reference for your collection and should be kept updated in a timely fashion. The accession ID#/ Local ID# must be on all documents.

Apart from the stock register each zoo should maintain a species wise Inventory. Like the stock register an Inventory should be a bound ledger and divided into different sections for different classes of animals.

### Recommended Inventory report

Sl. No.	Common & Scientific name	Local ID #	Opening Stock as on				Births			Acquisitions			Disposals			Death			Closing Stock as on			
Bird			M	F	U	T	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	T
1																						
2																						
.....																						
Total Birds																						
Mammal																						
1																						
2																						
.....																						
Total Mammal																						
Reptile/ Amphibians																						
1																						
2																						
.....																						
Total Reptiles/ Amphibians																						
Invertebrate																						
1																						
2																						
.....																						
Total Invertebrate																						
Total Animals																						

## **B. KEEPER'S DIARY**

Most of the zoos in India maintain a Keeper's diary in which the keeper's note down the activities of the animal like diet change, quantity of leftover feed, medical observation (treatment), behavioral observation (estrus, mating, grooming etc), enrichment, birth, hatching, weighing, death, shifting of animal to another enclosure within the zoo, marking of animals, export and import of the animals.

Each animal section/ beat should maintain a ledger with a printed standard format for keeper's daily report. One Beat/ Section may have several enclosures housing several species of animals. For e.g. in Darjeeling Zoo there are 16 holdings/ enclosures in Beat 1, including 2 aviaries and an aquarium. This Beat has 8 species of pheasants and 4 species of lesser carnivores, 2 keepers are in charge of this Beat. One ledger of keeper's diary is maintained by them.

In this way each section in a zoo can maintain one keeper's diary. The ledger's first page should clarify the keeper about what should be recorded in the Keeper's Diary. The first page along with the CZA's format for Keeper's Dairy which is reproduced below should be used for maintaining keeper's diary.

**The first page of the Keeper's Diary should look like this;**

**KEEPER'S SHOULD NOTE DOWN THE FOLLOWING THINGS IN THEIR DIARY**

1. DIET CHANGE
  2. MEDICAL OBSERVATION (TREATMENT)
  3. BEHAVIORAL OBSERVATION( ONSET OF ESTRUS, MATING, GROOMING, STEREOTYPIC BEHAVIOR)
  4. ENRICHMENT
  5. BIRTH
  6. EGG – LAYING
  7. WEIGHING
  8. HATCHING
  9. DEATH
  10. SHIFTING OF ANIMALS FROM ONE ENCLOSURE TO ANOTHER WITHIN THE ZOO
  11. MARKING OF ANIMALS
  12. EXPORT AND IMPORT OF THE ANIMALS
- In case nothing happens in a day it should be recorded saying – Nothing to report.

Name of the Zoo- Keeper \_\_\_\_\_

Section/Beat \_\_\_\_\_

Sl. No.	Date	Enclosure	Species/ House Name	Observation

Keeper's Signature

Signature of the Animal Supervisor

Comments and signature of Director/Dy. Director/S.O./ V.O. (when visiting)

### **C. DAILY REPORT**

The animal supervisor/ curator of the zoo summarizes the daily record from the Keeper's Diary from each Beat for circulating it in other departments of the zoo and the Director and finally the report comes back to the Research Department/ Records Keeper where the Biologist/ Records keeper records it in individual animal History Sheet/ ARKS software. For the sake of simplicity and convenience CZA's format for the Daily Report should be used for reporting the details happening in all the animal sections of the zoo.

If one sheet is not enough for reporting all the events then two sheets of daily report may be used.

## Recommended Daily Report with fictitious data

Zoological Park

Daily Report

Day & Date \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

Sl. No.	Section/Beat	Species & House Name	Observations	Action Taken/required
1.	Beat 1	Red Jungle Fowl	Hatched 6 chicks. All chicks seem to be normal	Feed will be reduced from tomorrow
		H. Monal	Laid 1 egg	
	Beat 2	Red Panda-Gora	Died in the hospital 11a.m.	
		Star Tortoise	Seems to adjust well to the new enclosure. Ate all their feed.	
		Asiatic Black Bear	Refused to come out to the open enclosure	
	Beat 3	Sundari		
	Beat 4	-----	Everything normal	
		Indian Tiger Kaveri	Out of 8kg beef given 4kg rejected. Animal in estrus	
	Beat 5	-----	Everything normal	
	CBC	Snow Leopard Neeta	Gave birth to 3 cubs 5:15pm. Cubs look healthy and normal	
		Red Panda John Sheetal	Weighed – 4.5kg Weighed – 4 kg	

Veterinary

Officer  
In-charge-  
Animal Section  
(signature)

(Vets comments and

Signature

Biologist  
(Biologists comments  
and signature)

Director  
  
(comments and signature)

(Director's

#### D. ANIMAL HISTORY SHEET

It is very important to maintain individual animal history sheet in a zoo. The history sheet is maintained and updated by the zoo biologist/ record keeper. For each animal in the zoo individual history sheet should be maintained. For each species there should be a different file. For e.g. a file for Indian tiger should contain Animal History cards of all the Indian tigers in the zoo collection. Each history card should be followed by at least 30 pages of the observation sheet printed on both sides for recording the daily observation from the daily report.

\_\_\_\_\_ Zoological Park

#### **ANIMAL HISTORY CARD**

Common Name	Scientific Name
Local ID# & House Name	Sex
Distinguishing (Natural) Mark:	Type of Marking Date:
National Studbook No.	Global Studbook No.
<u>Sire</u> National Studbook No. : International Studbook No. : Local ID# :	<u>Dam</u> National Studbook No. : International Studbook No. : Local ID# :
Date of Birth	When and from where acquired
If acquired from another institution its Local ID # in that institution	Date of death or other mode of disposal
Breeding History	Remarks



Note: a) Date of Birth – if the animal is of wild origin then the date of its birth may be estimated and it is extremely important to indicate when dates are estimated.

b) Breeding History- such details like delivery date, gestation period, no. of offsprings, breeding pair can be noted here.

c) Remarks- such details like whether the animal is contracepted or not, if it is whether temporary or permanent, rearing of the animal, whether parent, foster, hand or group reared. If one is unsure about the sire of the animal he/she can note down the most probable sires (any number) in this column.

d) Write out dates e.g. 5 Jul 1992, to avoid confusion.

### **Sample of the Observation Sheet**

Date	Observation

If one history file is not enough for one species, 2 or as required, files may be maintained for the same species marking the File as Indian Tiger History Sheet File1, Indian Tiger History Sheet File2 and so on.

## **E. STUDBOOK RECORDS**

A studbook is a pedigree and a demographic history of a specific group of animals. Studbooks are kept for the rare species in captivity. The main purpose of maintaining studbooks for rare species of animals in captivity is to facilitate the planned breeding of these species. Unless studbooks are kept it is extremely difficult to trace prolonged inbreeding, since the individual identity of the animal is often lost when it is exchanged or sold.

Studbooks may be global/ international, or they may cover a region or a single country.

Global/ International Studbook –	oversee by WAZA
European studbooks –	oversee by EAZA
North American Studbooks –	oversee by AZA
National/ Indian Studbook –	oversee by CZA

Every zoo should keep a studbook register/ printed ledger for its rare species. The National studbook number is allotted by the National studbook holders, and if that particular animal is also listed in the Global Studbook then Global Studbook number will also be provided to it by the Global Studbook holder of that species. If your zoo holds an endangered species listed in global studbook and the National Studbook, you should inform the respective studbook holders whenever there is birth, acquisition, disposal or death of the animal.

### Recommended studbook to be maintained by zoos for endangered species

**Species : Common Name (Scientific Name)**

[illegible]

**Note:** In the Event column such things like, release to the wild, other forms of disposition, acquisition, death etc. may be recorded.

For Sire and Dam ID, National Studbook #/ International Studbook #/ Local ID # along with house name should be given. Always indicate the type of ID# you have recorded.

## **F. MEDICAL RECORDS**

Medical records provide information on the medical history of individual animal maintained at the zoo. The medical records will contain information on the medical problem, preventive medicine, treatments and examinations of an animal. Good veterinary records reduce loss of animals due to disease, by tracking parasites and treatments, by keeping vaccination son schedule, by tracking optimal doses for immobilization drugs and individual animal sensitivities, and by reminding veterinary staff of follow-up work needed. Good veterinary records mean better animal health (Koliyal 1998).

The Veterinary department of the zoo should maintain an individual animal file (at least for endangered species) and for rest of the species and for those species living in groups, Species wise veterinary files must be maintained. The first page of the file should have the animal's History Card which is to be followed by Animal Treatment Sheet(20 pages/ as required), Animal Vaccination Sheet (20 pages/ required), Animal Deworming Sheet( 20 pages/ as required), Animal Tranquilization Sheet (9 pages/ as required). The pages should be printed on both sides.

The Veterinary officer can make a clinical note whenever some treatment is given to the animal.

Whenever there is a post – mortem conducted the copy of p.m. report should be attached to the daily report so that the animal's death and cause of death is properly recorded into animal's history file/ ARKS.

The veterinary department should also maintain Medicine stock register.

The Individual animal file and species should be best kept in different cabinets so it can be easily retrieved for reference and other purpose. Any other report, like the X- ray report, hematological report, genetic report etc. should be stored in the respective animal's cabinet.



Picture1: Cabinets for holding Medical Records of animal

**Following are the recommended samples of Medical records**

**ANIMAL TREATEMNT CARD**

**Species-**

**House Name-**

**Local Id.-**

**Beat No.-**

Date	Symptoms	Treatment	Clinical Note

**ANIMAL VACCINATION CARD**

**Species-**

**House Name-**

**Local Id.-**

**Beat No.-**

Date	Type of Vaccine	Amount	Route	Next Date	Remarks



## STOOL EXAMINATION CARD

Species-

House Name-

Local Id.-

Beat No.-

Date

### PHYSICAL EXAMINATION

Colour:

Consistency:

Worms:

Mucus:

Blood:

### CHEMICAL ANALYSIS

Reaction:

Occult Blood:

Reducing Subt.:

### MICROSCOPIC EXAMINATION

Pus cells:

R.B.C. :

Udigested Starch:

Soap:

Chalco laden crystals:

Yeast Cells:

Ova of :

Others:

**ANIMAL DEWORMING CARD**

**Species-**

**House Name-**

**Local Id.-**

**Beat No.-**

Date	Findings	Medicine Used	Remark

**ANIMAL TRANQUILIZATION CARD**

**Species-**

**House Name-**

**Local Id.-**

**Beat No.-**

Date	Medicine Used	Time at which given	Time showing effect	Time of recovery	Remarks

## Post – Mortem Report

Date

Kind of animal	Scientific Name	Sex	House Name	Age	Size
Weight	& Local ID#				

Time, date and place of death:  
Time of post-mortem examination:

A. Short history of illness, if any:  
B. Organ – wise description of lesions\_\_\_\_\_.

1. Head and Neck.....
  - (a) Skull and Brain
  - (b) Cervical vertebrae
2. Thorax.....
  - (a) Lungs
  - (b) Heart
  - (c) Ribs
3. Abdomen .....
  - (a) Liver
  - (b) Stomach
  - (c) Intestine
  - (d) Kidney
  - (e) Spleen
4. Pelvic girdle .....
  - (a) Uterus and ovaries
  - (b) Bladder
  - (c) Genital Passage
5. Limbs .....
  - (a) Fore limbs
  - (b) Hind limbs
2. Any other special features:
  - i) Biological tests done (if any)
  - ii) Blood
  - iii) Urine
  - iv) Discharges
  - v) Biopsy
3. Opinion (cause of death):
4. List of organs preserved for confirmative tests:  
Sent to:
5. Instruction for disposal
6. Name of officer present during disposal

**Signature.....**

**Place Name.....**

**Designation.....**

Date \_\_\_\_\_

**(Seal)**

## G. DIET CHART

A Diet Chart shows the feed given to animals in the zoo. A separate chart should be prepared for each species and preferably kept in a file. Any changes made in the diet should be noted along with the reason for change.

### Sample of Diet Chart for Red Panda

<b>Total No. of Red Pandas 15</b>	<b>FEED ITEMS</b>	<b>Quantity per individual</b>	<b>Total Quantity per day</b>
	Sweet bun	1piece	15pcs
	Egg	1piece	15pcs
	Banana, apple, papaya and other seasonal fruits	Banana: 2pcs Apple:500gms Others: 200gms	30pcs 7.5 kg 3kg
	Honey	50ml.	750ml
	Milk	500ml	7500ml
	Bamboo leaves	3kgs	45kgs
	Wild fruits, green leaves	Given depending On the availability	

## H. OTHERS

These include files that in some Institution are maintained by the Biologist/ Recordskeeper, but in other facilities may be kept in the curator's or administrative offices. If the original document is in someone else's file, the records keeper will have a copy. These files include:

- Loan agreements – the documents detailing terms and conditions of breeding, exhibit, or study loans.
- Animal Transaction Papers – any of a variety of documents associated with transfers.
- Permits – permit applications, permits issued, letters of authorization, etc. this file includes all permits (or copies of thereof) issued to the Institution, copies of permits specific to individual specimens are also placed in that specimen's file.
- “animals removed” (inactive files, archives) – the complete record files of animals which are no longer part of the collection. These files are stored safely, yet may be referenced easily. It should be noted that no records are discarded when an animal leaves the collection. These records become historic files which can be referenced should the need arise. Although the living animal is no longer at hand, the history of that animal still retains value.
- Other kinds – this list is not all – inclusive and again, copies of items in these files may be found in one or more other files.
  - Correspondence

- Survey/questionnaires
- Keeper Reports
- Weekly/ monthly Reports
- Husbandry letters
- Studbooks
- State and National regulations

## **2.2 Responsibilities of a Records Keeper**

Records- keeper is responsible for

- The recording of all animal transactions and related data
- Assigning local ID numbers and creating record files for new accessions
- The guaranteed security of records by safe – keeping, necessary duplication and computer back-ups, and restricted access for data entry
- Obtaining as much accurate information as possible about specimens and making additions or corrections to records as necessary
- Dispersing information to other appropriate areas of the institution (e.g. veterinary staff, curators, keepers, etc) and to other institutions as required.
- Provide information for surveys and questionnaires, federal/sate/local permits or licenses, studbook and loan updates
- Prepare animal transaction forms
- Prepare reports (e.g. inventory, statistics)
- Act as institution rep representative/ liaison for ISIS
- Maintaining medical or other animal related records
- Assisting in the updating and publication of studbooks
- Maintaining a file of animal related publications.

**The Recognition of Zoo Rules 1992 has recommended the following rules with respect to Records Keeping in Indian zoos.**

### **Maintenance of Records and Submission of Inventory to the Central Zoo Authority :**

1. Every zoo shall keep a record of the birth acquisitions, sales, disposals and deaths of all animals. The inventory of the animals housed in each zoo as on 31st March of every year shall be submitted to the Central Zoo Authority by 30th April of the same year.
2. Every zoo shall also submit a brief summary of the death of animals in the zoo for every financial year, along with the reasons of death identified on the basis of post-mortem reports and other diagnostic tests, by 30th April of the following year.
3. Every zoo shall publish an annual report of the activities of the zoo in respect of each financial Year. The copy of the said annual report shall be made available to the Central Zoo Authority, within two months, after the end of the financial year. The report shall also be made available to the general public at a reasonable cost.

### 3. PART II - MARKING OF ANIMALS FOR IDENTIFICATION

**Many people ask the question: why mark animals?** The following reasons are submitted.

It is now generally recognized that zoos have an important part to play, both in the conservation of rare animals and in scientific research. But their work in these fields will be of little value unless their animals can be identified individually and with certainty, and unless accurate records are kept. The breeding of animals in captivity over many generations, longevity surveys, work on animal biology and reproduction on animal behavior and on animal pathology, all depended on the certain, permanent identification of the individual animal, both during life and at post-mortem examination. General animal management in zoos is also greatly aided by being able to distinguish with certainty between individuals of the same species. It is true that with certain species and in zoos where the animal keepers are particularly observant and devoted to their charges, it may be possible to identify some animals visually, without using marking techniques. Even so, those zoos which now use marking devices report that the incidence of human error in animal identification is such that they consider the use of marking techniques essential for correct animal identification.

Zoos are now recognized as having important responsibilities as regards wild animal conservation. Not only are they repositories of wild living animals, but in the future it may well be through zoos that some areas are replenished with wild animals bred in zoos. However, if breeding is to be carried out scientifically over many generations, then precise information in the breeding and bloodlines of captive animals is essential. Apart from conservation, it is important for every zoo to know the age and source of individual animals, and to be able to identify them through the life of the individual. Without certain identification, it is impossible to establish precise information on longevity, on breeding, on behavior, on disease and on many other important subjects.

#### The ideal identification system is:

1. Permanent, resistant to loss or tearing
2. Easy to read from a distance to make it unnecessary to handle an animal to establish its identity
3. Easy to apply, and
4. Gives all of the information we desire at a glance.
5. Allow the animal to be as free of pain and / or stress as possible.
6. Be cost effective



Unfortunately it doesn't exist. Therefore while marking animals one has to choose from a variety of methods that meet one or more of these criteria. Very often two methods can be used in combination, each method chosen to compensate for the deficiencies of the other.

**An ideal mark should not;**

1. Cause death.
2. Have sub lethal effects on fitness, e.g. reduced growth or reproductive rates.
3. Influence the behavior of marked individuals.
4. Influence the behavior of other animals towards the marked individual.
5. It should not alter over time e.g. colored ear tags may fade from one color to another causing confusion as to the identity of an individual (to prevent this confusion for example red ear tag fades into pink over time then the color change should be properly recorded in the animal history card).

**GENERAL SAFEGUARDS FOR MARKING ANIMALS**

1. Humane, for ethical and public relations reasons.
2. Devices and methods must be selected carefully, where there is a choice, choose a device that has a size, weight and configuration appropriate for the animal species' size, behavior and habitat (e.g. Device that minimizes any adverse effects on the animal).
3. Only experienced and / or well trained personnel who are proficient in the method should carry out marking.
4. Accidental injury during marking should be immediately treated.
5. Personnel must minimize the transmission of infectious disease and parasites between animals during the marking procedure.

## 4. MARKING MAMMALS FOR IDENTIFICATION

### 4.1 IDENTIFICATION BY NATURAL MARKS

Identification of animals by natural marks and specific individual behavior is a non-invasive method of identification with no stress or adverse effect to the animal. Photographic recordings, sketches, coded descriptors or a combination of all these have long been used to keep track of individual features in a variety of animals. Such marks may be genetically controlled variations in pelage color or patterns (spots, blotches, stripes, facial markings, ridges, wrinkles, pigmentation, flaps of skin, whiskers or other physical traits. Some example so suitable characters are the facial markings of tigers, *Panthera tigris*, (Schaller 1967), vibrissae (whisker) spots of lions, *Panthera leo*, (Pennycuick and Rudnai 1970), skin flaps on Indian rhinoceros, *Rhinoceros unicornis* (Laurie 1978), flank stripes on Gravy's zebras, *Equus grevyi*, and various features of primates (reviewed by Ingram 1978). Other characters may be acquired in the course of the animals' life, such as large scars, chipped, bent or broken horns. Features that are temporary (antler size and configuration, small wounds, scars, size, absence of tail in amphibians) are not acceptable for identification but may serve to distinguish individuals for short periods.

The suitability of these characters for distinguishing individuals varies greatly with the nature of the marks and the number of individuals that must be identified. Members of a small collection may be identified by a "Gestalt" impression, which takes into account the behavior of the animals as well as physical attributes (eg. sex, age, body forms, markings) – the same means by which we recognize other humans. The greatest advantage of this method is the ease and speed with which it can be applied once it is learned. A problem with this method is that it is specific to the observer and therefore not easily transferable. It depends on memory, and is therefore unreliable. The learning process also becomes more difficult and time consuming with increased numbers of animals. Each animal should be examined for one or perhaps two particular traits that distinguish it from all other individuals must be examined for that particular trait to ensure that it is genuinely unique to that individual. However, once the uniqueness of the trait is established, only the unique trait needs to be recorded for each animal. Particular behavioral traits also sometimes can be used to distinguish individual animals.

Information on these characters needs to be permanently recorded in a manner decipherable to others, such that someone entirely unfamiliar with the animals should be able to take this record and correctly identify all the individuals. Three methods are commonly used for making such a record: written descriptions, photographs and drawings. A written description, simply station the condition of a particular trait, is most suitable, when only one or two characters can be used to distinguish an

individual. Photographs are well suited to large and complex body markings such as those found on zebras (*Equus spp.*), Giraffes (*Giraffa camelopardalis*), tigers (*Panthera tigris*). When drawings are used it is often helpful to start with a standardized form incorporating a line drawing of the animal (or a part of it), onto which a pictorial representation of a given character can be sketched. A short written description in addition to the drawing may also be helpful.

With the recent technological advances it is now easy to obtain and manage digital photographs. Photo IDs can be used for many species which have unique stripe or spot patterns such as zebra, tigers, leopards to name but a few. There are now software packages available to support this technique; whilst initially designed for use in the wild, there is potential to apply the technology ex-situ. Some animals also have unique face masks or scars which can be recorded to assist identification. Photo ID should be used when possible. However many species do not have sufficiently unique or permanent features and so photo ID should be used in conjunction with another identification method.

For best results natural identification system can be used in conjunction with artificial identification system so as to compensate the deficiencies of the other.



Picture 2: Photo ID for e.g. Somali Wild Ass, Grevy's zebra. Photo © Marwell



Picture 3: Difference in tail coloration of Himalayan palm civet

## Identification of Tigers Using Photo Recognition Software

The Photo Recognition Software is free downloadable software. The link to this software is <http://www.conservationresearch.co.uk/tigers/tigers1.htm>. The programme was designed by Lex Hilby from an organisation called Conservation Research and it could allow conservationists to track surviving tigers and to source the origins of poached skins.



Users use colour dots to indicate the position of the shoulder, hips and tail and the upper and lower margins of the image; the programme does the rest. It essentially unwraps the striped pattern from the tiger's flank and works out how it would look if it were laid out flat. It then compares the new image to every existing one and gives them a score based on how similar they are. This software can be used by the zoos keeping large number of tigers.

## ARTIFICIAL TECHNIQUES FOR IDENTIFICATION OF MAMMALS

### 4.2 EAR TAGS

Ear tags come in a variety of sizes, colors and identifying symbols or numbers. Plastic tags (eg. Rototag, All Flex, Du Flex) are typically made up of a front and a back piece which may be different colors. One piece has a post with a sharpened point that pierces the ear as the tag is attached. The other piece has a hole to accept the post, and the two pieces lock together as the tag is applied. A special tool is used to align the two pieces and to provide the force to pierce the ear and push the post into the hole. Numbered metal seal tags are also available in several sizes. These tags are

applied with pliers that flatten a hollow rivet to secure the tag. Generally, plastic tags are preferable as they seem to be less likely to result in infection.

On young animals with thin ears the tag should be affixed to the thickest cartilage portion of the ear, such as the lower half, near the base. On the other hand, it may be difficult to pierce some parts of the ears of large, mature ungulates, in which case it may be necessary to attach the tags to a thinner section of the ear or to pre-cut the puncture site with a clean scalpel. For ungulates of any age, care should be taken not to puncture any large blood vessels.

Fingerling eartags have been used to mark bats since the 1930's (Mohr 1934) but are not suitable for large eared bats that exhibit rapid ear movements synchronized with echolocation (Stebbins 1978). Eartags can also be applied to interdigital webbing (Keith et al. 1968), to the outer toes of the hindfeet (Linduska 1942), or to the skin of mammals' back (Errington and Errington 1937).

Indira, a Red panda, brought from Madrid Zoo, Spain in the year 1994 to Darjeeling zoo was ear tagged with a colored plastic ear tag. The tag lasted a lifetime and in no way hindered the behavioral activities of the animal. The visitors rarely noticed the tag. Thus this type of tag is highly recommended for Red Pandas and other lesser carnivores, like the palm civet, *Paguma larvata* and even leopard cats, marbled cats etc.

Several tagging strategies are possible. A unique color combination, such as red/blue or white/green, can identify each animal. One should avoid using two colors that may become difficult to distinguish if they fade, such as blue with green or yellow with orange. Colors should contrast with the surrounding areas. For differentiating the sex through ear tags, males can be tagged in the right ear and females can be tagged in the left (especially in cases where the sexes are difficult to differentiate e.g. Tibetan wolf, *Canis lupus chanco*). Tagging both ears with different color combination increases the number of possible color combinations. Alternatively one may tag both ears with the same color combination so that even if one tag is lost from one ear, the animal can still be identified.

Colored plastic tags are preferable over numbered metal tags. When properly applied, these tags meet most of the criteria for the ideal marking method. They can be read at considerable distances, they are inexpensive, quick and easy to apply, they cause little trauma and they are usually ignored by the general public.

**Drawback:** The biggest problem with ear tags is their lack of permanence. Ear tags may be lost by being torn out or by falling out when the front and back pieces separate. Problems may ensue when adult sized tags are placed on new born animals. These problems can be alleviated by waiting for tissues to mature.

Remedial measures:

- A. Replacement of the torn ear tag as soon as it is detected.
- B. One piece colored ear tags may be used instead of two- piece tag.
- C. Animals should be tagged only when their tissues become considerably mature (i.e. tagging should not be done to a new born animal).





Picture 7: Eartags on wolf



Picture 8: Ear tags with attached streamers

### 4.3 TATTOOS

Tattooing is one of the most permanent methods for marking animals and has found wide application in zoo and wildlife marking programs. Clear and legible tattoos may be made only on a clean body site free of hair. A tattoo is made by rubbing adequate amount of dye/ ink into a superficial wound inflicted in the animals' skin. As the wound heals the ink remains in the skin and is visible for many years. Common sites for tattooing are the ear (usually the inside), the inside of a lip, the inside of the thigh, the chest, the bottom of the foot, or (on bats) the wing or tail membrane.

Tattoos may be applied with a small battery – powered needle, but more commonly are done with tattooing pliers. These pliers have interchangeable units (of various sizes) in which stout needles spell out letters or numbers. As the pliers are compressed, the needles puncture the skin. The pliers are then withdrawn and tattooing ink is rubbed into the holes. While tattoo pliers are effective and easy to use, one must have access to the back as well as the front of the tattoo site. They are quite effective for tattooing ears and wing membranes. Attempting to tattoo small ears, however, may result in extensive damage and atrophy of the ear (e.g., sugar gliders, *Petaurus breviceps*). In animals whose ears are too small to be tattooed readily but which live in groups large enough to need individual identification, tattoo may be applied to the inside of the thigh. On parts of the body other than ear, tattoo pliers may be used if a fold of skin can be pulled up sufficiently to allow tattooing through the fold. In other cases, an electrically powered needle that both pierce the skin and inject the dye can be used. Human tattoo guns are an example of electro vibrator system. These tools are used simply to “write” an identifying code into the skin. Woodbury (1956) noted that the free ends of numerals such as 2,3,4,5,6, and 9 should be extended to aid in distinguishing them from each other. Effective tattoo application with an electric needle requires practice. With the drill running, the tip of the needle is dipped into the ink, the drill is firmly pressed against the skin, and the numbers are “engraved” on the tattoo site. Tattooed numbers poorly applied can be difficult to locate and decipher.

In practice, tattooing is inexpensive, relatively permanent, generally acceptable from a humane standpoint and inconspicuous. However, tattoos cannot be read from a distance, and the marks may fade with time, depending on the species. For instance, MacNamara et al. 1980 found that tattoos in wing membranes of fisherman bats, *Noctilio leporinus*, remained legible for more than ten (10) years, while those on hammer headed bats, *Hypsignathus monstrosus*, were “effaced after only a few months”. Tattoos on young animals will grow with the animal. The larger symbols

may be easier to read but the ink will also diffuse somewhat, making the marks less distinct.

The following strategies should increase the life of a tattoo:

1. Either choose a relatively hairless tattoo site or closely shave or clip the hair.
2. Thoroughly clean the site with alcohol to remove all oil and wax.
3. Let the alcohol dry completely before applying the ink.
4. Use green ink. Green ink contrasts with the background on most ears and has proven to be the most readable over time. (It is tempting to use white ink on the black inner ears of ungulates such as blackbuck, Antelope cervicapra, but this has not proven effective.)
5. Apply ink before and after applying the tattoo instruments. Once the tattoo punctures have been made, thoroughly rub in the ink for at least 1 minute.
6. Hold the animal securely while applying the tattoo to prevent scratching the animal and blurring the tattoo.
7. Be certain that the opposite side of the pliers is padded to ensure adequate penetration of the needles.

Thompson and Armour (1954) identified individual cottontail rabbits, and Keith et al. (1968) identified snow shoe hares by tattooed numbers in the ears. Polar Bears were tattooed on the upper lip and groin area by Lentfer (1968). Downing and Mc.Ginness (1969) tattooed white tailed deer fawns on the ends of the ear with green dye.

#### **4.4 COLLARS AND WRIST BANDS**

Collars have been used to mark both wild and domestic animals. A wide variety of designs have been developed (Twigg 1975; Stonehouse 1978; Day, Schemnitz, and Taber 1980). Common techniques include color coding the collars, painting them, or attaching numbers to them.

The greatest advantage of collars is the ease with which they can be read. They are also inexpensive and humane. On the other hand, collars are often not permanent (on long lived animals), and they are very conspicuous. It is notable that snug collar made of dog-collar chain coded with sections of aluminium and copper tubing, have been used without incident to mark hanuman langurs, *Semnopithecus* (= *Presbytis*) *entellus*, at the San Diego Wild Animal Park (R. Massena, pers. Comm.). Collars of any type should be monitored regularly to ensure that they do not wear or cut into the skin. In Loris, colored plastic bird leg bands may be fixed around the wrists. It is well visible from some distance. The band around the wrist should be so fixed that it is not too tight so as to prevent the accumulation of dirt under it leading to skin problems.

#### **4.5 PIT (PASSIVE INTEGRATED TRANSPONDER) TAGS**

Pit tags provide permanent identification. Each tag consists of an electromagnetic coil and custom designed microchip that emits an analog signal when excited by an electromagnetic energy from a scanning wand. The transponder chip is uniquely programmed with an alpha or a numeric code and > 34 billion combinations are available (Nietfeld et al. 1994). Once inserted under a mammal's skin with a large bore syringe, a PIT tag can be "read" by a scanner. PIT Tags are expensive, however relative to most other marking methods and they require a specific scanner matched to

the tag type to read the identification. However, a universal tag reader is also available now. PIT Tags may wander under an animal's skin, especially on large mammals. The transponders are rod shaped and are available in several sizes, ranging from 2mm in diameter by 10mm long to 3.5mm in diameter by 30 mm long. The larger the transponder, the greater the distance from which it can be read. The read range for all of the currently available transponders is very limited, ranging from less than 8cm for the 2 by 10mm transponders (Fagerstone and Johns 1987, Thomas et al. 1987) to approximately 16cm for the 3.5 by 30 mm transponders. As the larger transponder sizes are unacceptable for many mammals and increase the read range by only centimeters, the smaller 2 by 10 mm transponder are recommended.

Encased in glass, the transponder can be implanted in the muscle or under the skin. Transponders are packed in sterilized 12 gauge implanter needles. At the Wildlife conservation park we implant mammals subcutaneously. After the implant site is cleaned with alcohol, the hair is spread to expose the skin shaving the site is not recommended). The implanter needle is placed level-up at an approximately 45° angle to the skin surface, and the skin is pierced with the needle. The implanter needle is then positioned almost parallel to the skin, and the transponder is injected under the skin surface, and the skin is pierced with the needle. The implanter needle is then positioned almost parallel to the skin, and the transponder is injected under the skin. The needle should be carefully withdrawn and finger pressure applied to the implantation site for approximately 30 seconds. The implantation site then should be scanned by the reader to verify both successful implantation and the transponder's unique code. Occasionally the needle will leave a wound; if it does, the wound should be sealed with an adhesive skin bond.

When this technique has been properly applied, neither infection nor migration of the transponder implants has been a problem (Fagerstone and Johns 1987; Thomas et al.1987; Ball et al. 1991).

The most convenient site for the implantation of a microchip is at the base of the left ear for large mammals and between the shoulder blades to the left of centre for small mammals and for animal species with thick skin such as the slow loris, *Nycticebus coucang*, and Rock hyrax, *Procapra capensis*, on the left hip.

Recently, after reviewing the available transponder systems for performance, availability, and cost, the IUCN/CBSG working Group on permanent Animal Identification recommended that the international zoo community adopt the Trovan/A.E.G (125 KHz) transponder system (IUCN/CBSG 1991).

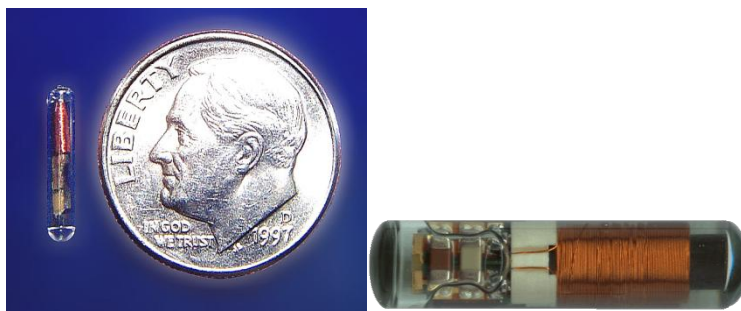
The major disadvantages of transponder identification are as follows:

- I. The equipment is comparatively expensive to other marking equipments.
- II. Transponders are not legible at a distance; Restraint of the animal is usually required to read them.
- III. Transponder permanence needs verification, early transponder studies were done on transponders encased in plastic. Because of leakage into the plastic case, their failure rates were 16% (Thomas et al, 1978) and 30% (Fagerstone and Johns 1987) in fairly short-term studies (< 1 year). Transponders are now being manufactured with glass casings and theoretically should not have the leakage problem. However, experience to date at the Wildlife Conservation Park and end elsewhere (Taylor, Emerson, and Wagner 1993) suggests that a failure rate of about 5% can still be expected, so one should not depend solely on transponders for identification of individual animal.



IV. Tag loss is primarily attributed to faulty implantation or to an inability to detect tags on large animals (Prentice et al. 1990). Transponder failures can occur because of damage to the capsule during implantation, or PIT loss immediately after injection (Conill et al. 1996; Sutterluety 1996). The level of experience of the operator has a major influence on tag loss (Geers et al. 1997). Inability to detect a PIT is most often due to migration of the tag within the animal. Not only does migration make detection difficult, but moving transponders can also be a risk to internal organs (Labooy and Merks1989). The degree of migration depends on the size and location of the implant, implantation method, tissue reaction and the age and species of the animal. Tags placed in areas associated with movement are more likely to migrate (Jansen et al. 1999). Therefore, tags are generally inserted into areas on the skull, around the ears or into the body cavity itself. The problem of migration has been reduced in recent years by the addition of bondable sheaths to the transponder capsules ( Rao and Edmondson 1990; Park and Wieser N.D).

Transponder ID chip show the promise of providing genuinely permanent marking method. They are humane and extremely inconspicuous.



Picture 9: Transponder chip



Picture 10: Transponder setup consisting of implanting tool, scanner/ reader, battery charger and a carrying case.

## 4.6 TOE CLIPPING

For very small mammals, such as mice and rats, a system of toe clipping is recommended. Toes may be clipped according to the following pattern; digits 5 to 1 on the left front foot are designated A to E; digits 1 to 5 on the right front foot are designated F to J; digits 1 to 5 on the left hind foot are designated K to O; and digits 1 to 5 on the right hind foot are designate P to T. Normally, not more than two digits are removed from any single animal, giving 210 different combinations for animals with 20 toes. Animals with fewer than five toes per extremity, or that have lost toes are not included in this system.

## 4.7 FREEZE BRANDING

Freeze branding or cryobranding is a permanent branding technique. It has been used on mammals ranging in size from neonatal mice, *Mus musculus*, to African elephants, *Loxodonta Africana*. It is of great visibility from a distance providing a crisp and clear mark, thus enabling easy identification. Freeze marks can be small and intricate. Ear marking using a hard backing to support the ear while the mark is being applied has been successful (Farrell and Johnston 1973; Pienaar 1970). The mark may consist of letters, numbers or other symbols. Farrell (Farrell and Johnston 1973) developed a numeric system based on a right angle mark and a straight line.

These symbols are different orientations plus an underlining bar can represent any integer. Freeze branding selectively destroys the pigment producing cells (melanocytes) in the hair follicles, resulting in the production of white hair or depigmented skin that contrasts with the original coat/ skin color. If properly applied, freeze branding produces long lasting, clear and highly visible marks. Many large animals do not need to be recaptured for identification (Newton 1978). In addition, the local anesthetic effect of refrigerants leads many researchers to believe that freeze branding is less painful than hot branding (Scheffer 1950; Schwartzkopf – Genswein, Stookey, De Pasille et al. 1977; Schwartzkopf- Genswein et al. 1998).

The skin is cooled by immersing a marking instrument in liquid nitrogen or a mixture of crushed solid carbon dioxide and 95% alcohol (Ethyl, methyl or isopropyl) and then applying the instrument to the skin of the animal. Rice and Kalk (1991) found that the dry ice – alcohol refrigerant had a broader exposure latitude and produced better marks. Alternatively, the skin may be cooled by exposure to Freon or liquid petroleum (Farrell, Farrell and Patterson 1974). The use of Freon, however, is not recommended, considering the potential for degradation of the atmospheric ozone layer.

Freeze marking is most commonly done with copper instrument, although brass and bronze can also be used (fire brands are not suitable; Farrell, Hostelter, and Johnson 1978). The instrument should have a depth of at least 2-3 cm. it is immersed in the refrigerant bath held in a suitable container (Styrofoam for dry ice- alcohol, urethane or insulated metal for liquid nitrogen). When the refrigerant stops boiling and only a stream of bubbles rises from the instrument, the instrument has reached the temperature of the bath. The site to be marked is prepared by clipping the hair and wetting the area with alcohol. Farrell et al. (1978) recommend close clipping blades (no. 40 Oster or E8-1-SUR Sunbeam) for dry ice-alcohol marking and coarser clipping (no. 10 Oster or 83-84 AU sunbeam) when liquid nitrogen is used. The instrument is usually applied to a well fleshed area such as the hip or shoulder to

ensure even contact (uneven contact results in distorted, broken marks). Application time varies greatly among species (Table 5.1). Excessive application time kills the hair follicles rather than just the melanocytes, and the mark becomes a scar that may or may not be legible. Insufficient contact time results in a patchy mark (if any).

Immediately after the instrument is removed, the affected skin appears frozen. As the tissue thaws, the mark fades and a reddened swelling appears. This remains for 1 to 2 days, after which a scruffy, blistered mark develops. After about 3 weeks the hair and superficial epidermis are shed, leaving a bare mark. Depending on the hair growth cycle of the animal, white hair should appear after 1-3 months.

The major disadvantages of freeze marking are as follows:

I. Combinations of proper refrigerant and application time are not yet well established for a broad range of species.

II. The animal must be restrained for the duration of the contact time. A good mark depends upon proper restraint.

III. The equipment necessary for containing the refrigerant is cumbersome.

IV. Commercially marketed marking instruments often make marks that are too large to be inconspicuous in a zoo.

Freeze marking has the potential of meeting many of our ideal marking method criteria. It is permanent, can be legible at a distance, and is thought to be painless; the rapid freezing of the skin acts as a local anaesthetic (Farrell and Johnston 1973) and inactivates local nerve endings for about 4 weeks (Farrell, Hostelter and Johnson 1978). The dry ice- alcohol and Freon refrigerants are inexpensive.

Refrigerant	Animal	Duration	Reference
Dry ice and alcohol(-70o C)	African elephant	2 x 2 mins	Pienaar 1970
	Cow (adult)	30 secs	Farrell, Kroger and Winward 1966
	Dairy cow (>18mths)	30 secs	Farrell,Hostelter and Johnson 1978
	Beef cow (>18 mths)	35 secs	Farrell,Hostelter and Johnson 1978
	Dairy cow 9-18 mths	25 secs	Farrell,Hostelter and Johnson 1978
	Beef cow 9-18 mths	30 secs	Farrell,Hostelter and Johnson 1978
	Dairy cow (4-8 mths)	20 secs	Farrell,Hostelter and Johnson 1978
	Beef cow (4-8 mths)	25secs	Farrell,Hostelter and Johnson 1978
	Dairy cow (2-3 mths)	15 secs	Farrell,Hostelter and Johnson 1978
	Beef cow (2-3 mths)	20 secs	Farrell,Hostelter and Johnson 1978
	Dairy cow (<2mths)	10 secs	Farrell,Hostelter and Johnson 1978

	Beef cow	15 secs	Farrell,Hostelter and Johnson 1978
	(<2mths)		
	White tailed and mule deer	20-30 secs	Day 1973
	White tailed deer	20-25 secs	Newsom and Sullivan 1968
	Dog (adult)	10 secs	Farrell, Kroger and Winward 1966
	Dog (adult)	4-10 secs	Farrell and Johnson 1973
	Dog (puppy)	3-6 secs	Farrell and Johnson 1973
	Wombat	30-45 secs	E.S. Dierenfeld pers.comm.
	Cat	10 secs	Farrell, Kroger and Winward 1966
	Fox squirrel	25- 40 secs	Hadow 1972
	Albert's Squirrel	25-40 secs	Hadow 1972
	Hooded Rat	20-35 secs	Hadow 1972
	House mouse(adult)	20-35 secs	Hadow 1972
	House mouse (3-6 days)	7-10 secs	Hadow 1972
	Degu	28 secs	Rice and Kalk 1991
	Patagonian cavy	18 secs	Rice and Kalk 1991
	Mouflon	12 secs	Rice and Kalk 1991
	Pere David's deer	30 secs	Kalk, unpub.
	Mongolian wild horse	30 secs	Kalk, unpub.
Liquid nitrogen	Horse (adult)	ca. 20 secs	Farrell,Hostelter and Johnson 1978
(-195oC	Dairy cow	20 secs	Farrell,Hostelter and Johnson 1978
	(> 18 mths)		
	Beef cow	25 secs	Farrell,Hostelter and Johnson 1978
	(> 18 mths)		
	Dairy cow	15 secs	Farrell,Hostelter and Johnson 1978
	13- 18 mths		
	Beef cow	20 secs	Farrell,Hostelter and Johnson 1978
	(13-18 mths)		
	Dairy cow	12 secs	Farrell,Hostelter and Johnson 1978
	(10-12 mths)		
	Beef cow	17 secs	Farrell,Hostelter and Johnson 1978
	(10-12 mths)		
	Dairy cow	10 secs	Farrell,Hostelter and Johnson 1978
	(6-9 mths)		
	Beef cow	15 secs	Farrell,Hostelter and Johnson 1978
	(6-9 mths)		
	Dairy cow	7 secs	Farrell,Hostelter and Johnson 1978
	(2-5 mths)		
	Beef cow	12 secs	Farrell,Hostelter and Johnson 1978
	(2-5 mths)		
	Dairy cow	5 secs	Farrell,Hostelter and Johnson 1978
	(<2 mths)		
	Beef cow	10 secs	Farrell,Hostelter and Johnson 1978
	(<2 mths)		

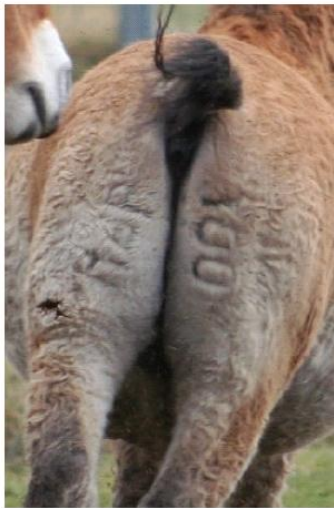
	Cow	10 secs	Macpherson and Penner 1967 a
	2-10 weeks		
	Pony (adult)	35 secs	Farrell,Hostelter and Johnson 1978
	Sheep and goats (adult)	ca. 20 secs	Farrell,Hostelter and Johnson 1978
	Sea lion	18- 20 secs	Ensley, pers. Comm.
	Seal (14mths)	7 secs	Macpherson and Penner 1967 b
	Seal (2 mths)	5 secs	Macpherson and Penner 1967 b
	Dog (adult)	8 secs	Farrell,Hostelter and Johnson 1978
	Beaver (6-10mths)	20 secs	Zurowski 1970
	Beaver (adult)	2 x 20 secs	Zurowski 1970
	Wombat	20 secs	E.S. Dierenfeld pers.comm.
	Mouflon	8 secs	Rice and Kalk 1991
Freon12 (-30oC)	Horse	9 secs	Farrell, Farrell and Patterson 1974
	Brown lemur (juvenile)	6-8 secs	Miller et al.1983
	Dwarf mongoose	5-8 secs	Rood and Nellis 1980
	Rats	10 secs	Lazarus and Rowe 1975
	Mice	4-10 secs	Lazarus and Rowe 1975
Freon 22 (-41o C)	Horse	6 secs	Farrell, Farrell and Patterson 1974
Liquid petroleum (-42o C)	Dog	5-6 secs	Farrell,Farrell and Patterson 1974

## Post Branding Results

Immediately after freeze branding you will see a frozen indentation in the animal's skin. Within five minutes the indentation will disappear and swelling will begin. The brand will be readable but the swelling will cause the mark to have two or three times the thickness that the actual finished brand will have. The brand will be swollen for 48 – 72 hours. After the swelling dissipates the brand may not easily be seen. About 20 to 30 days the brand will begin to get flaky and scaly – use creams to keep the skin oily during the scabbing stages to promote hair growth – do not attempt to remove the scab. By the third or fourth week the scab will start to turn loose. Once the scab is gone, white, peach fuzz type hair should appear in about 30 days. Full hair growth will depend upon the time of year the brand is applied. It is strongly advised during the winter months to clip off the hair from the branded area to expose the mark, it is also advisable to apply sunscreen to the site during the summer period until the site has healed

#### Time Brand Site

- 15 Seconds Indented pattern show
- 5 to 10 minutes Swelled pattern show
- 5 Days Swelled pattern disappears
- 1 Month Top layer of skin sheds
- 2 Months White hair starts growing
- 3 Months White hair growth complete



Picture 11: Freezebranding on a Przewlaski's horse

### 4.8 TEMPORARY MARKING

Dyes (Nyanzol dye), bleach, paint sticks, spray paint and guns that shoot a ball of paint are useful tools for temporarily marking animals. Most of these mark the animal for less than a month or until the next moult, but serve well to mark animals for veterinary treatment , shipments or specific study purpose.

### DISCUSSION

Apart from the above techniques there are other marking methods for mammals such as ear notching, hot branding and character prints. In context of zoo animals these methods are impracticable as character prints are not discernable at a distance and the process is time consuming as the animals have to be immobilized. For hot branding again animals have to be well restrained, immobilized or anaesthetized in order to achieve clear brands. Experimental work suggests that hot branding causes more immediate pain and discomfort than freeze branding. In addition hot branding is aesthetically unpleasant, both for the zoo staff and the public. Although the heat will initially sterilize the wound, the risk of subsequent infection is higher than some of the less invasive methods of marking, owing to the severity of the tissue damage and the time required for wound healing.

Since ear tags do occasionally come loose, tattoos or transponders may be used in conjunction with tags, but for quick identification without restraint, ear tags appear to be still the best method.

## **5. MARKING OF BIRDS/ PHEASANTS FOR IDENTIFICATION**

For a marking procedure to be effective, it should meet as many of the following criteria as possible (Marion and Shammis 1977).

1. The bird should experience no immediate or long term hindrance or irritation.
2. The marking should be quick and easy to apply.
3. The marking codes (digits or colors) should be readily visible and distinguishable.
4. The bird should suffer no adverse effects on its behavior, longevity or social life.
5. Careful methods should be made of all aspects of the marking procedure.

In special cases it may be possible to identify individuals on the basis of unique markings or vocalizations without the necessity of handling or attaching markers to them.

## **METHODS FOR MARKING BIRDS**

### **5.1 Leg Ring or Leg Band**

Leg bands are available in a large range of sizes to suit all birds and pheasants. They are manufactured from a range of materials the most common being plastic, aluminum and stainless steel.

Closed bands are circular and seamless. They are made of stainless steel, aluminum or plastic and come in a variety of colors and sizes. The band is placed on a baby bird, about 2-3 weeks of age, by sliding the band over the foot to the leg portion. As the bird grows, the feet become too large for the band to fall off. Removal can only be accomplished by cutting the band off. This permanency makes closed bands a more reliable method of identifying a bird than open bands which can be opened and substituted.

An open band is a piece of metal which has been bent into the form of a circle. The ends of the band do not meet and are separated by a space to enable them to be placed on a mature bird's leg. After placement, the ends are then pinched together until they meet. Open bands are used on older birds whose feet are too large for banding with a closed band.

Colored plastic and celluloid leg bands are a great aid for quick visual identification. They provide a means of individually recognizing birds in the field without recapturing them. When bands of the proper size are used few adverse effects of color bands have been reported (cf. Nisbet 1991). However some studies have shown that certain band colors, especially those that are similar to plumage or soft part colors involve in social signals, may affect mating attractiveness, dominance status, or aggression (e.g. Burley 1981, 1985, 1986a,b; Burley et al. 1982; Johnson et al. 1993; Holder and Montgomerie 1993) in some species. It may be important to consider that some colors of commercially available celluloid bands fade. After two years or so they may be unrecognizable (Anderson 1980; Hill 1992; Lindsay et al. 1995). UV- stable bands are available from several suppliers. Most colors of UV- stable plastic remain bright for several years. Blue bands fade relatively quickly.



The use of non colored numbered metal bands should be replaced by colored plastic/ metal alphanumeric bands in zoo birds as the birds with non colored metal bands cannot be identified from even a small distance, every time a bird needs to be identified it has to be captured which is very stressful for them especially the shy pheasants. Colored bands can be extremely helpful in recording bird relationships and breeding activity; and they are invaluable in species where there is no sexual dimorphism. The ideal leg band should be lightweight, strong, numbered and available in a selection of colors for each size.

Peacock pheasants should be ringed above the spur as the ring can interfere with the growth of the spur.

Leg banding of Ratite birds like the emus, Cassowaries, Rheas etc pose special problems because of their large size, strength and the greater diameter of their tarsi. Possibly through the use of a squeeze type cage, these large powerful birds could be restricted long enough to be leg- banded.

A lock type band would prove satisfactory for ratite birds. The design of the overlap band inhibits its removal by spreading, which is always a possibility with the butt- end band. The lock- type band is also more secure than the butt- end type. In this device, a tongue at one end of the metal is inserted through a slot at the opposite and is bent back over the edge and flattened securely with the end of the flat, long – nosed pliers(Griswold 1968).

The psittacines usually chew off their leg bands but strong colored steel leg bands are now available which can be used to mark parrots and macaws.



Picture 12: strong colored metal leg bands for parrots and macaws



Picture 13: Purple alphanumeric band on bald eagle





Picture 14: American Oystercatcher chick and willet leg banded on the tibiotarsus



Picture 15: Caspian tern with colored leg band

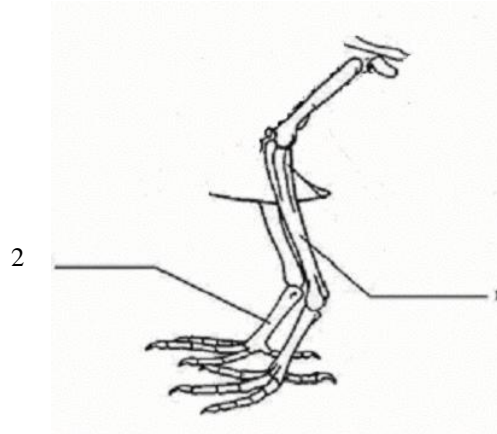


Picture 16: White crowned sparrow (Colored leg bands for small birds are made of plastic and come in a variety of colors that give unique combinations)

Before a new bird is banded several matters should be taken into consideration. First on the list is the type of bird to be banded. All but the very long-legged species are best ringed on the tarsometatarsus where the band is always in a plain view. Storks, herons, cranes and flamingoes, ibises, spoonbills are better banded above the 'hock' on the tibiotarsus, again in plain view, even though the bird may be

standing in the water or walking through high grass. The sex of the bird, if known, should be indicated by the common practice of banding females on the left and males on the right. Very close attention must also be given to the way a band fits; it must ride freely over the leg bone. It is wise to shape the band slightly for various species of diving birds whose leg bones are flattened. The plastic bands can be shaped if heat is applied.

Once ringed a constant watch must be kept for the slightest infection or swelling in the area of the band. If infection is detected it must be treated immediately.



- 1 tarsometatarsus
- 2 tibiotarsus

Fig.1: Diagram of a bird leg showing areas for ringing

### How to remove a leg band?

- Get a pair of band clippers which are specifically designed to remove a leg band.
- Hold the bird still, with one leg extended. Use the bird band clippers to carefully clip the leg band and remove it
- Save the clipped band for future use.
- Examine your bird's foot afterwards for any lesions, spots and scaly areas.
- Know that to help your bird heal from leg band irritation you should increase its intake of vitamins and nutrients as well as sunlight.

## 5.2 PATAGIAL TAGGING

Patagial tagging refers to the fitting of a plastic tag to the “patagium” or frontal flap of skin to the wing of a bird and has been used worldwide with great success on a wide range of bird species including vultures and condors, swans and eagles.

Patagial Markers are shapes of vinyl (often circles) or cattle ear tags (square with codes) attached over the leading edge (or patagium) of the wing. These markers are very visible both in flight and on perched birds, although part of the marker may be obscured by feathers on a perched bird. Homemade markers may be any shape and may include multiple colors. Codes of letters and numbers are usually painted or sewn

onto the marker. Commercial cattle ear tags are plastic with codes of letters and numbers. Cattle and sheep ear tags are sometimes used as patagial tags on birds.



Picture 17: Patagial tagging in vultures



Picture 18: Trumpeter Swan with patagial tag -- Wayne Miller photo

Patagial Markers are shapes of vinyl (often circles) or cattle ear tags (square with codes) attached over the leading edge (or patagium) of the wing. These markers are very visible both in flight and on perched birds, although part of the marker may be obscured by feathers on a perched bird. Homemade markers may be any shape and may include multiple colors. Codes of letters and numbers are usually painted or sewn onto the marker. Commercial cattle ear tags are plastic with codes of letters and numbers. Cattle and sheep ear tags are sometimes used as patagial tags on birds.



Picture 19: Bald Eagle with Orange Patagial Marker, (c) Steve Wagener of Wag the Dog Productions, Ltd.

The vast majority of patagial tags have codes, and the individual bird can often be identified by the code.

### 5.3 NECK COLLARS

The Neck collar is a method of marking which is more suitable for birds with long necks such as geese and swans. Neck collars have been used successfully on geese but not ducks. Plastic neck bands or collars have been used extensively for marking waterfowl. Aldrich and Steenis (1955) concluded that properly applied neck bands are effective markers with few adverse effects on geese. In general neck collars seem to be superior to nasal discs for tagging waterfowls (Sherwood 1966; Raveling 1976; but cf. Helm 1955; Lensink 1968; Ankney 1975; Hawkins and Simpson 1985; Abraham et al. 1983; Macinnes and Dunn 1988; Ely 1990). Collars can be easily read from a distance with binoculars or a telescope. This allows researchers to identify an individual bird using the combination of collar color, code color, and the code on the collar.



Picture 20: Neck bands or collars





Picture 21: Neck collars on waterfowls

## 5.4 PIT Tags

PIT tags can also be implanted on birds. A microchip should be implanted whilst the bird is under anesthetic. The best site for implanting a microchip will depend on the species and the size of the bird. Generally, they can be implanted into the breast muscle or collarbone cavity of a bird although sometimes an area of loose skin, such

as the neck or under the wing can be selected instead. The area of the PIT tag implantation should be properly recorded and mentioned in the animal history sheet. As the PIT tags cannot provide instant recognition of the bird it should be used in combination with other marking system.

## **Discussion**

Uses of dyes and ultraviolet markers, nasal discs and saddles, web tags etc are other methods for marking birds. These methods are unsuitable for use in zoos as dyes and ultraviolet markers only provide temporary identification to the birds and as for nasal discs and saddles various undesirable results have been reported, including high rates of marker loss, often with injury to the nares (Sherwood 1966), higher mortality rates attributed to entanglement with submerged vegetation (Sugden and Poston 1968) and reduced success in obtaining mates (Koob 1981). Visual identification of a web tagged waterfowl is impossible. A PIT tag in combination with other markers suitable for the specific species by far seems to be the best method for marking birds/pheasants for identification.

## **6. MARKING OF AMPHIBIANS FOR IDENTIFICATION**

### **NEW TECHNIQUES**

#### **6.1 VISIBLE IMPLANT FLOURESCENT ELASTOMER (VIE)**

Amphibians are difficult to mark or individually identify. Their small size, sensitive and slippery skin, subtlety of their markings and the ability of the caudates and anurans to regenerate all contribute to these difficulties.

A. VIE tagging system is bio- compatible and consists of two elastomer materials (color elastomer and curing agent) which are mixed at a 1:10 ratio. After mixing, the liquid elastomer material can be placed into a 0.3cc syringes and kept in a freezer to slow hardening, which occurs within 24 hours at room temperature. The 0.3cc syringes are used to inject the elastomer pigment into the animals.

B. A total of six fluorescent colors (red, green, orange yellow, blue and pink) that fluoresce with the VI Light and four color that do not fluoresce (white, purple, brown and black) are available. Detection of fluorescent tags is greatly enhanced by using VI Light. Furthermore, colors green and yellow are difficult to distinguish in UV light thus either green or yellow should be used for each plot.

In order to mark animals uniquely, fluorescent colors have to be combined with different tag locations (behind the front legs or in front of the hind legs or, if possible, in the legs itself). An injection into the legs shows up extremely well. Before and after injection, the syringe should be cleaned with an alcohol wipe to reduce the likelihood of infections. After marking tags should be checked for visibility using a hand held UV light and remarked if necessary. No anesthesia is needed.



Picture 22: Marking position in a salamander



Picture 23: This frog tagged as a tadpole retained its VIE tags through metamorphosis. Photo courtesy of S. Hopkins



Picture 24: Photo courtesy K. Kendall, Alberta Fish and Wildlife Division

Some amphibians lack septa between the skin and underlying tissue. VIE tags injected into these animals can therefore migrate from the original tagging location, making it impossible to use those tagging locations to create individual codes. In such cases, the use of Visible Implant Alpha tags is recommended.

Representatives of all the following families have been successfully tagged with VIE;

### **Amphibians**

Ambystomatidae

Ascaphidae

Caeciliidae – caecilians

Hylidae – tree frogs

Pelobatidae – spadefoot toads  
Plethodontidae – terrestrials salamanders  
Ranidae – true frogs  
Salamandridae

- The VIE is currently only manufactured by Northwest Marine Technology ([www.nmt.us](http://www.nmt.us))  
Corporate office: 360-466-3375 [office@nmt.us](mailto:office@nmt.us)  
Biological support: 360-596-9400 [biology@nmt.us](mailto:biology@nmt.us)

## 6.2 VISIBLE IMPLANT ALPHA TAG (VI Alpha Tag)

The fluorescent VI Alpha tag is injected internally but is externally visible, providing a method to quickly identify them. The tags are available in two sizes; standard (1.0mm x 2.5mm) and large (1.5mm x 3.5mm). VI Alpha tags are made of the same biocompatible, flexible material as the VIE tags but are pre-cured with individual alphanumeric codes printed on one side. VI Alpha tags are available in two sizes: standard (1.0 mm x 2.5 mm) and large (1.5 mm x 3.5 mm) and in a variety of colors. VI Alpha tags are injected under the skin in areas with little or no pigmentation so that the codes can be read without removing the tag. As with the VIE tags, the use of the VI Light dramatically improves the detection and readability of VI Alpha tags, sometimes even through highly pigmented skin.

Buchan et al.(2005) tested VI Alpha in a number of species, and concluded that VI Alpha “appears to be an effective and low cost method for individually marking and identifying amphibians”.



Picture 25: VI Alpha tag



The VI Alpha Tag is currently only manufactured by Northwest Marine Technology ([www.nmt.us](http://www.nmt.us))  
Corporate office: 360-466-3375 [office@nmt.us](mailto:office@nmt.us)  
Biological support: 360-596-9400 [biology@nmt.us](mailto:biology@nmt.us)

## CLASSICAL TECHNIQUES

### 6.3 TOE- CLIPPING

Pioneered by Bogert (1947) on *Bufo terrestris* and Martof (1953) on *Rana clamitans*, the technique was later applied by Heusser (1958) to about 20,000 *B. bufo* in the field, over a period of more than ten years. He found it quite satisfactory, with few ill effects, although he pointed out that the inner three digits of the forefoot



should never be involved in the coding system as they are vital to the performance of copulation. Neither should the longest digit of the hind foot be clipped as it is an essential element in proper sloughing. Viertel's (1976) two years of observation on frogs of the family Ranidae led him to caution against interfering with any of the rear phalanges as in these species the hind limbs are the major organs of locomotion. He suggested that the foredigits only should be clipped and that, even here, the first digit, which is important in aplexus, should be avoided. The amputation of Phalanx distalis on finger 4 is, according to Viertel, the optimal procedure. As the latter allows for only two possible codings, it is thus a technique best suited to a mass field study where, for example, two separate populations require designation, and is not appropriate in a zoo group that would normally be comprised of several individuals. Toes essential to animals for activities such as burrowing, climbing, amplexus, or nest excavation should never be removed. Removal of more than two non- adjacent toes per foot should be avoided. If behavior or survival of animal is likely to be seriously impaired, alternate marking techniques should be employed.

## Method

Prior to toe clipping, an amphibian should be anesthetized or given a suitable level of analgesia (e.g., 2% lidocaine applied to the site), and the limb to be toe clipped should be disinfected using a standard surgical protocol. If possible toes should be amputated at the interphalangeal joint (Wright 2001b). Sterile stainless steel clips or absorbable monofilament suture may be used to constrict the digit prior to amputation, and tissue glue applied after the procedure (Wright 2001b). stainless steel clips should not be used on amphibians that are being released because of the risk of entanglement (Wright 2001b).

In salamanders, newts and some frogs, digits can regenerate. Digit regeneration has been prevented by using cauterizing materials, such as the phenylmercuric acetate solution, after removal of the toe. However it should be noted that any mercuric compound is an environmental toxicant.

To mark anurans and caudates, two to four toes are removed using small, good quality scissors, generally, no more than three toes are removed, but never more than one toe from each foot. After the toes are clipped, the codes should be read back to the data collector to ensure that the mark corresponds to what is recorded on the data sheet, because while clipping the toes, it is easy to become confused as to orientation of the animal and the order in which the mark is read. After finishing with each animal, the scissors should be dipped in 95% ethanol to reduce the chance of transmitting infections between animals. An antiseptic could be applied to clipped digits to prevent infection.

To maximize data yield, it has been suggested that clipped toes should be kept for determination of age through skeletochronology by preserving them in 10% buffered formalin, or for genetic analysis by preserving them in 70 to 100% ethanol.

**Coding System:** The choice of coding system is largely a matter of personal taste and experience, but it is always desirable to use a system that is simple and easy to record. Below is given a simple symbolic coding scheme that does not require mental addition and uses a simple numeric character per foot. **This method may be used as a standard system of coding for toe clipping of amphibians.**

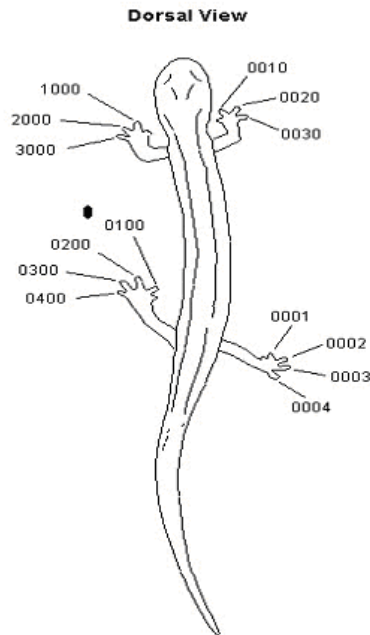


Fig.2: A symbolic coding scheme for toe- clipping salamanders and frogs

- Each mark is of the form 0000 where each character place corresponds to a particular foot. Numbers correspond to particular toes.
- No more than one toe from each foot should be excised
- The code is read from the left front foot to the left back foot, to the right front foot and finally to the right back foot.
- Toes are counted from proximal to distal, except that the most proximal toe on each foot is not counted because it is too small to use.
- Always a dorsal view is used because if the ventral side is turned upwards, the animals will struggle.
- Thus, 0320 represents toe number 3 on the left hind foot and number 2 on the right forefoot. For identification purpose in zoos, only two and three toe marks will be enough.
- To avoid using the same code twice, a sheet containing all the codes should be prepared, and codes checked off as they are used.
- Additional numbers may be used to indicate unusual marks (e.g., 5= foot missing; 6 = leg missing; 7 = two or more toes missing; 8 = toes fused; 9 = see comments)

## 6.4 PIT Tags

Passive Integrated Transponders (PIT Tags) or microchips have been used to mark amphibians and can be used as an ancillary method of identification. Wright(2001b) notes that these tags have been used successfully on a variety of species, including some newly metamorphosized newts with body mass greater than 2 grams. This method requires the animals to be recaptured for identification. After disinfecting the site where the device will be implanted, using standard surgical protocols, the devices are implanted subcutaneously or intraperitoneally. If possible, tissue glue (Cyanomethacrylate) is then applied to close the incision. The use of tissue

glue helps to ensure that the PIT tag does not become ejected before the wound heals (Wright 2001b).

Complications with PIT tags which have been noted include: migration of transponders if applied subcutaneously or internally, which may make them more difficult to read; breakage of the tags; and loss of signals (Wright 2001b).

## 6.5 Freeze Branding

Freeze branding was first used as a technique for individually marking anurans in 1976 by Daugherty.

Method:



Picture 26: Freeze branding of *Xenopus laevis*

Pieces of copper wire, bent into the shape of numbers, are placed into liquid nitrogen until boiling stops. The brand is momentarily placed for 1.5 seconds on the ventral surface of an *X. laevis* which has been patted dry with tissue.



Picture 27: Once branded animals are easily identified by number. The brands will be clearly visible within 24 hrs. This individual (089) was branded 2 years previously.

## DISCUSSION

Hot and freeze branding in amphibians are other invasive methods of marking but they are not recommended, as brand marks in amphibians may not be visible after a few months. Though described as convenient and the least expensive technique for marking amphibians (Donnelly et. al. 1994) recent studies has shown a number of negative effects of toe clipping. One of the disadvantages is that marks are not permanent since toes regenerate. Clarke (1972) reported a possible negative effect on survival using toe clipping in *Bufo woodhousei fowleri*. Underhill, cited in Daugherty (1976), noted a loss of weight in toe-clipped *Rana pipiens*. For tagging amphibians

VIE and VI Alpha tags seems to be the best method as it is least invasive, humane, lasts the lifetime of an animal and is inconspicuous to some extent.

## 7. MARKING OF REPTILES FOR IDENTIFICATION

### 7.1 Visible Implant Elastomer (VIE) and Visible Implant Alpha Tags

As in amphibians the VIE and VI Alpha tags may be conveniently used for marking reptiles.



Picture28: *Anolis sagrei* tagged with VIE (Photo Courtesy Melissa Losos)

**Representatives of the following families have been successfully tagged with VIE.**

#### **Reptiles**

Gekkonidae - geckos

Polychridae

Sincidae

### 7.2 TATTOOING

Tattooing was used by Woodbury (1951) as an alternative method of marking over 3200 snakes during his Utah den study and, provided that the numerals were applied with care, identification was found to be both positive and permanent. This method consists in tattooing individual numbers on snakes. This requires a portable battery operated tattoo outfit suitable for field work. The power must be sufficient to drive the tattooing needles through the scales and leave ink underneath. The numbers may be written on any smooth, light colored surface, such as the throat region or the base of the tail, where no color pigment interferes.

In this method there is the ever-present danger of misreading the numbers when recaptured. For this reason great caution should be exercised in making the figures when tattooing. The free ends of such figures as 2,3,4,5,6,and 9 should be made extra long to aid in distinguishing from each and from figure 8 without any free ends. If once properly tattooed so there can be no mistake in reading, the number will serve as a permanent identification of adults. This method does not handicap the snake after recovery from the operation of marking.

### 7.3 FREEZE BRANDING

Freeze branding has been used by Lewke and Stroud (1974) on sea turtles *Chelonia mydas* and alligators *Alligator mississippiensis* and on the snakes *Crotalus viridis* and *Pituophis melanoleucus*. For the snake branding the branding instrument was made from a solid bar of copper, soldered to wire handles. Best results were achieved with dry ice and 95% ethyl alcohol as coolant. The copper iron was placed into the coolant until boiling from the surface stopped, whereupon it was held firmly against the snake's skin for 25-30 seconds. It was found that by wetting the brand site with ethyl alcohol, conduction was increased and the brand rendered more effective. The area directly under the iron remained frozen for several seconds after its removal from the skin; no evidence of pain was observed and all snakes continued to feed after branding. Although depigmentation was not evident until the first slough following branding, the marks proved permanent and easy to read. They caused no disruption of natural movement or shedding, nor any noticeable pain or stress.

### 7.4 TAGGING

For tagging rattlesnakes the procedure described by Pendlebury (1972) could prove useful in zoos, as identification is possible, with binoculars, at a distance of up to 30m. A series of paired color-coded identification discs are attached, with the aid of a hypodermic needle, by a nylon fishing line to the second proximal segment of the rattle. As only keratin part of the rattle is in use, the risk of infection is negligible, and the discs do not interfere with ecdysis.

Affixing colored glass beads to the nuchal crest of lizards and iguanas by means of a suture is one of the methods of marking for identification. This method was developed by Rodda et al. for marking of iguanas but can be used conveniently for lizards as well. Glass beads are preferred over plastic beads as they retain their color better than plastic beads and are also superior in resistance to crushing. The beads are fairly visible from a distance.

Suture material :

Suture material used in mammals and birds are used for similar procedures in amphibians and reptiles. The size of the material used will depend upon the size of the animal. For most small amphibians and reptiles the size will range from 4-0 to 8-0. absorbable material such as polyglycolic acid and polydioxanone, are absorbed at a slower rate compared to birds and mammals. If used for closing skin it may have to be removed following healing of the incision site. Nylon is most commonly used for closing skin. Gut suture material, specially chromic gut is to be avoided since it induces a major inflammatory response in amphibians and reptiles (Jacobson et.al., 1985; Bennett, 2000a)

### 7.5 PAINTING

Land tortoises may be marked by painting alphabets or numbers on their carapace. The paint fades after about 5 months but as the tortoises can be handled easily it can be conveniently repainted before the color completely fades.



Picture 29: Starred tortoise paint marked at PNHZ Park

## 7.6 TOE CLIPPING

The same method as used for the amphibians may be applied for the reptiles (lizards) (refer page no.27 – 29).

The amputation causes the lizards little inconvenience. The longest (fourth) toe of the hind limb is never amputated, and at least two other digits on each foot are always left intact. It is a procedure which if performed with care, can usefully be applied in a zoo reptile collection, perhaps in conjunction with a record of individual color patterns and other distinguishing features. Veterinary attention is most important to avoid unnecessary pain and infection.

## 7.7 PHOTOGRAPHIC RECORDS

For species with conspicuous and individually distinctive skin patterning, a photographic record is probably the simplest and least expensive method of permanent identification. Photographing the ventral side of smaller crocodiles, known also as ‘belly printing’ has been used, for example, to identify *Alligator mississippiensis* under semi- captive conditions in Florida. It is an attractive procedure in that the basis of identification, the belly skin, cannot be changed by man and as long as the hides remain intact, the animals are identifiable (Street 1970; Harrison 1972). If enlarged to life size, the pictures may be compared visually without recourse to any code or formula, a factor which makes it an ideal system for zoo purposes.

With larger snakes and lizards, where handling can often be a problem photographic records if done properly will give satisfactory identification of individual animal. The genus *Heloderma* and certain of the gekkonid and varanid lizards, all of which have individually unique markings, lend themselves particularly to this kind of record. In some boids individual patterns on the head or on the tail have been used to identify a specimen over its entire lifespan. For e.g. identification of *Boa constrictor* is based on the tail markings. Photo records can be used in combination with other markers for better results.





Picture 30: Photo Id in Sand Lizard

## 7.8 PIT Tags

PIT tags may be used to mark frogs, salamanders or snakes except some small species. The tag is injected into the animal either subcutaneously or intraperitoneally.

## 7.9 NOTCHING

A method of marking and coding freshwater and terrestrial hard shelled tortoises and turtles was developed by Fred R Cagle (Copeia, 1939: 170), in which scissors and files were used for notching. But now a power grinder or a small hand held grinder may be used for notching which is more convenient. Once established such notches are permanent identification marks which do not interfere with the normal activity of the turtles.

The rather complicated coding scheme devised by Cagle (1939) has been simplified for use with the families Testudinidae and Emydidae at Zurich zoo. The same method may be followed for notching turtles and tortoises at Indian zoos for the sake of its simplicity.

### Method

- Only the last four marginals (1,2,3,4) on each side of the carapace are used.
- Numerical values are assigned to individual marginals in the following manner no.1=1, no.2=2, no.3=4 and no.4=7
- Thus a notch in marginal no.2 denotes specimen no. 2 and a combination of notches, for e.g. in marginals 3 and 4, would denote specimen no. 11.
- With the right front side designating units, the left front tens, the right hind side hundreds and the left hind side thousands, this coding system allows for the marking of up to 9999 individuals.

Similar process may be used for the more aquatic forms (Ernst et.al 1974) like the Kinosternon, Chelydra and Macrocllemmys, where the bridge of the carapace and plastron, should not be used because of the weakening of the shell at that point. With G. elephantopus, Mac Farlane et. al (1974) point out that specimen of less than 15-20 cm curved carapace length (approximately to one and a half years old) cannot be notched because the carapace is too fragile; in this case they are temporarily marked with paint or by scratching the scutes.

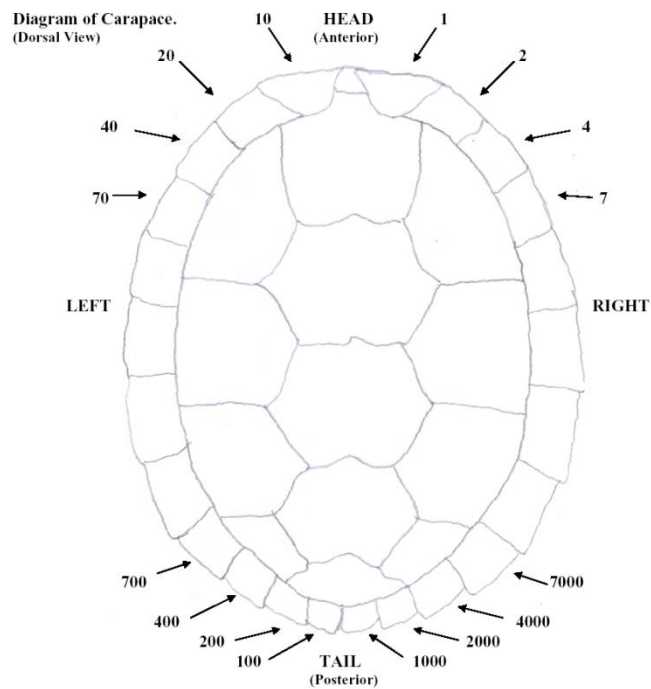


Fig3: Marginals of the carapace are notched to obtain the individual number required.

## 7.10 VENTRAL SCALE CLIPPING FOR SNAKES

The ventral scale clipping for permanently marking snakes given by William Brown and William Parker 1976 has been described here. It involves two features  
1) clipping ventrals 2) a serial enumeration system.

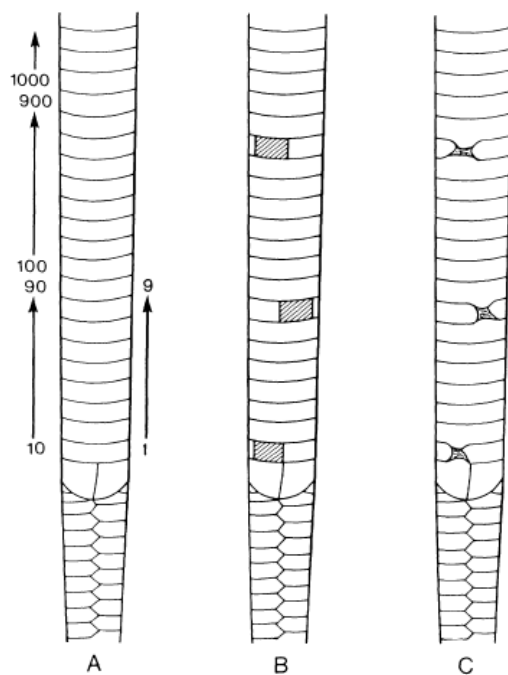




Figure4: Ventral scale clipping system for marking snakes. Diagrams are ventral, posterior views. A. Enumeration of ventrals proceeding anteriorly from anal scute; 10's, 100's and 1000's series on observer's left, units series on right. B. A freshly – marked snake, No. 718 C. Same individual three years after initial marking, showing appearance of scars.

The basic plan is shown in Fig.... Ventrals are counted anteriorly from the anal scute in series of 10's ( from 10-90 ), 100's (from 100-900), and 1000's (if necessary) on the observer's left, in units (from 1-9) on the observer's right. By removing half of a given ventral, a combination of 1-3 clipped scutes will enable an investigator to 989 individuals before advancing to the 1000's series. Examples of a freshly-marked snake (Fig.1B) and the same individual three years later (Fig. 1C) are shown, scars were readily identifiable in this individual, typical of many we have marked in this fashion (Parker and Brown, 1973).

Using a sharp pointed pair of dissecting scissor (for large animals) or tiny micro-surgical scissors (for hatching or small snakes), marking may be best done as follows :

1. Insert a tip of the scissors under the posterior edge of the scute to be clipped, push it forward beneath the width of the entire scute, and cut, Make two such incisions, one on each side of the intended block to be excised.
2. Insert the scissors under and across the top (anterior edge) of the scute and make a third cut transversely to remove the entire section. Depth of the cuts is important : the entire excision should include all layers of the skin (including the dermis) to exposed the underlying ventral musculature. Muscles should be visible and the section removed should be large enough to cover half of a given ventral. In cases of dual numerals involving the same scute (55,66, etc.) clip all the way across and leave some lateral traces of the scute so that its position can be counted after healing. There is an apparent tendency for adjacent scutes to 'invade' an excised area (Fig. 1c) or to adpress against an excision zone after removal of an entire scute. Number involving adjacent scutes on the same side (eg. 190's, 1900's) should be omitted. Occasional anomalies such as half-ventrals protruding laterally and ending at the midline (cf. Clark and callison,1967) may be separately photographed / sketched (or otherwise recorded whether counted or not) when critical to a snake's later recognition.

They noted minimal pain and bleeding, no instances of post-marking infection, and no difference in behavior between marked vs. unmarked animals in the field.

They have used this technique to mark 1,046 *C.constrictor* (Brown, 1973; Brown and Parker, 1974), 242 *M. taeniatus* and 211 *P. melanoleucus* (Parker, 1974) as well as lesser numbers of *Diadophis punctatus* (Parker and Brown, 1974a) and *Crotalus viridis* (Parker and Brown,1974b) between 1969-1973 at communal hibernacula in Utah, ventral scale marking has worked well for these species and should be applicable to population and demographic studies of virtually any snake species.

## 8. MARKING OF FISHES FOR IDENTIFICATION

For the purpose of identifying individual fishes in a public aquarium, the following list of criteria should be considered ideal and will help with the selection of an appropriate technique (Allen Marshall 2004):

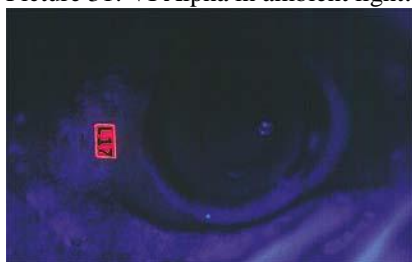
- A. uniquely identifies each individual fish
- B. remains unaltered on an individual throughout its lifetime
- C. has no effect on growth, behaviour, mortality, or vulnerability to predators
- D. nontoxic and nonirritating
- E. is easy and fast to apply, without anesthetic, and with minimal stress to the fish
- F. is not obvious to the public, while still unmistakable to curatorial staff and
- G. is inexpensive, easily obtained and requires little or no specialized equipment.

It is impossible to meet with all the criteria cited above. Thus while marking animals one has to choose from a variety of methods that meet one or more of these criteria. Instead of depending solely on one method for identification of individual animal two or more methods may be employed.

### 8.1 VI (Visual Implant) Alpha Tags



Picture 31: VI Alpha in ambient light.



Picture 32: VI Alpha in UV Light

The VI Alpha tag is a small fluorescent tag with an alphanumeric code designed to identify individual specimens. VI Alpha tags are implanted internally but remain externally visible for easy recovery.

The tags are implanted with syringe-like injectors, and are available in several colors (black letters on a red, orange, or yellow fluorescent background or the reverse), and in two sizes: standard - 1.0 x 2.5 mm and large 1.5 x 3.5 mm. Because the tags are made from a biocompatible medical grade elastomer, they do not irritate the tissue at the implant site and seem to have little negative effect on the host animal when properly used.

Although many fish have transparent tissue (adipose eyelids, fin membranes, clear boney tissue, etc.), tag retention varies by species. For example, the adipose eyelids of salmonids have generally proven to be suitable locations for these VI Alpha tags, but implants into larger masses of similar appearing tissue in mullet (*Mugilidae*) have been rapidly shed,. Size of the tagged specimens is also important. Shedding rates from adipose eyelids of salmonids less than 150 mm total length have been excessive while retention in larger fish often exceeds 90%

Tagging sites in other body locations may also be used successfully. Various sites on the head appear to be particularly useful ( e.g., mandible in walleye *Stizostedion vitreum* ([Larscheid 1995](#)), and elsewhere on heads as reported by Buckley 1994). Dorsal, anal, and adipose fins also provide potential targets (Crook and White 1995, Blankenship and Tipping 1993, Wenburg and George 1995).

Buckmeier and Irwin (2000) found that 100% of VI Alpha tags implanted in the dorsal fin of channel catfish *Ictalurus punctatus* were shed. However, researchers with the Iowa Department of Natural Resources have developed a very successful method of implanting VI Alpha tags into the tongue of flathead catfish (*Pylodictis olivaris*).

#### **Advantages of soft VI Alpha tags:**

- F. Provide individual identification
- G. High retention rates in suitable tissue/species
- H. Tags detected visually and readable in live specimens without removal
- I. Minimal impact on survival, growth and behavior
- J. Visibility is enhanced using the VI Light.

#### **Limitations of soft VI Alpha tags:**

- Unsuitable for very small fish
- Not all species have suitable tissue.
- Tag readability may become occluded by pigmentation.

### **8.2 Visible Implant Elastomer (VIE)**

The VIE system provides internal colored tags that are visible externally, for fish and other animals that are too small for the VI Alpha tag, or when group codes are sufficient. The system uses a bio-compatible, two part, elastomer material. Most species of fish have suitable area or transparent or translucent tissue. By the use of different marking sites, and perhaps two or more marks on each individual, development of numerous group or individual codes is possible

The VIE tag has been demonstrated to have minimal impact upon subsequent growth and behaviour of fish.

The smallest fish that can be tagged are 8mm long Pomacentrids *Chromis ovalis* and *Dascyllus olbisella* (Frederick).

#### **Tag location and retention rates:**

Clear tissue, such as behind the eye in salmonids, is the ideal site. Similar tissue exists in many other fish families behind and above the eye. Clear tissue is not present in all species, but semi-transparent and translucent tissue may also be suitable for elastomer implants, especially in smaller animals. In trials with turbot, VIE tags were implanted under the skin in less pigmented areas. Tagging shrimps in the last abdominal segment as been very successful. The base of fins and beneath the jaw are also good sites in many species. Fin membrane tissue, in spaces between rays, is another potential target. Such a technique offers the potential to develop a variety of unique codes based upon tags in specific spaces. A detailed description of some successful applications with different species is given in Section 4; this includes a consideration of tag locations and retention rates.



Picture 33: VIE tagged coho salmon (*O. kisutch*) smolt under ambient light



Picture 34: VIE tagged coho salmon (*O. kisutch*) smolt viewed with NMT's VI Light.



Injecting a VIE tag into the clear tissue behind the eye of a brown trout  
Picture 35



Multiple VIE marks in a 55 mm turbot.  
Picture 36



VIE tags in juvenile Chinook salmon  
Picture 37

Ten VIE colors are available. Six (red, pink, orange, yellow, green, blue) are fluorescent; the other four (black, white, purple and brown) are not.



Samples of the ten VIE colors under ambient light (left) and illuminated in a darkened room by the VI light. Note that only the six fluorescent colors show up in the VI light, and that the colors, especially the yellow, appear somewhat different when fluoresced.



VI Light

Picture 38

## Advantages of VIE tags

- High retention rates
- May be applied to very small fish and other animals
- Minimal impact on fish survival, growth and behavior
- Low capital and material costs make it viable for small-scale projects
- Fast to apply
- Tags detected visually in ambient light
- Detection can be further enhanced with appropriate illumination
- Well-established technique with extensive literature on successful applications in hundreds of species of fish, amphibians, crustaceans and other animals
- Tags may not be noticed and reported by casual observers

## Limitations of VIE tags

- Limited coding capacity (but use of several colors, several body locations, and possibly more than one tag allows a greater coding capacity to be developed)
- Tags may become difficult to detect in ambient light if growth is considerable and pigmented tissue is laid down over the tag, though it can usually be detected using the VI light

**Representatives of the following families have been successfully tagged with VIE.**

**Fish**

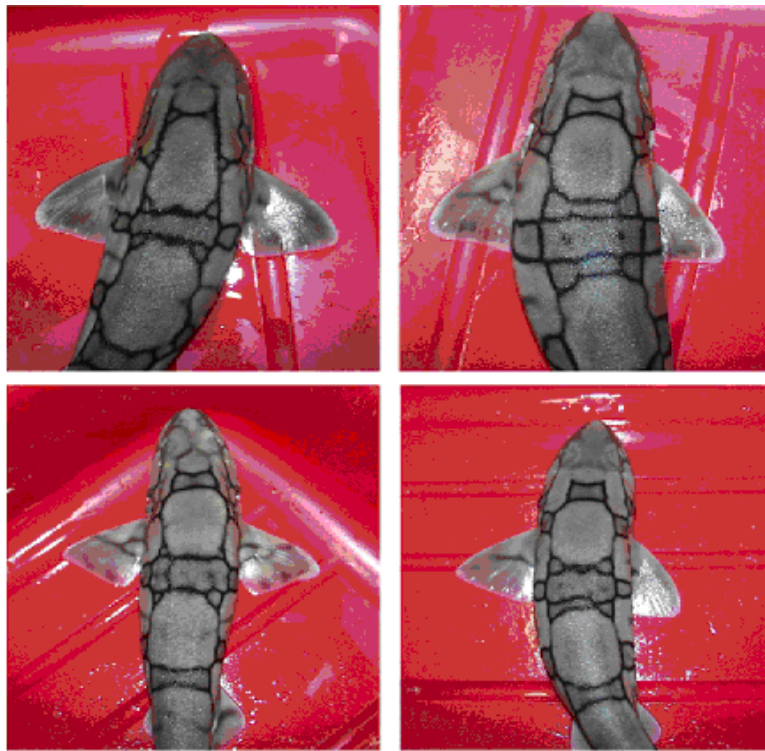
Acanthuridae - surgeonfishes  
Adrianichthyidae – ricefishes  
Anarhichadidae – wolffishes  
Apogonidae – cardinalfish  
Carangidae – jacks  
Centropomidae – snooks  
Centrarchidae – sunfishes  
Chaetodontidae – butterflyfishes  
Chanidae – milkfishes  
Clupeidae – herrings  
Cottidae – sculpins  
Cyprinidae - carps and minnows  
Cyprinodontidae - pupfishes  
Eleotridae - sleepers  
Engraulidae – anchovies  
Gadidae – cod  
Galaxiidae - galaxiids  
Girellidae – nibblers  
Gobiidae - gobies  
Ictaluridae - North American catfishes  
Kuhliidae – flagtails  
Labridae – wrasses  
Lutjanidae – snappers  
Moronidae – temperate basses  
Mugilidae – mullets  
Percichthyidae – temperate basses  
Percidae – perches  
Petromyzontidae – lampreys  
Poeciliidae– livebearers  
Polynemidae – threadfins  
Pomacentridae– damselfishes  
Salmonidae – salmon, trout, char  
Scophthalmidae – turbot  
Scorpaenidae– scorpionfishes and rockfishes  
Serranidae - sea basses  
Sparidae – sea breams and porgies  
Syngnathidae – sea horses and pipefishes  
Terapontidae – grunters or tigerperches

Instruction for implantation of VIE Tags and VI Alpha Tags are provided with all VIE/ VI Alpha Tag kits and are available for download from the website [www.nmt.us](http://www.nmt.us)

### 8.3 Natural Differences

The most common and straightforward method of identifying individual elasmobranchs is to take note of natural differences in coloration, markings, size, and/or sex (Ellis, pers. com.; Lewand, pers.com.; Smith, pers. com.; Violetta, pers. com.). This technique is particularly effective with species of a mottled, spotted, or otherwise non-uniform coloration. For example, sand tiger (*Carcharia staurus*), broadnose sevengill (*Notorynchus cepedianus*), and white tip reef (*Triaenodon obesus*) sharks can often be distinguished by the distribution of darker spots on their bodies. The shape of dorsal fins, and notches or scars thereon, have been used to identify individual white sharks (*Carcharodon carcharias*) in the wild (Klimley and Ainley, 1998). Relative size differences between individuals may become less obvious as animals grow. However, it is unusual for an individual within a collection to completely change its size ranking relative to other members of the group. Of course a medical condition that affects appetite or food assimilation may change this equation. Behavioral differences may be used as natural identification technique. Janse (pers. com.) has noted a clear and reliable difference in the feeding behavior of two individual blacktip sharks (*Carcharhinus limbatus*). Individual animals may consistently choose a specific area of an exhibit to swim and/or rest, or have distinctly different behavior toward the presence of divers. The skin pigmentation of some elasmobranch species is patterned, variations of which are characteristic to individuals. The arrangement of white spots on spotted eagle rays (*Aetobatus narinari*), particularly around the base of the tail, is distinctive for each individual (Gruber, pers. com.). These patterns are similar to human fingerprints in the sense that they are unique and do not change over time. Photo-identification of individual animals, as has been used in cetacea for many years, has recently been employed in elasmobranchs (Gruber, pers. com.). Firchau (pers. com.) has successfully used photo-identification to distinguish between individual chain dogfish (*Scyliorhinus retifer*). The chain-like patterns are characteristic for each individual, with the most distinctive differences occurring in the bands on the dorsal part of the head and the pectoral region.





Picture 39: photograph of the dorsal surface of four chain dogfish showing the individually distinctive chain like patterning. Top left and right are female specimens. Photo courtesy of Liz Kopecky.

#### 8.4 PIT Tags

Due to their small size, the readable range of PIT tags is restricted to 20-30 cm distance. The reader must therefore be positioned close to the site of the implant in order to get a reading. Until recently, hand-held readers were incapable of being submerged. A new design of reader is now available with a waterproof remote detection device located at the end of a long pole. This new reader enables animals to be identified while underwater and makes PIT tags more practical as an individual recognition device for elasmobranchs. It is possible to attach a submersible reader to the end of a feeding pole and identify individuals as they take food items. It is recommended that all elasmobranchs within a collection are PIT tagged in a standardized location, to facilitate later identification. Small elasmobranchs often have PIT tags placed in the peritoneal cavity, implanted by making a small incision and inserting the tag through the aperture with forceps (Basavaraju et al., 1998). In larger sharks, PIT tags are usually implanted in the dorsal musculature just below the dorsal fin. Rays are tagged by inserting the PIT tag on the dorsal side of the pectoral flap, midway down the body and lateral to the peritoneal cavity. Elbin (pers.com.) proposed a standard tagging-site protocol for all vertebrates housed at the New York Zoological Park, New York, USA. The protocol recommended using the left side of the body for dorso-muscular implantations, and this standard has been adopted at many institutions in North America. An injecting applicator needle, usually supplied with the tags, is used to implant the PIT tag into the musculature. For intramuscular implantation, it is recommended to insert the applicator needle at a shallow angle to the surface and to push the tag as far as possible away from the entry site. This procedure will reduce the possibility of the tag migrating back through the puncture wound and being shed (Firchau, pers.com.). Nexaband (Veterinary Products



Laboratories, Phoenix, USA), a liquid cyanoacrylate tissue adhesive, can be used to close the applicator puncture wound, helping to prevent loss of the injected tag.

Studies have shown PIT tags to have little or no effect on growth, mortality, or behavior, and to have an almost 100% retention rate (Basavaraju et al,1998). PIT tags provide reliable, positive identification and are small enough to be used on all species of elasmobranchs. Because PIT tags require no batteries, they will function for many years. Despite the initial expense, PIT tags are considered to be an invaluable, reliable identification technique for record keeping.

## 8.5 EXTERNAL TAGS

External tags are not recommended for display animals. Only when temporary identification is necessary external tags may be employed. There are four basic categories of external tags, classed by the way they attach to the animal(Figure), and include: (1) trans-body; (2) dart style;(3) internal-anchor; and (4) tail-loop.

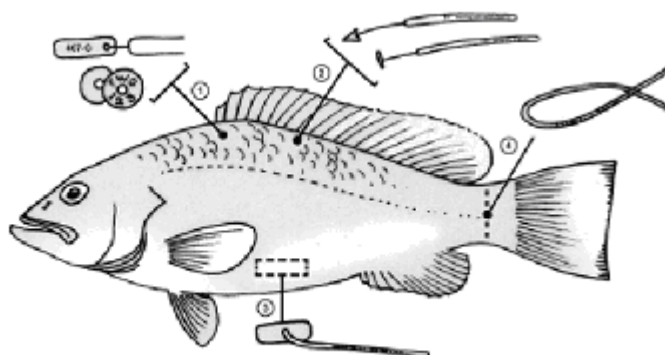


Fig 4: The four basic categories of external tags, classed by the way they attach to the animal, including; (1)trans-body;(2)dart style (3)internal anchor (4)tail loop.

Trans-body tags protrude through both sides of the body (e.g., through the dorsal fin). These tags include disc tags, dangling disc tags, and spaghetti loop tags. Dart-style tags protrude from only one surface of the animal and consist of a training shaft with an anchor on one end. The anchor is inserted into the body of the animal and the trailing end, usually enlarged, details information pertaining to the tagged animal. T-Bar and arrowhead are examples of dart-style tags. Internal-anchor tags are a modification of dart style tags. Instead of being anchored into muscle tissue, the anchor of an internal-anchor tag is a flat disc that lies against the inside wall of the fish's body cavity (Nielsen, 1992). Tail-loop tags consist of a length of material, or a plastic cable-tie, that is loosely tied around the caudal peduncle of the fish.

Researchers regularly use external tags for animal recognition. Within public aquariums, animals not on display can be tagged temporarily using external tags. Some public aquariums use external tags on display animals and take the opportunity to educate their public about the roles of tagging through written materials and presentations.

Wisner (pers. com.) has used different colored T- bar tags to identify animals within his collection. Instead of using commercial fish marking tags, Wisner used clothing price tags and an applicator gun. The flat end of each tag was colored with a plastic coating (Plasti Dip, PDI Inc., Circle Pines, USA). When the T of the t-bar tag was injected posterior to the first dorsal fin, the colored, trailing end was easily observed. These tags lasted for several years with no reported problems. For instances where temporary identification is necessary (e.g., sharks kept in holding tanks, etc.) a colored loop may be placed loosely around the caudal peduncle (i.e., a tail-loop tag). The tag may consist of ribbon, rope, string, or plastic cable-ties of various colors (Correia, pers. com.; Firchau, pers.com.; Perego, pers. com.). The tail-loop tag is tied around the animal in such a way as to be loose, but not dangling from the shark. Tail-loop tags provide a readily observable mark and in the short term do not injure the animal. Tail-loop tags should only be used for temporary identification (i.e., not more than two weeks) as constant rubbing of the material against the skin can lead to integument damage and possible infection.

## DISCUSSION

Fin clipping and branding (heat, freeze, and chemical) are not recommended for fishes due to their invasive and temporary nature and the necessity to restrain animals for longer period may cause undue stress to some animals. Using natural markings to identify individuals is the least intrusive technique and is preferred, providing that observations can be made reliably, and that unique features are long lived. PIT tags are reliable and accurate, with no chance of misidentification, and are usually relied on for accurate record keeping. Because PIT tags are not easily read without special equipment, and potentially restraining animals, they are usually used as a backup identification system to a more simplistic identification technique applied on a day to day basis. So far, Visual Implant Elastomer and Visual Implant Alpha tags seems to be the most promising technique for individual/ group identification of fishes.

## 9. CONCLUSION

Marking animals for identification and Keeping Records should be an integral part of an Institution. As the Indian Zoos do not hold any position for a Record Keeper, the zoo Biologist should fulfill all the responsibilities of a Record Keeper as well as that of marking animals for identification. The objectives of a modern zoo can only be achieved if the records are accurate, standardized and easy to retrieve.

To maintain accurate records in zoos, different datasheets are recommended (given in Appendices). The data will be generated at the keeper's level and it is very important to see that the data generated at the ground level is accurate with minimum observational error. The datasheets recommended is consistent with the ARKS software and these records if maintained properly will greatly enhance the incorporation of data into ARKS software and later on into SPARKS and MEDARKS.

## Annexure I

### Accession Log with data from Darjeeling Zoo

Local ID #	Common Name & Scientific Name	Sex	Acquisition		Disposition	
			Date	Institution Terms	Date	Institution Terms
1	Snow Leopard (Uncia uncia)	M	19-Mar-86	HELSINKI Donation	17-Jul-93	DARJEELIN Death
2	Goral Naemorhaedus goral)	F	01-Apr-86	NAINITAL Trade	01-Dec-90	DARJEELIN Death
3	Red Panda (Ailurus fulgens fulgens)	F	25-Jun-86	Wild Caught	01-Apr-90	GANGTOK Traded to
4	.....	.	.....	.....	.....	.....
5	.....	.	.....	.....	.....	.....
6	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....
....	.....	.	.....	.....	.....	.....

## Annexure II

### Inventory Report

Sl. No.	Common & Scientific name	Local ID #	Opening Stock as on				Births			Acquisitions			Disposals			Death			Closing Stock as on			
Bird			M	F	U	T	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	T
1																						
2																						
.....																						
Total Birds																						
Mammal																						
1																						
2																						
.....																						
Total Mammal																						
Reptile/ Amphibians																						
1																						
2																						
.....																						
Total Reptiles/ Amphibians																						
Invertebrate																						
1																						
2																						
.....																						
Total Invertebrate																						
Total Animals																						

### **Annexure III**

#### **Keeper's Diary**

The first page of the Keeper's Diary should look like this;

##### **KEEPER'S SHOULD NOTE DOWN THE FOLLOWING THINGS IN THEIR DIARY**

1. DIET CHANGE
2. MEDICAL OBSERVATION (TREATMENT)
3. BEHAVIORAL OBSERVATION( ONSET OF ESTRUS, MATING, GROOMING, STEREOTYPIC BEHAVIOR)
4. ENRICHMENT
5. BIRTH
6. EGG – LAYING
7. WEIGHING
8. HATCHING
9. DEATH
10. SHIFTING OF ANIMALS FROM ONE ENCLOSURE TO ANOTHER WITHIN THE ZOO
11. MARKING OF ANIMALS
12. EXPORT AND IMPORT OF THE ANIMALS

In case nothing happens in a day it should be recorded saying – Nothing to report.

-----Zoological Park

Name of the Zoo- Keeper \_\_\_\_\_

Section/Beat \_\_\_\_\_

Sl. No.	Date	Enclosure	Species/ House Name	Observation

Keeper's Signature

Signature of the Animal Supervisor

**Annexure IV****Daily Report****Zoological Park****Day & Date** \_\_\_\_\_ / \_\_\_\_\_

<b>Sl. No.</b>	<b>Section/Beat</b>	<b>Species &amp; House Name</b>	<b>Observations</b>	<b>Action Taken/required</b>
1.	Beat 1	Red Jungle Fowl	Hatched 6 chicks. All chicks seem to be normal	Feed will be reduced from tomorrow
		H. Monal	Laid 1 egg	
	Beat 2	Red Panda-Gora	Died in the hospital 11a.m.	
		Star Tortoise	Seems to adjust well to the new enclosure. Ate all their feed.	
	Beat 3	Asiatic Black Bear	Refused to come out to the open enclosure	
	Beat 4	Sundari	Everything normal	
		Indian Tiger	Out of 8kg beef given 4kg rejected.	
		Kaveri	Animal in estrus	
	Beat 5	-----	Everything normal	
	CBC	Snow Leopard	Gave birth to 3 cubs 5:15pm. Cubs look healthy and normal	
		Neeta		
		Red Panda		
		John	Weighed – 4.5kg	
		Sheetal	Weighed – 4 kg	

Veterinary

Officer  
In-charge-  
Animal Section

Biologist

Director

**Annexure V****ANIMAL HISTORY CARD**

\_\_\_\_\_ **Zoological Park**

Common Name	Scientific Name
Local ID# & House Name	Sex
Distinguishing (Natural) Mark:	Type of Marking Date:
National Studbook No.	Global Studbook No.
<u>Sire</u> National Studbook No. : International Studbook No. : Local ID# :	<u>Dam</u> National Studbook No. : International Studbook No. : Local ID# :
Date of Birth	When and from where acquired
If acquired from another institution its Local ID # in that institution	Date of death or other mode of disposal
Breeding History	Remarks



**Observation Sheet**

Date	Observation

## Annexure VI

Recommended studbook to be maintained by zoos for endangered species

Species: Common Name (Scientific Name)

[illegible]

## Annexure VII A

### Recommended Medical Reports

#### ANIMAL TREATMENT CARD

Species-

House Name-

Local Id.-

Beat No.-

Date	Symptoms	Treatment	Clinical Note

**Annexure VII B****ANIMAL VACCINATION CARD**

Species-

House Name-

Local Id.-

Beat No.-

Date	Type of Vaccine	Amount	Route	Next Date	Remarks

**Annexure VII C**

**STOOL EXAMINATION CARD**

\_\_\_\_\_Date\_\_\_\_\_

**PHYSICAL EXAMINATION**

Colour:

Consistency:

Worms:

Mucus:

Blood:

**CHEMICAL ANALYSIS**

Reaction:

Occult Blood:

Reducing Subt.:

**MICROSCOPIC EXAMINATION**

Pus cells:

R.B.C. :

Udigested Starch:

Soap:

Chalco laden crystals:

Yeast Cells:

Ova of :

Others:

**Annexure VII D**

**ANIMAL DEWORMING CARD**

Species-

House Name-

Local Id.-

Beat No.-

Date	Findings	Medicine Used	Remark

## Annexure VII E

### **ANIMAL TRANQUILIZATION CARD**

Species-

House Name-

Local Id.-

Beat No.-

Date	Medicine used	Time at which given	Time showing effect	Time of recovery	Remarks

**Post – Mortem Report**

Date

Kind of animal	Scientific Name	Sex	House Name	Age	Size
Weight			& Local ID#		

Time, date and place of death:

Time of post-mortem examination:

A. Short history of illness, if any:

B. Organ – wise description of lesions\_\_\_\_\_ -

2. Head and Neck..... (a) Skull and Brain
  - (b) Cervical vertebrae
2. Thorax..... (a) Lungs
  - (b) Heart
  - (c) Ribs
3. Abdomen ..... (a) Liver
  - (b) Stomach
  - (c) Intestine
  - (d) Kidney
  - (e) Spleen
4. Pelvic girdle ..... (a) Uterus and ovaries
  - (b) Bladder
  - (c) Genital Passage
5. Limbs ..... (a) Fore limbs
  - (b) Hind limbs
7. Any other special features:
  - i) Biological tests done (if any)
  - ii) Blood
  - iii) Urine
  - iv) Discharges
  - v) Biopsy
8. Opinion (cause of death):
9. List of organs preserved for confirmative tests:

Sent to:

10. Instruction for disposal

11. Name of officer present during disposal

Signature.....

Place Name.....

Designation.....

Date

(Seal)



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