

Forensic Wildlife Parts and their Product Identification and Individualization Using DNA Barcoding

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Abstract: Despite very strict wildlife protection acts in several countries and trading laws such as CITES, illegal trading and poaching of wildlife is still active mostly because of the use of their parts in Chinese medicinal products and ornaments. For successfully identifying wildlife and their parts, mitochondrial DNA sequencing is being used now-a-days. DNA bar coding using fragments of cytochrome b and cytochrome oxidase I genes are frequently utilized for mammalian species identification. This mini review describes some of the mtDNA sequences and STR markers used for mammalian species identification in the field of forensic wildlife along with the problems associated and their possible solutions.

Keywords: Cytochrome b, cytochrome oxidase, DNA bar coding, wildlife forensics.

INTRODUCTION

Earth is losing wildlife at an alarming rate and only few new species are being discovered each year. Illegal trade of wildlife parts and their products is worth more than 20 billion per year in black market [1]. In Nepal, every year millions worth of animal parts such as ivory, tiger skin and bone, bear bile, rhino horn and other wildlife materials are illegally transported across the borders mostly via Tibet. This kind of illegal trade creates a serious threat to the global as well as to the local diversity either directly or indirectly. Consequently the role of international organizations such as WWF (World Wildlife Fund), IUCN (International Union for Conservation of Nature) and CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) becomes more valuable than ever in protecting wildlife and their habitat. Habitat destruction causes increase of wildlife poaching due to their ever increasing vulnerability of being caught by humans, so that wildlife trade should also be cautiously examined and monitored for any critical illegal transactions [2].

WILDLIFE CONSERVATION

CITES regulates the global trade of wildlife within its 180 signatory countries [3]. It operates by listing wildlife (approximately 5,600 animal and 30,000 plant species are currently listed by CITES) in one of its three appendices (Appendix I, II and III). Since it is a trading treaty, it allows free and controlled trade of wildlife parts and their products from non-endangered wildlife (flora and fauna both), whose survival is not yet threatened but the species registered in Appendix I (630 fauna and 301 flora) [3] are banned from such trade, except for scientific research and other specific purposes. Although CITES is legally binding to the signatory

countries, it does not replace national laws. Problems arise when species of CITES appendix I cannot be verified by the laboratory when confiscated and sent for identification by the forest officers. Most of the time, domestic animal parts are confused with parts from protected and endangered animal species, as it is difficult to identify them through morphological and anatomical studies only. The difficulties that arise after the capture of wildlife parts or their products are: (i) determining the species that was killed with the help of a bloodstain only, (ii) when the sample is in altered or powdered form, (iii) identification up to family of animal but not to the specific species, and (iv) sometimes not even a clue, regarding the wildlife from which the sample originated, can be deciphered from basic morphological or anatomical test procedure [4].

Species identification becomes more problematic because most of the times it's not the whole animal part but rather only a small piece or some modified part such as musk cone, rhino-ceros horn, elephant ivory, elephant tail hair, tiger skin and bone that is traded [1]. This leads to complexity in precisely identifying the concerned protected wildlife species. The suspected animal is then either excluded or not excluded or a family of the animal is discerned for the species but not the species itself. This limitation can be remedied by using molecular tools and techniques for wildlife parts and product identification. Newer techniques such as DNA sequencing can help in identifying the species from which the product originated with great accuracy and reliability.

SPECIES IDENTIFICATION

For the purpose of species identification, although for most of the intact specimens the morphological observations may be enough, but in samples which contain only some part of an animal or their modified products (e.g. powder), DNA based methods are the methods of choice. In the text that follows, we first describe the limitations of conventional

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Forensic Wildlife Parts And Their Product Identification

John E. Cooper, Margaret E. Cooper



Forensic Wildlife Parts And Their Product Identification:

Forensic DNA Typing: Principles, Applications and Advancements Pankaj Shrivastava, Hirak Ranjan Dash, Jose A. Lorente, Jahangir Imam, 2020-12-11 The book explores the fundamental principles advances in forensic techniques and its application on forensic DNA analysis The book is divided into three modules the first module provides the historical prospect of forensic DNA typing and introduces fundamentals of forensic DNA typing methodology and technical advancements application of STRs and DNA databases for forensic DNA profile analysis Module 2 examines the problems and challenges encountered in extracting DNA and generating DNA profiles It provides information on the methods and the best practices for DNA isolation from forensic biological samples and human remains like ancient DNA DNA typing of skeletal remains and disaster victim identification the importance of DNA typing in human trafficking and various problems associated with capillary electrophoresis Module 3 emphasizes various technologies that are based on SNPs STRs namely Y STR X STR mitochondrial DNA profiling in forensic science Module 4 explores the application of non human forensic DNA typing of domestic animals wildlife forensics plant DNA fingerprinting and microbial forensics The last module discusses new areas and alternative methods in forensic DNA typing including Next Generation Sequencing and its utility in forensic science oral microbes and forensic DNA phenotyping Given its scope the book is a useful resource in the field of DNA fingerprinting for scientists forensic experts and students at the postgraduate level

Conservation Genetics in the Neotropics Pedro M. Galetti Jr., 2023-08-29 This book explores how genetics and the new technologies in genomics have been used for conservation of plants and animals in the Neotropics It shows the new perspective for conservation genetics beyond the use of theoretical and methods in genetics at species level and presents how genetics and genomics can be used for assessing communities Conservation genetics and genomics are presented as a helpful field of study for resolving taxonomic uncertainties and hidden biodiversity understanding populations and extinction risk genetic management wildlife forensic genetics assessing biology and molecular ecology assessing communities conservation genomics and the use of conservation biology and genetics in science learning highlighting case studies in the Neotropics Applications of conservation genetics for management or policy decision making planning and implementation of conservation practice in the Neotropics are addressed across chapters This book will interest to researchers and students in conservation genetics and biology conservation interested in the Neotropics Stakeholders and decision makers in conservation biology may also find this book useful

Wildlife Necropsy and Forensics P.K. Sriraman, 2021-04-13 The book discusses various necropsy procedures for wild animals both for the disease investigation and forensic usage The list of various wildlife crimes the role of each member of wildlife crime team investigation in general and the role of pathologist in particular the forensic veterinary pathology and the salient features of methodology of crime investigation is given Information on the mistakes and omissions in forensic necropsy negative necropsy common errors committed by pathologist while performing forensic necropsy postmortem

appearances of common pathological conditions and estimation of age of some of the domestic animals and their fetuses is given for guidance Various types of wounds and the types of firearms and their terminology are also given for easy understanding about the wounds and fire arms Note T F does not sell or distribute the Hardback in India Pakistan Nepal Bhutan Bangladesh and Sri Lanka *Forensic Science & Its Evidentiary Value* Mr. Rohit Manglik, 2024-03-21 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels **Fundamentals of Forensic**

Biology Avinash Puri, Nithyanandam Mahalakshmi, Tanya Chauhan, Alka Mishra, Preeti Bhatnagar, 2024-06-13 This textbook for graduate students presents fundamental and essential principles of forensic biology It covers the theory principles and applications of forensic biology focusing on the easier understanding of the applicability of the topics It discusses the subject with an aim to enhance the theoretical and practical knowledge of the subject and explore the potentials of the fields in modern day crime scene investigation for researchers and practitioners of the field The book is supplemented with real life case studies from national and international cases significant to the discipline or unique approach to evidence analysis Notably the textbook discusses forensic sample analysis emerging trends and new technologies and legal and ethical concepts about forensic investigations It further presents the history and development of forensic DNA profiling and the role of DNA databases in forensic investigations It elucidates the applications of nanotechnology in forensics and examines the role of forensics in attributing acts of bioterrorism or bioproliferation *Wildlife Forensics* Jane E. Huffman, John R. Wallace, 2012-02-08 *Wildlife Forensics Methods and Applications* provides an accessible and practical approach to the key areas involved in this developing subject The book contains case studies throughout the text that take the reader from the field to the lab analysis to the court room giving a complete insight into the path of forensic evidence and demonstrating how current techniques can be applied to wildlife forensics The book contains approaches that wildlife forensic investigators and laboratory technicians can employ in investigations and provides the direction and practical advice required by legal and police professionals seeking to gain the evidence needed to prosecute wildlife crimes The book will bring together in one text various aspects of wildlife forensics including statistics toxicology pathology entomology morphological identification and DNA analysis This book will be an invaluable reference and will provide investigators laboratory technicians and students in forensic Science conservation biology classes with practical guidance and best methods for criminal investigations applied to wildlife crime Includes practical techniques that wildlife forensic investigators and laboratory technicians can employ in investigations Includes case studies to illustrate various key methods and applications Brings together diverse areas of forensic science and demonstrates their application specifically to the field of wildlife crime Contains methodology boxes to lead readers through the processes of individual techniques Takes an applied approach to the subject to appeal to both

students of the subject and practitioners in the field Includes a broad introduction to what is meant by wildlife crime how to approach a crime scene and collect evidence and includes chapters dedicated to the key techniques utilized in wildlife investigations Includes chapters on wildlife forensic pathology zooanthropological techniques biological trace evidence analysis the importance of bitemark evidence plant and wildlife forensics best practices and law enforcement *Wildlife Forensic Investigation* John E. Cooper, Margaret E. Cooper, 2013-05-23 Wildlife forensics is the application of forensic science to the conservation and protection of non domesticated animals both in the wild and in captivity Providing an in depth introduction to this rapidly evolving field *Wildlife Forensic Investigation Principles and Practice* also chronicles aspects of the history of management conservation and environmental protection with an emphasis on their global importance in the twenty first century The book examines the crucial role of wildlife forensic investigation with regard to live animals dead animals and samples and covers national regional and international legislation While the text particularly focuses on forensic science as it relates to wild animals it also includes mention of plants and habitats because of their relevance to conservation The book discusses animal welfare as well as the damage that can be inflicted on humans and property by wildlife Offering access to sound evidence based on good science and obtained using the best available practices the book is enhanced by case studies from experts who describe some of their own work This resource is essential for those involved in a range of endeavours including investigating wildlife crime identifying animal remains ascertaining the circumstances of death of wild species and other legal proceedings and activities concerning wildlife The forensic skills described in this book can be applied to a wide range of activities not necessarily involving the legal process including environmental impact assessments insurance claims governmental and other enquiries checking of trading standards and the inspection of for instance pet shops animal boarding establishments and zoological collections The authors point out that one of the most important requirements of those persons involved in wildlife forensic work is to retain an open mind Such personnel should also be conscious of new developments and evolving techniques and be able to anticipate situations where their investigative and scientific skills might be used to advantage so called horizon scanning Examples of these are given **Introduction to Veterinary and Comparative Forensic Medicine** John E. Cooper, Margaret E. Cooper, 2008-04-15 Introduction to Veterinary and Comparative Forensic Medicine is a ground breaking book in an emerging new speciality It reflects the increasing demand for expert opinion by veterinarians and others in courts of law and elsewhere on such matters as wildlife conservation welfare of and alleged cruelty to animals insurance certification and malpractice the identification of live and dead species or their derivatives It also discusses and analyses current concern over possible links between domestic violence and abuse of animals Throughout the book the emphasis is on the need for a systematic and thorough approach to forensic work A particular feature is practical advice with protocols on dealing with common problems together with case studies various appendices and an extensive bibliography A vital reference for members of the veterinary profession lawyers

enforcement bodies and welfare and conservation organisations The comparative aspects provide an important source of information for those working in human forensic medicine and the biological sciences

The Office of Law Enforcement Annual Report:1999 , Environmental Quality Council on Environmental Quality (U.S.),1989 The Forensic Laboratory Handbook Procedures and Practice Ashraf Mozayani,Carla Noziglia,2010-12-14 Forensic science has come a long way in the past ten years It is much more in depth and much broader in scope and the information gleaned from any evidence yields so much more information than it had in the past because of incredible advances in analytic instruments and crucial procedures at both the crime scene and in the lab Many practices have gone digital a concept not even fathomed ten years ago And from the first collection of evidence to its lab analysis and interpretation to its final presentation in court ethics has become an overriding guiding principle That s why this new edition of this classic handbook is indispensable The Forensic Laboratory Handbook Procedures and Practice includes thirteen new chapters written by real life practitioners who are experts in the field It covers the tried and true topics of fingerprints trace evidence chemistry biology explosives and arson forensic anthropology forensic pathology forensic documents firearms and toolmarks This text also addresses an array of new topics including accreditation certification ethics and how insects and bugs can assist in determining many facts including a margin of time of death In the attempt to offer a complete and comprehensive analysis The Forensic Laboratory Handbook Procedures and Practice also includes a chapter discussing the design of a laboratory In addition each chapter contains educational requirements needed for the discipline it covers Complete with questions at the end of each chapter brief author bios and real crime scene photos this text has risen to greet the many new challenges and issues that face today s forensic crime practitioners

Social and economic impact of environmental policies R. Swarup,S. N. Mishra,V. P. Jauhari, *Crime Laboratory Digest* ,1987 Department of the Interior and Related Agencies Appropriations for 1998 United States. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies,1997

Department of the Interior and Related Agencies Appropriations for 1998: Justification of the budget estimates, Bureau of Land Management United States. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies,1997

Police Behavior, Hiring, and Crime Fighting John A. Eterno,Ben Stickle,Diana Scharff Peterson,Dilip K. Das,2021-09-27 This edited collection by internationally recognized authors provides essays on police behavior in the categories of police administration police operations and combating specific crimes Individual chapters strike at critical issues for police today such as maintaining the well being of officers handling stress hiring practices child sexual exploitation gunrunning crime prevention strategies police legitimacy and much more Understanding how police are hired and behave is a way of understanding different governments around the world The book will cover the practices of countries as diverse as China Germany India Japan Turkey South Africa the United States and others Readers will be exposed to aspects of police that are rarely if ever explored The book is intended for a wide

range of audiences including law enforcement and community leaders and students of criminal justice **DNA Fingerprinting: Advancements and Future Endeavors** Hirak Ranjan Dash,Pankaj Shrivastava,Braja Kishore Mohapatra,Surajit Das,2018-11-01 This book describes the basics and various applications of DNA fingerprinting including in actual case studies The book is divided in four modules Module 1 Basics of DNA Fingerprinting Module 2 Applications of DNA Fingerprinting Module 3 DNA Fingerprinting Case Studies and Module 4 Future of DNA Fingerprinting Each module consists of 4 to 5 chapters written by reputed researchers academics and forensic scientists from around the globe The respective chapters cover e g related fields the tools and techniques used various genotyping kits real world case studies ancient DNA and wild life forensics molecular diagnosis of human diseases legal aspects microbial forensics and the economics of the DNA fingerprinting technique The book offers a practical guide for professionals graduate and post graduate students in the fields of Forensic Science Medicine Genetics Anthropology Microbiology and Zoology It also serves as a useful reference resource summarizing major technological advances in the field of DNA fingerprinting the problems faced in this field of science and possible new solutions to these problems Presently DNA fingerprinting is utilized in solving the majority of criminal cases as such the book is also helpful for investigating agencies as it includes representative case studies **Interior, Environment, and Related Agencies Appropriations for 2018: Testimony of Interested Individuals and Organizations: Members' Day Hearing, February 28, 2017; American Indian** United States. Congress. House. Committee on Appropriations. Subcommittee on Interior, Environment, and Related Agencies,2017 **Department of the Interior and related agencies appropriations for 1990** United States. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies,1989 **Department of the Interior and Related Agencies Appropriations for 1990: Testimony of public witnesses for resource management programs** United States. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies,1989

This book delves into Forensic Wildlife Parts And Their Product Identification. Forensic Wildlife Parts And Their Product Identification is a vital topic that must be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Forensic Wildlife Parts And Their Product Identification, encompassing both the fundamentals and more intricate discussions.

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- This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Forensic Wildlife Parts And Their Product Identification.

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Table of Contents Forensic Wildlife Parts And Their Product Identification

1. Understanding the eBook Forensic Wildlife Parts And Their Product Identification
 - The Rise of Digital Reading Forensic Wildlife Parts And Their Product Identification
 - Advantages of eBooks Over Traditional Books
2. Identifying Forensic Wildlife Parts And Their Product Identification
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Forensic Wildlife Parts And Their Product Identification
 - User-Friendly Interface
4. Exploring eBook Recommendations from Forensic Wildlife Parts And Their Product Identification
 - Personalized Recommendations
 - Forensic Wildlife Parts And Their Product Identification User Reviews and Ratings
 - Forensic Wildlife Parts And Their Product Identification and Bestseller Lists
5. Accessing Forensic Wildlife Parts And Their Product Identification Free and Paid eBooks
 - Forensic Wildlife Parts And Their Product Identification Public Domain eBooks
 - Forensic Wildlife Parts And Their Product Identification eBook Subscription Services
 - Forensic Wildlife Parts And Their Product Identification Budget-Friendly Options
6. Navigating Forensic Wildlife Parts And Their Product Identification eBook Formats
 - ePub, PDF, MOBI, and More
 - Forensic Wildlife Parts And Their Product Identification Compatibility with Devices
 - Forensic Wildlife Parts And Their Product Identification Enhanced eBook Features
7. Enhancing Your Reading Experience

- Adjustable Fonts and Text Sizes of Forensic Wildlife Parts And Their Product Identification
- Highlighting and Note-Taking Forensic Wildlife Parts And Their Product Identification
- Interactive Elements Forensic Wildlife Parts And Their Product Identification
- 8. Staying Engaged with Forensic Wildlife Parts And Their Product Identification
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Forensic Wildlife Parts And Their Product Identification
- 9. Balancing eBooks and Physical Books Forensic Wildlife Parts And Their Product Identification
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Forensic Wildlife Parts And Their Product Identification
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Forensic Wildlife Parts And Their Product Identification
 - Setting Reading Goals Forensic Wildlife Parts And Their Product Identification
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Forensic Wildlife Parts And Their Product Identification
 - Fact-Checking eBook Content of Forensic Wildlife Parts And Their Product Identification
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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