Wildlife Forensics: Methods and Applications

Jane E. Huffman
East Stroudsburg University, USA

John R. Wallace
Millersville University, USA

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 brings together in one text the 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.

ISBN 376-0-78482-9

WILEY-BLACKWELL
www.wiley.com/wiley-blackwell
Wildlife Forensics
Wildlife Forensics

Methods and Applications

Edited by

Jane E. Huffman
East Stroudsburg University, USA

John R. Wallace
Millersville University, USA
This book is dedicated to all wildlife agents/investigators for their outstanding service in protecting and conserving wildlife resources. We remember those wildlife conservation officers who gave the ultimate sacrifice so that others may enjoy the beauty and bounty of wildlife.
Contents

Developments in Forensic Science xiii
About the Editors xv
List of Contributors xvii
Foreword xxiii
Acknowledgements xxv

1 Wildlife Ownership 1
Eric G. Roscoe and Michael McMaster
Introduction 1
Ancient Rome and the Concept of Res Nullius 2
Common Law England: The King’s Ownership 3
The New World: Hunting for the Market 5
Management: The Property Right of States 8
Federal Law and the Regulatory State 10
Globalization: Working toward Worldwide Conservation Practices 11
Conclusion 13
Cases Cited 13
References 13

2 Society for Wildlife Forensic Science 15
DeeDee Hawk
Introduction 15
Formation of the Society 19
The Code of Ethics 22
Membership of the Society 24
Member Labs 25
Proficiency Program 25
Scientific Working Group for Wildlife Forensic Sciences (SWGWILD) 29
Conclusion 32
References 33

3 The Application of Forensic Science to Wildlife Evidence 35
John R. Wallace and Jill C. Ross
Introduction 35
Overview of Forensic Science 37


<table>
<thead>
<tr>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of Wildlife Forensics</td>
</tr>
<tr>
<td>Enforcement of Wildlife Protection Policy</td>
</tr>
<tr>
<td>Development of Wildlife Forensic Laboratories</td>
</tr>
<tr>
<td>Current Perceptions</td>
</tr>
<tr>
<td>Conclusion</td>
</tr>
<tr>
<td>Acknowledgements</td>
</tr>
<tr>
<td>References</td>
</tr>
</tbody>
</table>

4 Defining a Crime Scene and Physical Evidence Collection 51

*Jason H. Byrd and Lerah K. Sutton*

| Introduction | 51 |
| Definition of a Crime Scene | 51 |
| Questions to Be Asked | 52 |
| Scene Priority | 52 |
| First Responding Officer | 53 |
| Securing the Scene | 53 |
| Chain of Custody | 55 |
| Processing the Scene | 55 |
| Initial Documentation | 56 |
| Scene Documentation | 58 |
| Remains in an Aquatic Environment | 60 |
| Collection of Evidence | 61 |
| Review of Scene Processing | 62 |
| Final Inspection | 62 |
| References | 63 |

5 Forensic Evidence Collection and Cultural Motives for Animal Harvesting 65

*Michelle D. Hamilton and Elizabeth M. Erhart*

| Introduction | 65 |
| Wild Animals as Pharmacopeias | 66 |
| Trade in Wild Animals | 67 |
| Recovering Evidence at Poaching Scenes | 68 |
| Locating the Burial: Anomalies on the Surface | 71 |
| Acknowledgements | 76 |
| References | 76 |

6 Forensic Entomology and Wildlife 81

*Jeffery K. Tomberlin and Michelle R. Sanford*

| Introduction | 81 |
| Application of Forensic Entomology to Wildlife Crimes | 82 |
| Arthropods Commonly Encountered | 86 |
| Diptera | 88 |
| Coleoptera | 95 |
| Sampling | 98 |
| Conclusion | 100 |
| Appendix | 101 |
| Acknowledgements | 102 |
| References | 102 |
CONTENTS

7 Wildlife Forensic Pathology and Toxicology in Wound Analysis and Pesticide Poisoning 109
  Douglas E. Roscoe and William Stansley
  Introduction 109
  Wound Analysis 109
  Wildlife Poisoning by Insecticides 121
  Wildlife Poisoning by Rodenticides 123
  References 125

8 The Use of Hair Morphology in the Identification of Mammals 129
  Lisa Knecht
  Introduction 129
  Types of Hair 130
  Hair Structure 131
  Techniques for Studying Hair Structure 140
  Conclusion 142
  References 142

9 Plants and Wildlife Forensics 145
  Christopher R. Hardy and David S. Martin
  Introduction 145
  Plants as Trace Evidence 145
  Poisonous Plants 149
  The Basics of Collecting and Preserving Botanical Evidence 153
  Finding a Forensic Botanist 156
  Conclusion 156
  Acknowledgements 157
  References 157

10 Identification of Reptile Skin Products Using Scale Morphology 161
  David L. Martin
  Introduction 161
  International Trade in Reptile Skins 162
  Challenges to Species Identification of Reptile Skin Products 166
  Species and Products Represented in the Reptile Skin Trade 168
  Reptile Scale Morphology Basics and Current Limitations 170
  Identifying Features of Major Reptile Groups 178
  Conclusion 194
  Acknowledgements 195
  References 195

11 Best Practices in Wildlife Forensic DNA 201
  M. Katherine Moore and Irving L. Kornfield
  Introduction 201
  The Need for Appropriate Standards 203
## CONTENTS

Wildlife Forensic DNA Best Practices 206
Standards and Guidelines for Wildlife Forensics 206
Training 208
Case File 209
Laboratory Facility (QA) 213
Validation 214
Laboratory Protocols 216
Data Analysis 218
Interpretation Guidelines 220
Vouchers/Reference Samples 221
Species Identification 224
Reporting 224
Contents of the Case Report 225
Review 226
Court Testimony 229
The Way Forward 230
Note 230
Acknowledgements 230
References 231

### 12 Statistics for Wildlife Forensic DNA

*B.S. Weir*

Introduction 237
The Central Problem 238
Genetic Sampling 241
Lineage Markers 242
Relatedness 245
Inbreeding 247
Testing for Allele Independence 248
Assignment testing 250
Conclusion 251
References 252

### 13 Forensic DNA Analysis of Wildlife Evidence

*Sabrina N. McGraw, Shamus P. Keeler, and Jane E. Huffman*

Introduction 253
DNA Isolation and Handling 254
Polymerase Chain Reaction (PCR) 255
Sample Speciation 256
Minisatellites (VNTRs) 256
Mitochondrial Markers (mtDNA) 257
Additional Genetic Speciation Methods 259
Limitations of Genetic Speciation 260
Sample Sexing 261
Sample Individualization 262
Sample Localization 263
Validation of Wildlife Forensic Techniques 264
Court Admissibility 266
Conclusion 266
CONTENTS

Cases Cited 266
References 267

14 DNA Applications and Implementation 271
Robert Ogden
Introduction 271
History 272
Questions and Techniques: Wildlife Crime Issues 272
Species Identification 273
Identification of Geographic Origin 275
Individual Identification 279
Exclusion 280
Practical Applications 282
Sample Types for DNA Analysis 282
Laboratory Models: Individual Facilities 283
Future Developments 287
Summary 288
References 289

15 Conservation Genetics and Wildlife Forensics of Birds 293
Rebecca N. Johnson
Introduction 293
Avian Genetics 295
Avian Taxonomy, Legislation and Conservation 299
Avian Wildlife Forensics: A Range of Applications 302
Conservation Genetics and Wildlife Forensics: Identification Using DNA 307
Conclusion 315
References 317

16 Wildlife Forensics in Thailand: Utilization of Mitochondrial DNA Sequences 327
Suchitra Changtragoon
Introduction 327
DNA Extraction and Amplification 327
DNA Sequencing 328
Origin Identification 328
Species and Subspecies Identification 328
Results of the Investigations 330
Conclusion 338
Acknowledgements 341
References 341

17 The Future of Wildlife Forensic Science 343
Edgard O. Espinoza, Jesica L. Espinoza, Pepper W. Trail, and Barry W. Baker
Introduction 343
Technical Challenges 344
Enhancing Wildlife Protection by Integrating Forensic Science and the Law 350
# CONTENTS

<table>
<thead>
<tr>
<th>The U.S. Endangered Species Act and the Limits of Science</th>
<th>351</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Future of Forensic Scientists and the Laboratories in which They Work</td>
<td>353</td>
</tr>
<tr>
<td>Conclusion</td>
<td>355</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>356</td>
</tr>
<tr>
<td>References</td>
<td>356</td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td>359</td>
</tr>
</tbody>
</table>
Developments in Forensic Science

The world of forensic science is changing at a very fast pace. This is in terms of the provision of forensic science services, the development of technologies and knowledge and the interpretation of analytical and other data as it is applied within forensic practice. Practicing forensic scientists are constantly striving to deliver the very best for the judicial process and as such need a reliable and robust knowledge base within their diverse disciplines. It is hoped that this book series will be a valuable resource for forensic science practitioners in the pursuit of such knowledge.

The Forensic Science Society is the professional body for forensic practitioners in the United Kingdom. The Society was founded in 1959 and gained professional body status in 2006. The Society is committed to the development of the forensic sciences in all of its many facets and in particular to the delivery of highly professional and worthwhile publications within these disciplines through ventures such as this book series.

Dr. Niamh Nic Daéid
Series editor
About the Editors

Dr. Jane Huffman, Ph.D. is the director of the Northeast Wildlife DNA Laboratory at East Stroudsburg University, where her work focuses on the application of genetic methods to wildlife law enforcement and conservation management. She runs wildlife DNA forensic training courses for conservation officers from New Jersey and Pennsylvania.

She, along with her students, has undertaken a wide range of applied research projects including the development of DNA profiling systems for game species in PA and NJ and microscopic hair characterization. The laboratory provides species identification tests for illegally sold wild meat. She provides forensic analysis and expert witness testimony in PA wildlife crime prosecutions.

Dr. Huffman is also the graduate student coordinator for the Department of Biological Sciences at East Stroudsburg University.

Dr. John R. Wallace, Ph.D., D-ABFE, F-AAFS, is one of 15 board-certified forensic entomologists and a diplomate of the American Board of Forensic Entomology. Dr. Wallace is a Professor of Biology and focuses on teaching courses in Entomology, Aquatic Biology, Aquatic Entomology, Forensic Entomology, Forensic Science, and Ecology and Evolution. His research interests cover topics such as mosquito and disease ecology as well as mosquito and blackfly surveillance, and the role of aquatic organisms such as insects, algae and crayfish on decomposition within forensic science.

As a forensic entomologist, Dr. Wallace has participated in criminal investigations all over the country since 1995. He has taught forensic entomology courses at the University level and workshops at various universities to law enforcement throughout the United States, published more than 45 articles or book chapters in National/International journals. He is a Fellow of the American Academy of Forensic Science and an active member since 2002. Dr. Wallace is a co-founder and past President of the North American Forensic Entomology Association (NAFEA) in 2005 as well as the editor-elect for the NAFEA newsletter.
Contributors

Barry W. Baker, M.A.
U.S. National Fish and Wildlife Forensics Laboratory,
United States Fish & Wildlife Service,
1490 East Main Street,
Ashland, OR 97520-1310, USA

Jason H. Byrd, Ph.D., D-ABFE, F-AAFS
William R. Maples Center for Forensic Medicine,
Department of Pathology, Immunology, and Laboratory Medicine,
College of Medicine,
University of Florida,
Gainesville, FL, USA

Suchitra Changtragoon, Ph.D.
Forest Genetics and Biotechnology Division,
Forest and Plant Conservation Research Office,
Department of National Parks, Wildlife and Plant Conservation,
61 Phaholyothin, Chatuchak,
Bangkok,
Thailand 10900

Elizabeth M. Erhart, Ph.D.
Department of Anthropology,
Texas State University-San Marcos,
601 University Drive,
San Marcos, TX 78666, USA

Edgard O. Espinoza, Ph.D.
U.S. National Fish and Wildlife Forensics Laboratory,
United States Fish & Wildlife Service,
1490 East Main Street,
Ashland, OR 97520-1310, USA
CONTRIBUTORS

Jesica L. Espinoza, J.D.
Office of Law Enforcement,
United States Fish & Wildlife Service,
16507 SW Roy Rogers Road,
Sherwood, OR 97140-9292, USA

Michelle D. Hamilton, Ph.D., D-ABFA
Department of Anthropology,
Texas State University-San Marcos,
601 University Drive,
San Marcos, TX 78666, USA

Christopher R. Hardy, Ph.D.
James C. Parks Herbarium,
Department of Biology,
Millersville University,
Millersville, PA 17551, USA

DeeDee Hawk, M.S.
Wyoming Game and Fish Wildlife Forensic Laboratory,
Department 3312,
1000 E University Avenue,
Laramie, WY 82071, USA

Jane E. Huffman, Ph.D., M.P.H.
Northeast Wildlife DNA Laboratory,
Department of Biological Sciences,
East Stroudsburg University,
East Stroudsburg, PA, 18301, USA

Rebecca N. Johnson, Ph.D.
Australian Museum, Head of Research
DNA Laboratory,
6 College Street,
Sydney, NSW 2010, Australia

Shamus P. Keeler, M.Ed., M.S.
Southeastern Cooperative Wildlife Disease Study,
Department of Population Health,
College of Veterinary Medicine,
University of Georgia, Athens, GA 30602
Department of Infectious Diseases,
College of Veterinary Medicine,
University of Georgia, Athens, GA 30602, USA
CONTRIBUTORS

Lisa Knecht, M.S.
Northeast Wildlife DNA Laboratory,
East Stroudsburg University,
East Stroudsburg, PA 18301, USA

Irving L. Kornfield, Ph.D.
Molecular Forensics Laboratory,
University of Maine,
Orono, ME, USA

David L. Martin, Ph.D.
Canorus Ltd.,
5669 Snell Ave. #297,
San Jose, CA 95123,

David S. Martin
James C. Parks Herbarium,
Department of Biology,
Millersville University,
Millersville, PA 17551, USA

Sabrina N. McGraw, D.V.M., M.S.
Southeastern Cooperative Wildlife Disease Study,
Department of Population Health,
College of Veterinary Medicine,
University of Georgia, Athens, GA 30602
Department of Pathology,
College of Veterinary Medicine,
University of Georgia, Athens, GA 30602, USA

Michael McMaster, J.D.
20234 E Lake Cir,
Centennial, CO 80016-1281, USA

M. Katherine Moore, M.S.
Marine Forensics Program,
Center for Coastal Environmental Health and Biomolecular Research,
National Centers for Coastal Ocean Science,
National Ocean Service,
National Oceanic and Atmospheric Administration,
219 Fort Johnson Road,
Charleston, SC 29412 USA
Robert Ogden, Ph.D.
Program Director,
TRACE Wildlife Forensics Network,
c/o The Animal Conservation and Education Department,
Royal Zoological Society of Scotland,
134 Corstorphine Road,
Edinburgh EH12 6TS, UK

Douglas E. Roscoe, M.S., Ph.D.
New Jersey Division of Fish and Wildlife,
Office of Fish and Wildlife Health and Forensics,
P.O. Box 394,
Lebanon, NJ 08833, USA

Eric G. Roscoe, J.D., LL.M.
5415 Connecticut Ave. NW,
Washington, DC 20015, USA

Jill C. Ross, B.S.
Department of Biology,
Millersville University,
Millersville, PA 17551, USA

Michelle R. Sanford, Ph.D.
Department of Entomology
2475 TAMU
College Station, TX 77843-2475, USA

William Stansley, M.S.
New Jersey Division of Fish and Wildlife,
Office of Fish and Wildlife Health and Forensics,
P.O. Box 394,
Lebanon, NJ 08833, USA

Lerah K. Sutton, B.A.
William R. Maples Center for Forensic Medicine,
Department of Pathology, Immunology, and Laboratory Medicine,
College of Medicine,
University of Florida,
Gainesville, FL, USA

Jeffery K. Tomberlin, Ph.D., D-ABFE, F-AAFS
Forensic & Investigative Sciences Program,
Department of Entomology,
2475 TAMU,
College Station, TX 77843-2475, USA
CONTRIBUTORS

Pepper W. Trail, Ph.D.
U.S. National Fish and Wildlife Forensics Laboratory,
United States Fish & Wildlife Service,
1490 East Main Street,
Ashland, OR 97520-1310, USA

John R. Wallace, Ph.D., D-ABFE, F-AAFS
Department of Biology,
Millersville University,
Millersville, PA 17551, USA

B.S. Weir, Ph.D.
Department of Biostatistics,
University of Washington,
Seattle,
WA 09195-7232, USA
Foreword

Killing wild animals is big business. While much wildlife trade is legal, a massive black market exists. The species and products involved run the gamut from tarantulas to tigers. The rarer the animal, the more people want it. As a result, wildlife trafficking targets those species already under threat and least able to withstand the losses.

Laws to protect wildlife can be found in international treaties, like the Convention on International Trade in Endangered Species (CITES), and in national legislation, such as the Lacey Act and Endangered Species Act in the United States. Yet, to be effective, those laws require enforcement.

Enforcement involves not only catching poachers and traffickers but also prosecuting and convicting them. For that, one must link a suspect to his or her crime. The problem is, when an animal is hunted down and killed, there aren’t any eyewitness accounts. The victims’ relatives and neighbors can’t talk. And once the victim leaves the poachers hands, it’s sliced and diced and processed until it’s eventually transformed into a host of consumable products – from trinkets and high fashion accessories to traditional medicines. Its identity is lost. That makes the prospects for prosecution slimmer and slimmer.

Wildlife forensics changes that. By identifying the victim and allowing the evidence to speak, it connects suspects to their illegal actions.

Wildlife forensics, like human forensics, uses science to answer a legal question. For wildlife forensic scientists, however, most of the time that legal question is to identify the victim. For wildlife crimes, figuring out what the victim is is essential to establish that a crime even took place. That’s because some species are protected and others are not. For instance, a wool shawl made from cashmere goats is legal but one from Tibetan antelopes is not. Traffickers know the differences in the laws so that, when caught, they often claim that the item they smuggled is legal because it’s from an unprotected species. Unless an investigator proves otherwise, the suspect goes free. That’s where wildlife forensics comes in: proving the crime.

Identification of a species from a part or product is extremely complicated. For example, take an item like a feathered headdress. Normally, ornithologists have a lot to go on when they identify a bird: its size, shape, plumage pattern,
geographical location, habitat, vocalizations, flight pattern, diet and other behavior. But when a forensic ornithologist receives that item in his or her lab, (s)he has just a fragment of that information to go on – often just an isolated feather.

Most birds have about 5,000 feathers. Within the same species, those feathers will vary depending on their location on the bird and whether they are from males or females, or juveniles or adults. To complicate matters, feathers from one part of the bird – like the wing or tail – might exhibit diagnostic characteristics, meaning something unique to that species, while feathers from another part of that same bird – like the chest – might not. The same thing happens with claws or teeth. A single species can display significant variation, and there may or may not be distinguishing traits for each variation.

Now, imagine you don’t even know what the part is. Imagine the evidence is a tooth or tusk that’s been carved, so that you no longer have the size or shape to go on. Or a rhino horn or bear gall bladder that’s been ground up into a medicine. For each species, wildlife forensic scientists must find some sort of identifying characteristic. Not only that, but they have to do it for each part of each species, and they need to account for the many different ways a part might be processed or manufactured.

The complexities don’t stop there. Wildlife forensic scientists have to be ready to answer new types of legal questions as they occur. Sometimes that will still mean answering the “what is it?” question but for species that are newly protected. Other times, it will mean focusing on a different question, like “where did it come from?” When trade is permitted for distinct populations of otherwise protected species, as has happened with the recent one-off sales of elephant ivory from southern African stockpiles, the ability to tell where a sample came from is critical. The “where did it come from?” question of geographic origin is also a critical question to determine whether an exotic pet was captive-bred, which typically is legal, or wild-caught, which is not. For each part of each species, and for the legal question involved, the characteristic might be different, and the method for finding them may also vary.

In my view, Wildlife Forensics: Methods and Applications will go a long way toward helping share information and advancing the field of wildlife forensic science. Every step – whether it’s a new case that results in uncovering an identifying characteristic for a species’ part or a budding scientist exploring these issues – pushes the science forward. The end result will be more and more heroes able to link suspects to their crimes – and ultimately a slowdown in the extent of wildlife trafficking.

Rhinos can’t call 911. Instead, law enforcement agents, and the wildlife forensic science that support them, give them a voice – one that grows stronger every day. This book will help in that vital mission.

Laurel A. Neme, Ph.D.

Author, ANIMAL INVESTIGATORS: How the World’s First Wildlife Forensics Lab is Solving Crimes and Saving Endangered Species

May 2011
Acknowledgements

The editors of this work would like to extend our deepest appreciation and gratitude to the contributors of this text. This book would not have been possible without the diverse experiences, professional efforts and research endeavors of those who contributed. JH would like to thank Terri Ombrello and Kim Harle for their invaluable assistance and comments, Alan Semon and Matt Guesto for logistical assistance. JW would like to thank Susan, Harrison and Max Wallace, Peg Wallace, Ann and Bob Stackpole, Ostrowski/Sikora/Sheaffer families for logistical assistance to be able to work on this book and to Laurie Goodrich (Hawk Mountain Sanctuary) and Wallace research lab for their invaluable discussions.
1

Wildlife Ownership

How the state became responsible for management

Eric G. Roscoe and Michael McMaster

Introduction

Forensic techniques that identify wildlife, and assist in linking wildlife crimes to the responsible party are invaluable to the legal community. This book has been devoted to assisting law enforcement in the identification of individuals responsible for wildlife crimes. The identification techniques provided by forensic science are even more important in the courtroom. Oftentimes law enforcement has a good idea as to who committed a crime, and simple investigative techniques will reveal the most likely suspect. However, once that suspect is identified, focus turns to providing enough admissible proof in court so that a conviction can be obtained. DNA identification has permitted attorneys to quantify facts that in the past where left up to impressions. Proof that meat found in a suspect’s freezer matches with 98% certainty a carcass found in the woods removes the factual issue from the table. The judge or jury only needs to consider whether the law, as applied to the fact that the freezer meat matched the carcass, requires that the suspect be found guilty or not. There may be due process problems inherent in jurors’ willingness to accept DNA evidence as infallible without being able to properly weigh the effects of mishandled evidence or improper gathering techniques, however, that is beyond the scope of this book (DeWitt, 1996).

The question of the law is separate from the factual question in the case. In criminal proceedings the prosecutor decides which law is to be applied, meaning which law has been violated. The prosecutor and, if there is a jury, the judge will
explain the law that the suspect is accused of breaking, and what facts the state will prove in order to find the suspect guilty.

The purpose of this section is to address the question of law. State authorities draft most laws regulating the taking of wildlife in the US. The federal government tends to regulate broader issues that concern the transportation of wildlife across state lines as well as internationally. State and federal governmental authority to regulate the taking of wildlife is derived from a legal history stretching nearly 2,700 years. The first half of this section follows the development of wildlife regulation from the property rights of ancient Rome through the royal prerogatives of King Charles’ England to the unlimited resources of Colonial America. The second half focuses on present-day state, federal, and international regulations affecting the taking, transportation, and management of wildlife.

Ancient Rome and the Concept of *Res Nullius*

Ownership is a pivotal concept in understanding the Roman citizen’s relationship with wildlife. Some of the earliest legal writings, dating back to the time of the Sumerians in ancient Mesopotamia, recognize the ability of humans to own or possess animals (Wise, 1996). The concept of wildlife as property allows separation between what is mine and what is yours. This is my dog, not your dog. In the legal realm, ownership is incredibly important when determining schemes of compensation. Laws based upon the economics of owning property allow compensation for damaged or stolen property (ibid.). You have killed my dog so you must give me your dog or financially compensate me. Ownership of the dog as if it were property allows the law to create a resolution to situations in which one suffers a loss. If I could not own the dog, then I would suffer a loss for which there is no compensation if the dog is killed or stolen by another.

The Romans divided property into three main categories: *res publicae*, *res communes*, and *res nullius* (Blumm and Lucus, 2005). *Res publicae* refers to things owned by the state such as roads, ports, rivers, and public buildings. *Res communes* includes things that belong to the community like air, running water, and the sea. *Res nullius* are things owned by no one such as unoccupied lands, property of the enemy captured in battle, and wildlife. Things labeled as *res nullius* only belonged to no one as long as no one had taken possession of the item through *Occupatio* (Wise, 1996). An individual could own wildlife only after physically capturing the animal (Blumm and Lucus, 2005). If the animal escaped the cage, then it became *res nullius* again, if the animal fell dead on neighboring property, the property owner maintained the right to prevent a hunter from trespassing to retrieve the game (Wise, 1996).

Roman law saw wildlife in the open as owned by no one until it was captured. English law took a different perspective. Wildlife was property under English common law, but instead of being owned by no one, it was owned by the king.