Wildlife Forensics: A New Approach to Species Conservation and Preservation

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Abstract: In 1989, the U.S. Fish and Wildlife Service established the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon. The mission of the laboratory is to provide forensic support to law enforcement investigations at the federal, state, and international levels. The primary difficulty is that commonly accepted species-defining characteristics are often not present on wildlife parts and products seized by wildlife law enforcement officers and submitted to the lab as evidence. Thus one of the primary goals of the lab is to research, develop, and verify new species-defining characteristics that will enable the lab staff to make positive species-source identifications of the submitted evidence and to testify to those identifications in a court of law.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 47:752–756

In Spring 1989, in order to assist the law enforcement efforts of federal, state, and international wildlife officers, the U.S. Fish and Wildlife Service established a unique federal crime laboratory in Ashland, Oregon.

Housed in a modern 2,100 m^2, concrete and glass building, and located in a small Southern Oregon town of 16,700 that is known both nationally and internationally for its Shakespearean Festival, the National Fish and Wildlife Forensics Laboratory is unique in that it is the only full service crime laboratory in the world dedicated solely to wildlife forensics.

In terms of functional operation, the lab is divided into 3 analytical sections (criminalistics, serology, and morphology) and 3 support sections (administration, evidence and property control, and technical support). The lab is currently staffed with 18 forensic specialists of widely varying disciplines and 15 technical and clerical support personnel.

The mission of the new laboratory is to provide wildlife forensics support to 1.) approximately 220 special agents and 80 wildlife inspectors of the U.S. Fish and Wildlife Service's Division of Law Enforcement; 2.) any other federal agency investigating wildlife violations (i.e., the National Marine Fisheries Service, the National Park Service, the Forest Service, etc.); 3.) all 50 state fish and game agencies; and 4.) the 119 signatory countries of the Convention on International Trade in Endangered Species (CITES) Treaty.

Primary Functions of the Laboratory

Very much like any of the other 309 state and local crime laboratories and 40 Federal crime labs in the United States, this new wildlife forensics lab has 2 primary functions: first to identify seized evidence items, and then to link, in a triangular fashion, suspect, victim, and crime scene using physical evidence.

The process of linking suspect, victim, and crime scene is a fairly straight forward operation that, for the most part, utilizes long established crime scene investigation procedures. Much like in any other crime lab, we use a number of standard police forensic lab techniques (such as the comparison of fingerprints, footprints, tire tracks, bullets, tool marks, and questioned documents) to assist wildlife law enforcement officers in resolving the classic investigative questions of who, what, when, where, why, and how.

In fact, in terms of linking suspect, victim, and crime scene together, the only significant difference between our lab and the FBI crime laboratory (other than size, of course) is that in wildlife forensics, the victim is a non-human animal. Something that our forensic specialists must always keep in mind is that, every now and then, the primary suspect may be non-human as well. We must be able to distinguish between the natural interaction of animals in the wild and the activities of human violators of wildlife laws.

While investigating wildlife crime scenes is a relatively simple and straightforward process, the task of identifying evidence seized in a wildlife crime is anything but . . . which leads us directly to the basic forensic problem being addressed by the scientific members of our laboratory staff.

The Basic Forensics Problem

Simply stated, if the approximately 9,000 federal agents, wildlife inspectors, game wardens, and conservation officers who comprise our primary user groups always seized whole animals (e.g., whole elephants) as evidence, we wouldn't have much difficulty in making the necessary species identifications. If nothing else, I think we could expect the average juror to be able to recognize an elephant if one were brought into court (based upon well established elephant-defining characteristics, such as large ears, tusks, trunk, etc.). Trained biologists are certainly capable of using morphological "keys" to distinguish, for example, African from Asian elephants, and testifying as to that identification in court.

In reality, however, the wildlife investigators who submit their cases to our laboratory rarely seize whole animals as evidence. Rather, they tend to seize wildlife parts and products in which those long-established, species-defining characteristics are no longer present. Because there are few established methods for determining the species source of wildlife parts and products, it is often necessary for us to conduct extensive research into the characteristics of a species before we can examine evidence on a submitted case.

Thus, a primary task of our laboratory is to establish and verify new species-defining characteristics that will allow us to write a report and to testify in court,

with absolute certainty, that a seized part of product came from a certain species and from no other animal species in the world.

Current Capabilities of the Laboratory

The Criminalistics Section

To date, the criminalistics section, under the supervision of Dr. Ed Espinoza, has had some of the more notable successes of the laboratory. Scientists have developed 1.) a method of identifying the species source of all ivories; 2.) a non-destructive means of distinguishing African and Asian elephant carvings from mammoth and mastodon carvings when the ivory in question is not fossilized (for obvious reasons, it is not illegal to kill a mammoth or mastodon); a chemical means of distinguishing bear gallbladders from visually identical pig gallbladders; and most recently, a means of utilizing fractal mathematics and chaos theory to computerize the striation aspects of a bullet match.

In recent months, the criminalistics section has begun conducting chemical and instrumental analyses of submitted poison, pesticide, and gunshot residue evidence. In a typical example of a gunshot residue case, we might examine the tissue of an excised wound where a hunter, during bow season, is suspected of using a gun to kill a deer and then pushing a broadhead arrow into the wound to give the appearance of an arrow kill.

In addition to his conventional wildlife forensics work, Dr. Espinoza has also assisted investigators in trying to match *Tyrannosaurus rex* bones suspected of being stolen from a protected archaeological dig. As the director of the lab, I have the uneasy feeling that some day I am likely to find on my desk a purchase order from our criminalistics and serology sections requesting a dozen frog eggs and an extra-large choker chain.

The Serology Section

During the past 4 years, the serology section of the lab, under the supervision of Wayne Ferguson, has made tremendous progress in using both protein analysis and DNA analysis techniques to identify the species source of blood and tissue samples from any animal source in the world.

Using DNA and protein analysis, we hope to be able to answer a number of basic questions typically asked by wildlife investigators. These include:

Species identification—This is the most basic question of wildlife forensics, and is usually resolved in the serology section by a combination of protein and DNA analysis techniques.

Gender identification—An example of this type of case would be the situation in which a hunger spots a doe during buck season, determines that no one is looking, kills the doe, removes the head and genitals, and then attempts to bring a "generic" deer past the check-point. Our serologists have discovered a DNA "probe" which seems to be capable of resolving this gender identification issue for a large number of species. However, because a DNA analysis can typically take 10

days from start to finish and because the cost of such a test involves about $50 worth of supplies, we are now trying to refine and automate the procedure so that hundreds or thousands of "gender" samples can be analyzed during open hunting seasons. The ultimate goal, of course, is to develop a test kit that would give the wildlife officer probable cause in the field to seize a questioned carcass.

Matching of individual characteristics—This is, perhaps, the most significant advance made by our laboratory staff to date. In summary, using DNA technology, it is at least theoretically possible to match tissue from a kill site (i.e., "gut pile") with absolute certainty to meat from a freezer, or blood from a vehicle or a suspect's clothing. While this may sound more like science fiction (or at the very least, wishful thinking) to many of our field investigators, our lab is now capable of making such "individual matches" for all cervids (except moose), bear, wild sheep, walrus, and a limited number of bird species. As we continue on with our DNA research into the priority wildlife law enforcement issues, it is anticipated that this list will continue to grow . . . much to the delight of our user group investigators.

Determining the number of animals involved—Using a combination of protein analysis techniques (which give us species identifications) and DNA analysis (which give us individual characteristics), our scientists can often determine how many individual animals are involved in a seizure of, for example, dozens of wrapped meat packages from a suspect's freezer.

The Morphology Section

The morphology section of our laboratory, under the supervision of Dr. Stephen Busack, is responsible for visual and microscopic identifications of submitted wildlife parts and products, which are based upon long-established morphological characteristics. The section is divided into 3 units: mammals, birds, and reptiles.

A considerable amount of the section's efforts is directed toward the development of a comprehensive collection of vouchered or "known" specimens. In order to collect these specimens, our scientists are actively engaged in cooperative efforts with museum and zoo experts throughout the world. In addition, a large number of our known specimens are collected and submitted to the lab by game wardens and conservation officers throughout the United States as well by officials in the signatory CITES countries.

The Technical Support Section

The technical support section of our laboratory, under the supervision of Stu Mitchell, consists of a photo/video unit (with the capability of processing and printing a wide variety of film formats, as well as video recording and editing); a computer support unit (involving 45 in-house and networked computers and a growing number of link-ups with external databases); an electronics support unit (involving the use of transmitters, receivers, recording devices, and radio communications in the field); and a graphic arts unit (that creates courtroom displays for our experts).

The primary mission of the technical support section in the lab is to assist our forensic experts in documenting their research and casework and making their presentations in court. One future role of this section will be to establish a robotics capability within the lab in order to increase the number of samples which can be analyzed with a fixed number of scientists and to minimize the hazards to our lab staff in dealing with potentially lethal pesticide and poison evidence.

The Evidence and Property Section

The evidence and property section of our laboratory, under the supervision of Tom Rayl, consists of an evidence control unit (which receives, logs, tracks, packages, and returns evidence on submitted cases); a central repository (currently holding over 200,000 seized evidence items), an eagle repository (which receives and transfers bald and golden eagle carcasses to Native Americans), a crime scene unit (which, in addition to collecting evidence in the field, processes latent print and impression evidence); a lab maintenance unit (which maintains the facility); and a veterinary services unit (which includes a veterinary pathologist and a veterinarian who conduct necropsies, determine cause of death, and deal with live animals in field situations).

Summary

In the first 4 years of operation, the staff scientists of the National Fish and Wildlife Forensics Laboratory have made tremendous advances in their individual areas of forensic research and have managed to transfer a great deal of that technology to agents, game wardens, and conservation officers in the field. By continuing to work together with state, federal, and international wildlife officers, we hope to be able to report similar accomplishments, and have a similar impact on our user groups, in the future.