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The Importance of Understanding and Developing Identification Techniques in Wildlife Crime

By Savannah Nguyen

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Abstract: Wildlife crime continues to grow annually and globally, impacting several species and ecosystems. New advancements of technologies and techniques can track criminals and aid the affected victims. Highlighting the complexity of conservation and the development of identification techniques helps tackle this widespread dilemma. New developing techniques in wildlife forensics can differentiate an animal between wild and poached to pave the way for further advancement in understanding wildlife crimes. Hence, though the wildlife forensics field is still new, emphasizing the need for intricate identification techniques can help save threatened species.

Keywords: Wildlife forensics, forensic science, conservation, wildlife conservation, hemastix testing, DNA sequencing

Introduction:

Wildlife crime stems from human interaction and leads to damaged ecosystems and populations. Wildlife crimes, usually driven by fashion demands and products from rare species, involve smuggling endangered species, causing abuse and suffering[1]. Cases that involve poached species taken for sale or display at zoos need efficient wildlife forensic science to combat the increasing amount of wildlife crime[1]. For example, at the Biscayne National Park, 77% of fish stocks in parks are overfished, preventing spawning and hurting populations[2]. The problem is growing so rapidly that even increasing the average population of fish species by 20% will not sustain certain species[2]. Utilizing forensic science to focus on specific affected species can allow for new crime detecting techniques to develop.

The Need for Conservation

In India, many threatened species exist, and one of them is the Indian pangolin. While it is an adaptable species, the population continues to decline in Sri Lanka due to wildlife crimes, such as hunting, poaching, illegal international trade, habitat loss, and fragmentation[3]. The Department of Forestry and Environmental Science at the University of Sri Jayewardenepura observed the pangolins to assess their conservation status and understand the pangolins' threats. The results demonstrate that more than 17,500 Asian pangolins had been traded, with the price increasing ten-fold between 2001 to 2014[3]. Though more laws have been put into effect, the uncontrollable growth

of illegal trade needs to be tracked to its origin. Therefore, the Indian pangolins stand as one of many examples to push the need for conservation.

Also, turtles and tortoises experience the same detrimental effects as pangolins. Tortoises are essential to the ecosystem because of their role in the food chain, and they act as scavengers to clean up water bodies, helping maintain healthy aquatic ecosystems. Currently, tortoises face threats due to illegal hunting for food in traditional Chinese medicine[4]. In Uttarakhand, India, a study utilized DNA sequences to gather more information to find the poaching areas' origins to save this species[4]. Thus, the investigation of wildlife crimes needs reliable information about the crime source to sustain the threatened and endangered species.

Identification techniques

Many studies that are conducted to solve the growing crisis deal with differentiation. In some instances, extensive illegal trapping and trading use decoys, creating confusion in depicting which animals are poached versus the purely wild ones. One study analyzed the isotopes of the Ortolan Buntings' feathers to indicate whether the bird has been illegally captured or grown in captivity[5]. When in captivity, the Ortolan Buntings consume different foods than in the wild, changing the isotopes in their feathers. Likewise, another study also conducted stable isotope analysis at feather samples from sub-Saharan countries[6]. The feather samples gave region, altitude, annual rainfall, and seasonal patterns, which were reasons for the various isotope

ranges[6]. Therefore, understanding the full benefits of isotope analysis allows poachers to be tracked, helping affected species.

Another type of identification method founded to find a resolution for the crimes is the development of DNA sequencing techniques. A multiplex genotyping assay was developed in one study to track illegal ivory trading in African and Asian elephants from Zimbabwe and Thailand[7]. The newly developed PCR-based dual-genus, multi-complex, PCR-based assay helped find the origin of illicit trading, assisting animals affected by illegal trade. A study in Zambia took three unknown animal cases, and with the advanced DNA barcoding from the COI gene, all three cases were correctly identified[8]. The DNA barcoding could specify which cases were affected by illegal poaching and which ones were merely domestic[8]. Therefore, continuous development of DNA sequencing techniques will enhance the ability to detect crimes in unlawful poaching.

Blood testing has been critical in forensic science in identifying the culprit of a crime. Though blood is an essential biological fluid to determine a suspect's identity in forensics, blood can also be utilized to assess the individualization of a bloodstain[9]. Kastle Meyer and Hemastix reagents are presumptive tests in forensic science used for the detection of blood[10]. However, the Kastle Meyer and Hemastix presumptive tests are predominantly used on human blood. A study in the United Kingdom focused on validating the use of either of the presumptive tests for non-human blood since criminality can involve the persecution and abuse of wild animals[10]. The two presumptive tests were then determined to be useful in forensic wildlife casework.

Thus, identifying the ability to use the presumptive test allows for the detection of possible sampling areas for DNA testing in forensic wildlife cases.

Forensic Entomology

Another helpful identification technique is the use of forensic entomology. A study used new autosomal-based DNA techniques that identified blowfly species to alleviate problems with conventional DNA markers. The current situation is that most insects captured at a crime scene are too immature and indistinguishable, making them unable to use for forensics. To combat this, bicoid sequencing pieces were amplified to depict species-specific DNA markers and aid in morphogenesis[11]. The bicoid sequence was determined to be useful for identifying forensically essential insect species through the use of PCR amplification on twelve blowfly species. Therefore, bicoid genomic sequencing can help forensic investigations identify when and what location an animal has been killed by inducing morphogenesis.

Furthermore, entomology can identify if an animal has been abused before its death. Knowing the body temperature, fly species, and insect development stage, abuse duration can be distinguished[12]. Comparisons of post-mortem colonizers can determine the longevity of the abuse. Besides abuse, entomology can also distinguish the stage of decomposition. The insect succession proves successful when fewer blowflies appear[12]. Understanding the importance of entomology and determining important features in investigations allows more crimes to be dissected carefully.

Conclusion

Wildlife crimes damage different species, their populations, and their ecosystems around the world. Observing threatened species helps to enact actions to help solve the root of the issue. For instance, new techniques, like multiplex genotyping assays, identifying individual isotopes, using specific genes for entomology, utilizing blood presumptive tests for accuracy and specificity, and using mitochondrial genes have been developed to track the culprits of the crimes. Though more knowledge is accumulating to understand the crisis, the situation will only worsen without communication. Recognizing endangered species and providing protection and help aids conservation and combats wildlife crime. Nonetheless, continuing to advance implemented techniques will help specifically identify where crimes occur and why. Hence, focusing on combatting the impact of wildlife crimes will improve multiple ecosystems.

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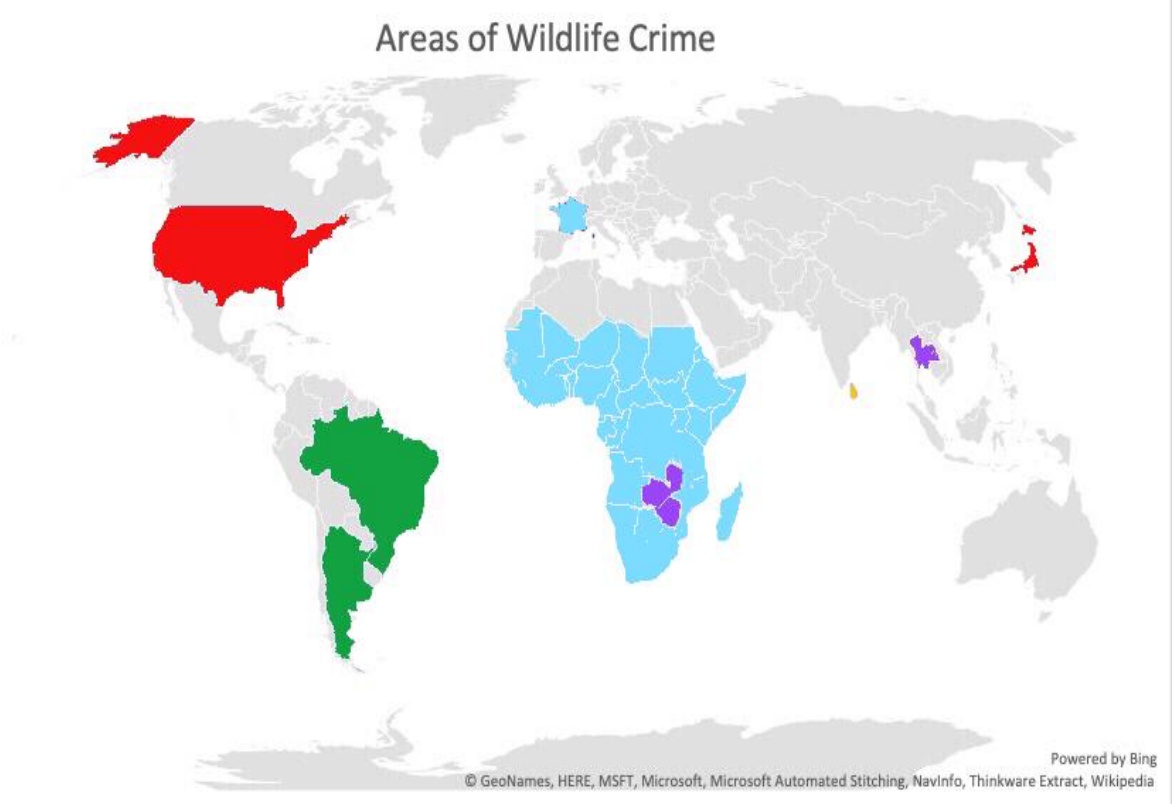

*Figure 1: Map Illustration of the Countries Affected. The map highlights countries that share the same wildlife crime or shares similar solutions. *Zimbabwe and Zambia are a part of the Sub-Saharan Region but do not share the exact solution to wildlife crimes.*

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