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Impact of Endangered Animal Protection Rights, Policies, and Practices on Zoonotic Disease Spread

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Honors Project

Submitted to the Honors College

Bowling Green State University

in partial fulfillment of requirements for

graduation with University Honors

December 7, 2020

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Impact of Endangered Animal Protection Rights, Policies, and Practices on Zoonotic Disease Spread

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Abstract

Building on field research in Costa Rica and Belize, this honors project analyzes environmental and endangered animal protection policies, rights, and practices in Central America and the Caribbean, and assesses the impact of veterinary science and biological research and practice, particularly conservation biology, on animal welfare concerns. Informed by the recent surge in awareness regarding zoonoses and zoonotic disease transmission, prevention and control, resulting from the current global pandemic of SARS-CoV-2, the project assesses the need for new and innovative types of collaboration, particularly involving conservation biologists, environmental scientists, public health experts, law and policy makers, and global trade and technology experts, is needed to save endangered and critically endangered species, not only in Central America and the Caribbean region, but worldwide. Given the attention to the COVID-19 pandemic, the honors project includes a case study on the *Manis javanica* (Sunda, Javan, or Malayan pangolin) and the impact of illegal trafficking of this critically endangered animal. Building on this case study, the project theorizes that awareness of zoonosis transmission, prevention and control, especially during a global pandemic, could be key to reducing the sale, either legal or illegal, of wild animals in order to mitigate zoonotic infection spread. Given that nearly sixty percent of all emerging infectious diseases are zoonotic in nature, and seventy-one percent of those zoonotic diseases originate in wildlife, this honors project argues that the COVID-19 pandemic could be instrumental in new awareness and policy development that can reduce illegal trafficking of endangered and critically endangered species.

Impact of Endangered Animal Protection Rights, Policies, and Practices on Zoonotic Disease Spread

Introduction

From illegal sales of critically endangered animals via the dark web (Fleming, 2012), to smuggling them on trans-Atlantic flights (CITES, 2014), to broader anthropomorphic environmental crises, numerous species of animals are at grave risk.

Focusing specifically on Central America and the Caribbean, and building on preliminary field research in Costa Rica and Belize, this Honors Thesis originally aimed to compare and contrast the success rates of environmental and endangered animal protection rights in Belize, Costa Rica, and Puerto Rico, and assess the impact of veterinary science and biological research and practice, particularly conservation biology, on animal welfare concerns.

Original Scholarly Focus and Questions

In order to compare and contrast wildlife conservation policy priorities (social, political, environmental) in the Americas, and the effectiveness of these national policies, in coordination with international organizations such as the United Nations Environmental Program, and policies and conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), this original project proposal included policy analysis to determine if conventions and treaties can prevent neotropical species from becoming endangered or extinct because of illegal trafficking. Original research questions included the following:

RQ1: What policies are in place in Belize, Costa Rica, and Puerto Rico to protect animals from exploitation for instrumental/economic value? What organizations enforce these conventions and treaties?

RQ2: What is the effectiveness of implementation of those policies in Belize, Costa Rica, and Puerto Rico to protect animals from exploitation for instrumental/economic value?

RQ3: What new types of collaboration and cooperation are needed to increase the success of this enforcement?

Given that the thesis proposal included field research in Puerto Rico in March 2020, Additional questions were included in the original thesis proposal:

RQ4: In what ways do populations in Belize, Costa Rica, and Puerto Rico express their commitment to the intrinsic value of animals, particularly endangered species?

RQ5: Do people in Puerto Rico have similar ideas as do people in the continental United States about the Endangered Species Act (ESA)?

RQ6: Do they support the ESA because it supports animals' intrinsic value? Or do they support people over animals (e.g., they support cattle farming for meat-eating Americans?

RQ7: Do those who claim they support ESA say they support the intrinsic value of animals, until they are compromised about supporting animals versus profit (for certain humans who profit off the ago-animal industry?

RQ8: How can those whose support the intrinsic value of animals be willing to convert to veganism or at least vegetarianism?

I was also particularly interested in asking the following questions, which have been lacking in research: How can we increase the intrinsic value of endangered species, without

increasing the monetary value that can be gained by illegal trafficking? How do we analyze and catch people doing illegal sales of endangered and exotic animals on the so-called "dark" or deep web? The second question was initially exciting to me as it is an area that has received little to no research attention. As I continued to think about actually responding to this question, I began to be increasingly unsettled. The "dark" or deep web is called that because it is a place where few people go to engage in honest, ethical work. This will be addressed more thoroughly in the literature review.

I also aimed to analyze the differences between monetary and intrinsic value of various species, particularly the Scarlet Macaw. Thus, I hoped to do interviews with residents in Playa Hermosa which is in the Puntarenas Province of Costa Rica where numerous animals including a large community of Scarlet Macaws live, and with directors and volunteers at the Costa Rica Animal Rescue Center.

How the Project Transformed as the World Transformed

during the COVID-19 Pandemic

This honors project transformed as the world transformed. Who could have possibly guessed, in December 2019 when I submitted the project proposal on endangered and critically endangered animals, that some of those very animals may have been playing a part in the worst public health crisis in a century?

A whole new vocabulary was introduced to the entire world in January 2020. The attention to what was originally identified by the World Health Organization China Country Office (cited in Lawrence, 2020, p. 21) as "cases of pneumonia of unknown etiology" Lu,

Stratton, Tang, 2020), or unknown cause, was called, first "novel coronavirus infection pneumonia," then SARS-nCov, SARS-CoV-2, and COVID-19. These terms were followed by others, previously not used among people outside science and medicine: PPE, social distancing, R-nought, Hydroxychloroquine, and others not used frequently, such as quarantine, contact tracing, and flattening the curve), and a new awareness of geography – first of Wuhan in the Hubei Province of China and then of Bergamo, Italy, in the northern Lombardy region.

It also reminded the world of other things in the not-too-distant past – diseases of the past few decades, such as Avian flu/SARS, Mad Cow Disease, Ebola, Middle East Respiratory Syndrome or MERS (few people knew early on in 2020 that this, too, started with a coronavirus, MERS-CoV), and of many centuries ago, such as the "Black Death" (circa 1342-1356) and the Great Plague of London in 1665. All of these had a common thread – a connection to non-human animals.

Research Questions

The common thread of the connection of non-human animals to deadly diseases in humans has shifted the focus of this Honors Project to address the current, crucial topic of zoonotic disease spread. The decision to revise the research questions was based on the importance of awareness about zoonosis due to the current pandemic, and because "[z]oonotic diseases today account for around sixty percent of all emerging infectious diseases, and seventy-one percent of these originate in wildlife" (Anand & Batra, 2020, para. 1). Who had heard of the pangolin before SARS-CoV-2? While many people had some idea that "aviary flu" had something to do with birds and that Zika was spread by mosquitoes, beyond that, there was very

little knowledge or awareness of zoonotic diseases. Thus, a new research question (RQ4) was added to this honors project. Also, a I looked at the existing research questions (RQ1-RQ3) through a new perspective -- not only are non-human animals dying at unprecedented rates, but, given the current deadly COVID-19 pandemic, humans are dying at unprecedented rates, possibly due to the transmission of diseases from non-human animals to humans.

RQ1: What policies are in place in Belize and Costa Rica to protect animals from exploitation for instrumental/economic value? What organizations enforce these conventions and treaties?

RQ2: What is the effectiveness of implementation of those policies in Belize and Costa Rica to protect animals from exploitation for instrumental/economic value?

RQ3: What new types of collaboration and cooperation are needed to increase the success of this enforcement of animal protection laws and policies?

RQ4: Can the COVID-19 pandemic help to raise awareness of zoonotic disease spread and, if so, can this awareness help to reduce instances of illegal wildlife trafficking?

A Literature Review for the Study of a "Wicked" Problem

The above research questions draw from existing research in a number of interdisciplinary areas: policy on endangered animals and conservation, policy history, biology, illegal trade and law enforcement, and the intrinsic value of these animals, and zoonosis. All of these areas lead to the first section of this literature: the ideas of "wicked" problems and how to address them through interdisciplinary and collaborative research, advocacy, and action.

Following the work of wildlife veterinarians (see, for instance, Cattet, 2013), this project argues for RQ3 that an interdisciplinary, collaborative effort is needed as well as an increased "mutual understanding between fields with respect to the other's training and experience in addressing animal welfare issues" (p. 33). For instance, in "Falling through the cracks: Shortcomings in the collaboration between biologists and veterinarians and their consequences for wildlife," Marc Cattet, DVM, Ph.D. (2013) argues, "Although biologists and veterinarians have shown considerable success in working together to address wildlife-related issues, including disease, chemical immobilization, reproductive biology, and conservation biology, examples of shared efforts to evaluate and ensure the welfare of study animals are mostly absent" (p. 33). An interdisciplinary, collaborative effort is needed as well as an increased "mutual understanding between fields with respect to the other's training and experience in addressing animal welfare issues. In effect, each assumes that the final word on animal welfare rests with the other. The reality is, however, that neither field contains the knowledge and skills required to address animal welfare concerns alone" (Cattet, 2013, p. 33).

So-called "wicked problems" require interdisciplinary expertise and analysis. Thus, this project brings together veterinary medicine, biology, conservation science, climate science, environmental (endangered species) policy, cultural studies, and rhetorical analysis to address what should be widely named the "extinction crisis" (Center for Biological Diversity, n.d.). It is also informed by scholarship in the area of values and explores the differing variations in intrinsic value of animal welfare in Belize, Costa Rica and, since the COVID-19 pandemic, China and other areas where certain animals that have been linked to the possible transmission of SARS-CoV-2, and the related ideologies about environmental ethics. It is informed by literature

on how different cultures and nations non-humans have different policies and states of ideas about the intrinsic value of the natural world.

What should be called the extinction crisis is certainly a wicked problem. For instance, at the thirty year anniversary of the U.S. Endangered Species Act (ESA), Scott, Goble and Davis (2003), wrote "It has been thirty years since the ESA was signed into law on December 28, 1973, and the task of conserving at-risk species is more complex than ever" (p. 4).

In their recent article, in the *Lancet*, titled, "Diabetes, like COVID-19, is a wicked problem," David Kerr and Namino Glantz (2020) characterize a wicked problem as one that "persists in perpetuity because of incomplete information, multiple (often selfish) stakeholder interests, a large economic burden, and a ripple effect whereby every action triggers a reaction with other wicked problems."

By contrast, "*Tame* problems can be solved by having engineers, clinicians, and scientists develop guidelines, algorithms, and systems that achieve easily measured outcomes that matter to these same stakeholders." Kerr and Glantz (2020) argue "COVID-19 is also a classic wicked problem, as evidenced by the unanticipated and disproportionate effect of the virus on minority racial and ethnic populations and individuals who have experienced health disparities."

I argue that studying the pandemic is even more wicked, in an interdisciplinary sense, because it draws in even more areas of study including but not limited to history, given its links to the pandemics from the Justinian plague to the 14th century Bubonic plague to the 1918 so-called "Spanish flu." Kerr and Glantz (2020) note "As the COVID-19 example shows, there is no single, correct, definite answer to a wicked problem." There are also issues emerging

during the pandemic that extend far beyond science and medicine. These include ethnonationalism and racism. Given the racism that has emerged in pandemics in history, and in the present, it also needs study from medical humanities, from economics and global trade, from ethnicity and cultural studies, and from journalism and media literacy – due to its "fake news" disinformation and misinformation; and from political science, given the way COVID-19 has been politicized.

Intrinsic Value of Endangered Species

The philosophical foundation of this Honors Project surrounds the question, as Dr. Justin Donhauser (2019) asks, "Is there any good reason to take measures to protect endangered species that have no value for anything we care about?" (p. 237). There are several environmental philosophers who are asking this and related questions concerning the valuation of species in terms of value of individual organisms that construct the species population, the worth of individuals in a given species population is grounded in the representational goals of those specific organisms, and species preservationist ethics (see, for instance, Adams, 2014; Agar, see Agar, 2017; Brown & Shogren, 1998; Callicott, 1986; Courchamp, Angulo, Rivalan, Hall, Signoret, et al., 2006; Davidson, 2013; Donhauser, 2020; Douglas & Alie, 2014; Hall, Milner-Gulland, & Courchamp, 2008; Maguire & Justus, 2008; McCord, 2012; Sandler, 2009; Sandler, 2012). Their research focuses on reasons to protect these species and the definitions of intrinsic value, specifically reasons as to why species obtain intrinsic value as well as alternate perspectives surrounding the topic.

One of the most important scholars in this area is Ian Smith. Smith (2016), in his book, *The Intrinsic Value of Endangered Species*, defines the concept of intrinsic value, which can be defined as an the artefact, entity, or individual must have value regardless of whether it is useful as a means to promote other ends or goals (Lau, n.d.). It has been argued throughout history that living beings have intrinsic value, and it has also been argued that anything with intrinsic value should be protected on the basis of morality and innate human obligation. Although this value assessment applies to a wide range of subjects, this paper focuses on endangered species. Protection for endangered species has always been noted as controversial, due to the fact that 99% of currently threatened species are at risk from human activities, primarily those driving habitat loss, introduction of exotic species, and the climate catastrophe. Humans have been creating a problem and then arguing as to why acts such as the U.S. Endangered Species Act of 1973 (ESA) are in place (Brown & Shogren, 1998). The ESA protects registered endangered species by removing them from a "take" list, making it unlawful for a person to shoot, harm, capture, trap, or attempt to harm any such actions to the species. The ESA protects the specific species in the habitat they were found in, which imposes limitations on those who desired the land for instrumental use. Another key complaint of the ESA is that saving some solely intrinsically valuable endangered species can result in a resource sink, in which the costs of protection outweigh the value of the species itself. This is where perception and the weight of value are manipulated in order to align with either side's viewpoint of this difference in opinion, whether or not these species possess intrinsic value.

Smith poses clear proposals for improving the ethicality of environmental policies and resource management strategies which would benefit the valuation of endangered species, as

well as help them sustain their individual populations. In order to do this, he defines what a species is, by stating that a species is a population or group that is reproductively isolated and ceases existing by going extinct or falling victim to natural selection. Then he critically responds to views of others such as Rolston Holmes, Lawrence Johnson, Baird Callicott in order to support his view that life is intrinsically valuable. He offers a complex mode to evaluate species and their intrinsic value. Smith also discusses the importance of understanding the innate value of species. In order to elaborate on the importance, he presents a case study surrounding the endangered humpback chub, *Gila sypha,* and discusses the efforts made to protect the endangered species. The humpback chub is an example of many endangered animal cases in which value becomes the most important role in land use regulation. Furthermore, the specific species is a good example of a species that possesses solely intrinsic value, as the chub has little to no aesthetic value. Smith (2016) argues "Since either the humpback chub has no clear instrumental value, or what little instrumental value it does have is likely outweighed by the costs of trying to save it, instrumental value cannot reasonably be used in a defense of its preservation" (p. 10). Smith argues that, on the basis of morale, the humpback chub should be protected due to its intrinsic value and its endangered status, however he brings up an important issue surrounding the protection of intrinsically valued species: the costs of saving the species. Dr. Justin Donhauser (2020), poses an important viewpoint that discusses the specificities required to save endangered chubs, and states that the conditions required would negatively impact numerous other valuable species, ones that pose instrumental values as well as intrinsic. He further explains that in order to produce and sustain the muddy conditions that the humpback chub requires to survive would adversely affect more than what the humpback

chubs perceived worth is, since the introduced fisheries, tourism, and reservoirs of usable water would all diminish over time. The pros of saving the humpback chub do not outweigh the cons and costs that are required for full protection. This makes it difficult for many with an economical and commercial mindset to want to save these species, because in many cases the only reasoning is that the only value is because they are alive.

Examples such as the humpback chub, in which the environment that the species is found must be altered to better protect the species and in turn damage the surrounding fragile ecosystem, are not completely addressed in the ESA. The ESA works to protect the species and the environment in which they are found until the species no longer requires protection, and is indistinct on whether that includes altering the environment completely in order to protect one species while simultaneously damaging the habitat of numerous other species. This puts humans in a situation in which they must decide whether they should protect endangered species and potentially impact other non-endangered species and the surrounding environment. This particular situation requires a more strict definition for what it means to be intrinsically valuable. Smith references Rolston's (1994) viewpoint in which Rolston further defines this by stating that each organism has a built in end, which implies that each organism had an end in itself. Meaning that with this telos, each organism also simultaneously has a good of its own, which further implies that organisms have intrinsic value (p. 51). To explain this further, ends are goals and goals can be defined from ranging ideas such as getting from point A to point B, or something more complex such as completing a masters degree. The difference between and end and a built in end is the way the brain responds to the stimuli and situation presented. For example, one may desire a goal, or an end, because they believe that this end is a means to

promote another end, and in this case they would be described as having a desired end that promotes some other ends. This individual may claim that they desire the original end whether they believe that end is a means to promote other ends, or a desire for this end for its own sake. and although this seems to separate the two goal sets initially, they can be the same goal the path of description is determined on they way that individual's brain interprets goals (Lau, n.d.). When Rolston (1994) argues that organisms have ends in themselves, it implies that they complete these goals for the purpose of the goals themselves, which further implies that species are capable of sustaining goal sets in their thought processes. The specific telos that Rolston (1994) assigns species is that their end is to survive and successfully reproduce based on environmentally evolved behaviors. Smith argues that his view is insufficient, because it provides an account of how species exist with intrinsic value, but lacks on why species should be protected.

Expanding on this viewpoint, Rolston (1994) had good intentions, however he was lacking a strong scientific basis of whether or not animals are capable of possessing ends, or if they are simply innately programmed subconscious actions. Observational research and studies have been done which support the idea that intelligence has an evolutionary basis and is prevalent throughout all species that have a neural network, including species as simple as the ant, *Formica rufa*. Self awareness could be a category of evaluation when determining the value of a species. Self awareness has no instrumental value and supports the notion that animals have the capability to have ends, because it further supports that species have the capacity to have thoughts. The self awareness test, or mirror self-recognition test (MSR), is a behavioural technique developed in 1970 by psychologist Gordon Gallup Jr. as an attempt to

determine whether an animal possesses the ability of visual self-recognition (Gallup, 1970). If an animal were to pass this test, it is more likely to have intrinsic value. This test is done by surreptitiously marking the animal with an odourless dye, and observing whether the animal reacts in a manner consistent with it being aware that the dye is located on its own body. This is just an example of a possible way to incorporate further physical testing in order to determine a species' value. There are obvious implications with this particular test, however the idea of determining an animal's intelligence can greatly increase the assessment of intrinsic value in protecting endangered species and their habitats. Incorporating animal intelligence into Smith's evaluation of individual species would create a stronger valuation scale that would help others determine how much time, money, and resources to invest into different species in order to reduce resource sinks in the future.

Smith's view of species and their intrinsic value would be useful in my honors project because it would help in supporting arguments as to why certain endangered species preservation acts should be taken more seriously, because one of the main arguments of saving endangered species is they lack "value," in the sense of instrumental value which is similar to intrinsic however it pertains more to an anthropogenic view in which the use value is determined by the person and the purpose they are determined to fulfill. Although morally one would naturally want to protect endangered species, situations such as the humpback chub arise which makes it difficult to protect the species due to the costs outweighing the value of the species. By creating a strong and feasible value evaluation scale, that includes animal intelligence in order to rank the amount of resources that go into a particular species, endangered species acts would be taken more seriously and the

number of endangered species would hopefully be reduced due to more individuals taking action to save these species.

It has been debated throughout history, as well as Ian Smith's (2016) book, whether or not these species have intrinsic value, however Smith gives a viewpoint which is beneficial in understanding value itself as well as value within a species set. Many argue that without instrumental value, protecting endangered species is not as important as many make it seem. Smith counters this opinion by arguing that endangered species possess intrinsic value, and should be protected regardless. Smith provides insight and reflects on others viewpoints surrounding the valuation of endangered species. In addition, Smith's definition of intrinsically valuable species can be extended through modes of animal intelligence.

Although ambitious, Smith makes a good argument as to why species should be protected from a philosophical standpoint. Smith's viewpoint can be utilized in various manners, and would be especially useful in defending arguments surrounding the topic of evaluating species and their value as well as use in further research surrounding the topic of protecting endangered species.

Illegal wildlife trafficking on the "darknet"

In a study from the University of Oxford's Oxford Martin Programme on Illegal Wildlife Trade, Wright (2019) in the article, "Darknet Usage in the Illegal Wildlife Trade," provides an overview on illegal markets that use Tor anonymous network services in order to hide users' and hosts' locations and operators. While the "darknet", also known as the "dark" web or deep web has been heavily in use for trafficking of drugs, guns, and other illicit products, Wright (2019)

notes "[t]he darknet has not, to date, proven to be a particularly attractive platform for the buying and selling of illegal wildlife" (p. 1). Roberts and Hernandez-Castro (2017) report that it is more likely that it is illegal wildlife products , such as elephant tusks and rhinoceros horns, that are trafficked on the "darknet."

Surprisingly, it is not the "darknet" but rather than easily accessible areas of the Internet where wildlife trafficking occurs. Marley (2017) reported similar findings to Wright (2019) and Roberts and Hernandez-Castro (2017) and, actually, quoted one of the authors, Julio Hernández-Castro, "Criminals can trade on the surface web without facing charges for the most part," said Julio Hernandez-Castro, who is a cybersecurity expert at Kent University, in England. He said, "That's why they don't feel compelled to move to the darknet as other criminals, selling drugs or firearms, are forced to" (cited in Marley (2017, para. 7). This is surprising and upsetting, because, as Marley (2017) writes that conservationists say it is "because it suggests that traders are content to sell wildlife products on mainstream websites like eBay, where they rely on the sheer volume of transactions and lack of regulation to mask their activity" (para. 2).

Other researchers, such as Harrison, Roberts, and Hernandez-Castro (2016) and Siriwat and Nijman (2020) believe that increased scrutiny of illegal animal trafficking will likely move this activity more to the "darknet." It will be interesting to see if future publications will address this, especially after COVID-19 pandemic. Recent briefs, such as "Coronavirus (COVID-19) and Wildlife Trafficking," by the Organisation for Economic Co-operation and Development (2020) suggest this.

Methodology

In order to analyze wildlife conservation policy priorities (social, political, environmental) in the Americas, and the effectiveness of these national policies, in coordination with international organizations such as the United Nations Environmental Program, and policies and conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), I conducted field research, policy analysis, and a case study analysis to find how policies, conventions and treaties can prevent non-human animals from becoming endangered or extinct because of illegal trafficking.

To answer the research questions, the original methodology included the following: Preliminary field research in Costa Rica (prior to Honors Project); Field research, Phase I; Analysis of animal welfare and conservation policies, including translation of policies from Spanish to English; and a case study of zoonotic disease spread of endangered animals.

Complex problems require what is called "triangulated" methodological approach Bekhet and Zauszniewski (2012) methodological triangulation as an approach that "involves using more than one kind of method to study a phenomenon. It has been found to be beneficial in providing confirmation of findings, more comprehensive data, increased validity and enhanced understanding of studied phenomena (p. 40). In addition to the policy analysis, case study and extensive literature review, it was the field research in Belize that made the greatest impact on my learning about endangered and critically endangered animals, and the widespread problem of illegal trafficking of these animals.

Phase I Field Research in Belize

Phase I of this Honors Project occurred during a veterinary science study abroad program in San Ignacio, Cayo Belize, in the Central American and Caribbean region. I drew upon the knowledge I gained from what was a pilot field research project, which was a June to July 2016 two-week trip to Costa Rica. The in-field experience in Belize occurred at the Belize Wildlife and Referral Clinic through the University of Florida Department of Wildlife Ecology and Conservation program in Belize and the Wildlife Institute, whose mission is to support opportunities for veterinary study abroad, and the Belize Wildlife Conservation and Sustainable Development through Collaboration. These organizations collaborate with undergraduate and graduate students, veterinary medical professionals and educators, and the Government of Belize and other national and international wildlife health professionals to develop national guidelines concerning wildlife and human health, to support wildlife conservation animal health and welfare, and the veterinary profession in Belize through medical services, education, research, and collaboration.

Preliminary observations and reflections from the Belize in-field experience were presented at the Embracing Global Engagement Undergraduate and Graduate Conference, Bowling Green State University Center for Undergraduate Research and Scholarship (CURS) (Fedak-Lengel, 2019, October). The CURS conference presentation focused on a range of topics including the need for more research and reporting on vector-borne diseases in Belize (see Maggi & Krämer, 2019). Specific courses taken during the study abroad program Wildlife Medicine and Conservation; Distance Immobilization; Reptile Medicine, Conservation, Handling, Restraint and Bathing; Green Iguana Population Health Survey; Comparative Wildlife Anatomy, Osteology and

Forensics; Basic Avian Fracture Repair, Wing Wrap and Clinical Applications; Population Biology; Conservation Medicine; and Wildlife Biology and Parasitology. Additional knowledge gained included the contributions of veterinary public health (VPH) in situations of disaster (see, for instance, Scheider, et al., 2012).

The Belize Wildlife Referral Clinic broadened my knowledge about the vastly unknown world of the dangers of exotic pet trade and the importance of veterinary practice to assist in combating the malpractices associated with this phenomenon. For instance, in their article in the journal Biological Conservation, Auliya, et al. (2016) note, "[o]f the 10,272 currently recognized reptile species, the trade of fewer than 8% are regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the European Wildlife Trade Regulations (EWTR)" (p. 103). However, Auliya, et al. (2016) report that "the International Union for Conservation of Nature (IUCN) Red List has assessed 45% of the world's reptile species and determined that at least 1390 species are threatened by 'biological resource use'. Of these, 355 species are intentionally targeted by collectors, including 194 non-CITES-listed species. Herein we review the global reptile pet trade, its impacts, and its contribution to the overharvesting of species and populations, in light of current international law" (p. 103).

In order to preserve the endangered ecosystem that Belize is battling, due to poachers and the imposed economic value behind the endangered species present, the Wildlife Protection Act - Wildlife law in Belize. This law reduced the cases of poaching tremendously, however many cases are still observed. In response to RQ2, these policies have not been very effective in decreasing the amount of abductions and poachings. In Costa Rica turtles are highly sought

after for their eggs (Busuttil, 2019). Biosphere Expeditions is a wildlife non-profit preservation organization composed of scientists, research assistants, and volunteers from the Latin American Sea Turtles association. Their goal is to reach the nesting turtles before any threat presents itself such as poachers, and allow as many eggs to hatch.

In response to Research question 3: What new types of collaboration and cooperation are needed to increase the success of this enforcement? There are, of course, numerous examples of scientific collaboration to support conservation and preservation of wildlife (Aguirre, Ostfeld, & Daszak, 2012; Auliya et al., 2016; Böhm, et al., 2013; Boyle & Bishop, 2010;

A team of scientists, Drs. Carlos Diez, Jafet Vélez-Valentin, and Antonio Mignucci, worked together to save endangered species in Puerto Rico. They began with 13 Puerto Rican Amazon Parrots, to 130 parrots released in 2017 (Guzman, 2017). Such efforts are encouraging, however, some of the situations I learned about during my field research were not. For instance, during my time at the Belize Wildlife and Referral Clinic, my classmates and I were shown numerous radiographs containing images of howler monkeys with bullets still inside their bodies. A common practice for obtaining howler and spider monkeys is to shoot the mother and steal the infant monkey for trade in the pet trade market.

As disturbing as this learning and awareness was during my study in Belize, I realized the importance of proper veterinary care, as well as the importance with public acknowledgment and advocacy. If more people are aware of the harms involved with obtaining exotic animals, there would be no demand for the possession of species at risk of extinction.

Endangered Species Policy Analysis

At the heart of this thesis, from the original proposal until now, is an analysis of laws and policies on the conservation and protection of wildlife. There is a large amount of research on the development, implementation, and impact of the U.S. Endangered Species Act from numerous disciplines. Legal (Houck, 1993; Houck, 1995; Petersen, 1999), history, conservation biology, and public policy. Peterson (1999), in her study of the legislative history of the Endangered Species Act, argues that

> The Act was sold on the passionate images of large and breathtaking wildlife. Further, legislative history indicates that many of the problems that the ESA has encountered were not foreseen. Since 1973 the scientific understanding of the scale of threatened extinction and the needs of endangered species has grown, indicating that a much greater effort and cost than originally thought will be needed to preserve species. (p. 463)

Other researchers (see, for instance, Chessa, 2005; Jessup, 1999; Lueck & Michael, 2003; Wilcove et al., 1993), argue since 1973 when the ESA was signed into law, there is far more understanding of the critical nature of endangered and critically endangered species, the numerous factors that contribute to the extinction crisis or "sixth mass extinction" (Ceballos, Ehrlich, Barnosky, García, & Pringle, et al., 2015, p. 1), most notably climate change, or the climate catastrophe.

This section of the project, in particular, responds to Research Question 1 (of the revised Research Questions): What policies are in place in Belize and Costa Rica to protect animals from exploitation for instrumental/economic value? What organizations enforce these

conventions and treaties? In response to RQ1 I read, in its original Spanish language, the following policies of La Asamblea Legislativa de la República de Costa Rica (Sistema Costarricense de Información Jurídica, 2020): Reformas de la ley N° 4573, Código Penal y ley N° 7451, Ley de Bienestar de los Animales, N° 9458; Decreta: Reformas de la Ley n.° 4573, Código Penal, de 4 de Mayo de 1970 y reformas de la Ley n.° 7451. Decreta: Bienestar de los Animales Capitulo 1 (Please see Appendix 1: Policies Analyzed). Of these, one law that is of particular interest to me, given my professional goal of being a doctor of veterinary medicine, is Nº 8495 Ley General del Servicio Nacional de Salud Animal Veterinary - General Law on the National Service of Animal Health (Law 8495 of del April 6, 2006. The is the Costa Rican national law that organizes the Veterinary Official Service of Costa Rica (SENASA), the government institution that is responsible for animal welfare and many other aspects related to animal production and the protection of human and animal health.

Belize may be a relatively small country, but it hosts an enormous amount of various flora and fauna. Currently Belize is home to over 150 species of mammals, 549 birds, 150 reptiles, and close to 600 fish; Belize has upwards to 3,400 vascular plant species as well ("Wildlife Conservation Program (WCP)"). In order to preserve the endangered ecosystem that Belize and other nations are battling, due to poachers and the imposed economic value behind the endangered species present, more powerful laws and more powerful implementation of these laws is desperately needed to enforce the abduction and trafficking of any endangered species (Goyenechea & Indenbaum, 2015; da Silva, Pearce-Kelly, Zimmerman, Knott, Foden, & Conde, 2019) especially in cross-border contexts Groff, & Axelrod, 2013).

Case Study Analysis: The Case of the Critically Endangered *Manis javanica*

Early on during the spread of SARS-CoV-2, in early February 2020, Lam et al. (2020), in their study, "Identification of 2019-nCoV related coronaviruses in Malayan pangolins in southern China," reported a possible "identification of 2019-nCoV related coronaviruses in pangolins (*Manis javanica*) seized in anti-smuggling operations in southern China" (p. 1). The outbreak of the, at the time, very new, frightening disease was linked with a so-called "wet market" in Wuhan, China, that sold live, wild animals. It was certain types of animals that Lam et al. (2020) posited as "the source of zoonotic infection." The researchers argued, "Although bats are likely reservoir hosts for 2019-nCoV, the identity of any intermediate host facilitating transfer to humans is unknown." They argued that "the identification of 2019-nCoV related coronaviruses in pangolins (*Manis javanica*) seized in anti-smuggling operations in southern China" could be a causal link to the human disease outbreak. They reported, "Metagenomic sequencing identified pangolin associated CoVs that belong to two sub-lineages of 2019-nCoV related coronaviruses, including one very closely related to 2019-nCoV in the receptor-binding domain. The discovery of multiple lineages of pangolin coronavirus and their similarity to 2019-nCoV suggests that pangolins should be considered as possible intermediate hosts for this novel human virus and should be removed from wet markets to prevent zoonotic transmission" (p. 1).

Others also highlighted *Manis javanica* as a possible origination of 2019-nCoV-2 (Wu et al., 2020). The Organisation for Economic Co-operation and Development (OECD) (2020) argue: "The ongoing Covid crisis has brought renewed attention to the global problem of wildlife trafficking. The World Health Organization has determined that COVID-19, just like

SARS, Ebola, Bird Flu, and MERS, originated from an animal" (p. 1). OECD (2020) cited scientists including Lam et al. (2020) who "claim that smuggling of pangolins in South-East Asia could be one of the triggers of the current crisis, as these smuggled animals carried viruses closely related to coronavirus. In fact, pangolins are the most-commonly illegally trafficked animal in South East Asia, used both as food and in traditional medicine" (OECD, 2020, p. 1). Previous research also analyzed *Manis javanica,* focusing on international trafficking and exploitation (Challender, Heinrich, Shepherd, Katsis & 2020; Heinrich et al., 2017; Ingram, Coad, Abernethy, Maisels, Stokes, Bobo, et al., 2018; Liu et al., 2019). Liu et al. (2019), for example, found that "viral metagenomics revealed sendai virus and coronavirus infections" in *Manis javanica* [Malayan pangolin] (p. 12).

Perhaps the most important work is communicating emerging scientific research to the public. Media organizations, such as the BBC, Reuters, Al Jazeera, among others, have done an impressive job of drawing attention to the pangolin, both in terms of its critically endangered status, but also its links to SARS-CoV2 and the COVID-19 pandemic (Briggs, 2020, February 25). Similarly, civil society and non-governmental organizations such as the Iguana Specialist Group (2014) have played an important role in raising awareness about zoonosis (See, also, Anand & Batra, 2020; FUNCI, 2020, April 3; GVI, 2016) and to the threats to the pangolin (IUCN SSC Pangolin Specialist Group, n.d.).

Innovative Collaboration and Cooperation Needed to Increase the Success of Animal Protection Laws and Policies

In order to answer Research Question 3 ("RQ3: What new types of collaboration and cooperation are needed to increase the success of this enforcement?"), I analyzed various organizations to determine the different types of organizations that were already instituted. The first is the World Wildlife Fund (WWF) and it gives assistance to communities to conserve their natural resources, transform policies into more sustainable ones, and protect the animals along with their habitats. Their local efforts can be reflected onto a global scale. One organization is the International Union for Conservation of Nature (IUCN). It is a network of global government and civil society organizations that provides private, public, and non-governmental organizations information on how to balance human life and economic growth with conservation of wildlife.

Through my field research in Belize, I discovered an outstanding collaboration at the Belize Wildlife and Referral Clinic. There are similar collaborations throughout Central America and the Caribbean (Acha, 1981; Alleyne, 2002; Arambulo, 2008; Belize Forest Department, 2018; Casas Olascoaga, Rosenberg, & Astudillo, 1991; Góngora, 2003; Harbison, 2017; Nelson, n.d.; Peery Wildlife Ecology & Conservation Lab, 2018; RUSVM, 2019). Still, much more needs to be done to address this and other "wicked" problems on a global scale, for instance, with continental collaboration between Central America and Europe (Altherr, 2014; Henle, Bauch, Auliya, Külvik, & Pe'er, et al., 2013; Iguana Specialist Group, 2014), with other considerations, such as poverty as a reason for illegal animal trafficking (Duffy, St. John, Büscher & Brockington, 2016; Pangolin Specialist Group, 2014).

Collaboration and cooperation is needed because, as Dr. Adrian Rabe (cited in Carbonaro, 2020), an epidemiologist at Imperial College London, notes, “It appears that consumption of certain animals may predispose our population to new viruses in the future. Our continued intrusion into virus environments and those sanctuaries is also one of the reasons why these pandemics have arisen. And we will probably need to protect those sanctuaries in the future (para. 14). Rabe and others such as Dr. Martin Beer, a virologist at the Federal Research Institute for Animal Health in Greifswald, Germany, highlight the fact that related viruses for SARS-CoV-2, the pangolin is a “likely intermediate host for the virus outbreak” (Beer, cited in Carbonaro, 2020, para. 8)

Strengths of the Project

This Honors Project has numerous strengths. The field research in Belize Wildlife and Referral Clinic was a life transforming experience that will guide my future career in veterinary medicine. It ignited a passion for future international field research. The methodological triangulation is another important strength of the project.

The project also has a substantial literature review, the length and breadth of some Ph.D. dissertations. I had extra time during the COVID-19 pandemic to read as much as I could about zoonotic diseases and, especially the connection of COVID-19 to the pangolin. It has all reputable sources, and information about endangered species policies and protection laws. The project has a plethora of information, regarding the topics, including literature reviews. The inclusion of literature reviews is another strength, because it portrays the work that went towards the completion of this honor’s thesis.

Most importantly, I am confident that, given that the COVID-19 pandemic is still current, it is highly likely that there is no more current undergraduate level research outside of this project on the integration of COVID-19 into endangered species protection policies.

Limitations of the Project

A major change in the research plan was the cancellation of all study abroad programs at BGSU and nearly all other universities. The March 2020 Puerto Rico study abroad trip, to be led by Drs. Carmen Álvarez, Francisco Cabanillas, and Pedro Porbén, would have allowed me to attend lectures at Sagrado Corazón University and conduct informal, brief interviews. The cancellation of this trip meant I would have to gather my research in another fashion. I had to find reputable sources from the library, as well as EBSCOhost and other similar databases. This took a toll on the project, however, because I planned on interviewing, in Spanish, people living in Puerto Rico about their opinions of the U.S. Endangered Species Act and about trafficking of endangered animals. Without knowing their true opinion on the controversy, the paper lost an aspect that would make it more accurate when documenting information regarding Puerto Rico.

Outcomes, Conclusions, Implications, and Directions for Future Research

The Honors Project was a life transforming experience. The field research in Belize opened my eyes to the widespread problem of illegal trafficking of endangered and critically endangered species.The analysis environmental and endangered animal protection policies, rights, and practices in Central America and the Caribbean, lead me to understand ways to

combat the problem of animal trafficking, but also revealed that laws and policies may have limited impact on reducing trafficking. The impact of veterinary science and biological research and practice, particularly conservation biology, can have a positive impact on animal welfare concerns. Perhaps the increased awareness about the spread of zoonotic diseases, given the current global COVID-19, especially for critically endangered animals such as *Manis javanica*, may be the most powerful impact on reducing animal trafficking.

Ongoing research is needed to assess the need for new and innovative types of collaboration, particularly involving numerous scientific disciplines, law and policy makers, global trade, and technology experts, to analyze and find better practices to save endangered and critically endangered species. Collaboration in the area of public health campaigns and health communication, can also help to raise awareness of zoonotic disease transmission, especially during a global pandemic, which could be key to reducing the sale, legal or illegal, of wild animals in order to mitigate zoonotic infection spread. More research on infectious diseases COVID-19 pandemic could be instrumental in new awareness and policy development that can reduce illegal trafficking of endangered and critically endangered species.

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APPENDIX 1:

Animal Welfare Policies Analyzed

Nº 7317 Ley de Conservación de la Vida Silvestre, del 30/10/1992. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_norma.aspx?param1=NRM&nValor1=1&nValor2=12648&nValor3=110020&strTipM=FN

No 7451 LA ASAMBLEA LEGISLATIVA DE LA REPUBLICA DE COSTA RICA DECRETA : BIENESTAR DE LOS ANIMALES [Animal Welfare]. CAPITULO 1 (Sistema Costarricense de Informacion Juridica, 1994/2020). Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=24319&nValor3=25739&strTipM=TC

LA ASAMBLEA LEGISLATIVA DE LA REPÚBLICA DE COSTA RICA (1994). Reformas de la ley N° 4573, Código Penal y ley N° 7451, Ley de Bienestar de los Animales, N° 9458, DECRETA: REFORMAS DE LA LEY N.° 4573, CÓDIGO PENAL, DE 4 DE MAYO DE 1970 Y REFORMAS DE LA LEY N.° 7451, BIENESTAR DE LOS ANIMALES, DE 16 DE NOVIEMBRE DE 1994. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=84296&nValor3=108689&strTipM=TC

Nº 8495 Ley General del Servicio Nacional de Salud Animal del 06/04/2006. [CR - Veterinary - General Law on the National Service of Animal Health (Law 8495)]. Veterinary Official Service of Costa Rica (SENASA), the government institution that is responsible for animal welfare and many other aspects related to animal production and the protection

of human and animal health. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_norma.aspx?nValor1=1&nValor2=57137&nValor3=80913&param2=1&strTipM=FN&lResultado=4&strSim=simp. See, also, https://www.animallaw.info/statute/cr-veterinary-general-law-national-service-animal-health-law-8495

Nº 9245 Ley Contra las Peleas de Caninos [Law Against Canine Fighting]. http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_norma.aspx?param1=NRM&nValor1=1&nValor2=77410&nValor3=96989&strTipM=FN

Nº 8799 Control de Ganado Bovino, prevención y sanción de su Robo, Hurto y Receptación del 17/04/2010. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_norma.aspx?nValor1=1&nValor2=67888&nValor3=80618&param2=1&strTipM=FN&lResultado=1&strSim=simp

LA ASAMBLEA LEGISLATIVA DE LA REPÚBLICA DE COSTA RICA. (2017). Nº 9458 Reformas de la ley N° 4573, Código Penal y ley N° 7451, Ley de Bienestar de los Animales del 11/06/2017. REFORMAS DE LA LEY N.° 4573, CÓDIGO PENAL, DE 4 DE MAYO DE 1970 Y REFORMAS DE LA LEY N.° 7451, BIENESTAR DE LOS ANIMALES, DE 16 DE NOVIEMBRE DE 1994. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=84296&nValor3=108689&param2=1&strTipM=TC&lResultado=4&strSim=simp

La Ley contra el maltrato animal aprobada a principios de 2017 pena con cárcel y multas a quienes maten o maltraten animales.

EL PRESIDENTE DE LA REPÚBLICA Y EL MINISTRO DE AGRICULTURA Y GANADERÍA. (2016). Nº 39481-MAG: Declara de interés público nacional la celebración en Costa Rica de la LXI Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos y Animales (PCCMCA). http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=81347&nValor3=103689&param2=1&strTipM=TC&lResultado=6&strSim=simpž

N° 42008-MJP Declaratoria de utilidad pública la Asociación Nacional Protectora de Animales, EL PRESIDENTE DE LA REPÚBLICA Y LA MINISTRA DE JUSTICIA Y PAZ. Decreto Ejecutivo: 42008 del 29/08/2019. Retrieved from http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=90220&nValor3=118728&param2=1&strTipM=TC&lResultado=2

APPENDIX 2:

Preliminary Findings Presented at the Embracing Global Engagement Undergraduate and Graduate Conference, Bowling Green State University Center for Undergraduate Research and Scholarship, October, 16, 2019

BGSU HONORS COLLEGE
BOWLING GREEN STATE UNIVERSITY

Neotropical Wildlife Rescue and Rehabilitation Field Research: Preliminary Findings

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Honors College, Biology, and Pre-Veterinary Science, Bowling Green State University

Abstract

This project emerges from a veterinary science study abroad program in San Ignacio, Cayo Belize, Belize, Central America. Specifically, the project presents details of an in-field experience at the Belize Wildlife and Referral Clinic through the University of Florida Department of Wildlife Ecology and Conservation program in Belize and the Wildlife Institute, whose mission is to support opportunities for veterinary study abroad, and the Belize Wildlife Conservation and Sustainable Development through Collaboration. Outcomes included broadening knowledge about the largely unknown world of the dangers of exotic pet trade and the importance of veterinary practice to assist in combatting the malpractices associated with this phenomenon.

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Presented at the Embracing Global Engagement Undergraduate and Graduate Conference, BGSU Center for Undergraduate Research and Scholarship (CURS), October 16, 2019.

This project emerges from a veterinary science study abroad program in San Ignacio, Cayo Belize, Belize, Central America. Specifically, the project presents details of an in-field experience at the Belize Wildlife and Referral Clinic through the University of Florida Department of Wildlife Ecology and Conservation program in Belize and the Wildlife Institute, whose mission is to support opportunities for veterinary study abroad, and the Belize Wildlife Conservation and Sustainable Development through Collaboration. These organizations collaborate with undergraduate and graduate students, veterinary medical professionals and educators, and the Government of Belize and other national and international wildlife health professionals to develop national guidelines concerning wildlife and human health, to support wildlife conservation animal health and welfare, and the veterinary profession in Belize through medical services, education, research, and collaboration.

Although Belize is a relatively small country, it hosts an enormous amount of various flora and fauna. Currently Belize is home to over 150 species of mammals, 549 birds, 150 reptiles, and close to 600 fish; Belize has upwards to 3,400 vascular plant species as well (Belize Forest Department, 2018).

The in-field experience focused on a range of topics including the need for more research and reporting on vector-borne diseases in Belize (see Maggi & Krämer, 2019). Specific courses taken during the study abroad program Wildlife Medicine and Conservation; Distance Immobilization; Reptile Medicine, Conservation, Handling, Restraint and Bathing; Green Iguana Population Health Survey; Comparative Wildlife Anatomy, Osteology and Forensics; Basic Avian Fracture Repair, Wing Wrap and Clinical Applications; Population Biology; Conservation Medicine; and Wildlife Biology and Parasitology. Additional knowledge gained included the contributions of veterinary public health (VPH) in situations of disaster (see Scheider, et al., 2012).

The Belize Wildlife Referral Clinic broadened my knowledge about the vastly unknown world of the dangers of exotic pet trade and the importance of veterinary practice to assist in combatting the malpractices associated with this phenomenon. For instance, in their article in the journal *Biological Conservation*, Auliya, et al. (2016) note, "[o]f the 10,272 currently recognized reptile species, the trade of

Working with near-extinct green iguanas at the Iguana Project at the Belize Wildlife and Referral Clinic.

At the Belize Wildlife and Referral Clinic, working with the types of reptiles sold illegally within and outside Belize.

fewer than 8% are regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the European Wildlife Trade Regulations (EWTR)" (p. 103). However, Auliya, et al. (2016) report that "the International Union for Conservation of Nature (IUCN) Red List has assessed 45% of the world's reptile species and determined that at least 1390 species are threatened by 'biological resource use'. Of these, 355 species are intentionally targeted by collectors, including 194 non-CITES-listed species. Herein we review the global reptile pet trade, its impacts, and its contribution to the over-harvesting of species and populations, in light of current international law" (p. 103).

In order to preserve the endangered ecosystem that Belize is battling, due to poachers and the imposed economic value behind the endangered species present, a law was implemented which prohibited the abduction of any endangered species. This law reduced the cases of poaching tremendously, however many cases are still observed.

During my time at the clinic, my classmates and I were shown numerous radiographs containing images of howler monkeys with bullets still inside their bodies. A common practice for obtaining howler and spider monkeys is to shoot the mother and steal the infant monkey for trade in the pet trade market.

As disturbing as the entire situation was, I then realized the importance of proper veterinary care, as well as the importance with public acknowledgment, because if more people are aware of the harms involved with obtaining the perfect pet monkey, or boisterous scarlet macaw, there would be no demand for the possession of species at risk of extinction.

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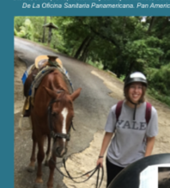

Life transformative study at the Belize Wildlife and Referral Clinic.