Report Submitted to:

Professor Vernon-Gerstenfeld
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By

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In Cooperation With

Director de Recursos Terrestres, Dr. Miguel A. García

Departamento de Recursos Naturales y Ambientales

EXOTIC SPECIES MANAGEMENT

May 3, 2007

May 3, 2007

Dr. Miguel A. García
Director, División de Recursos Terrestres
Department of Natural and Environmental Resources
San Juan, Puerto Rico

Dear Dr. García:

Enclosed is our report entitled Exotic Species Management. It was written and compiled at the Puerto Rican Department of Natural and Environmental Resources during the period between January 9 and May 3, 2007. Preliminary work was completed in Worcester, Massachusetts, prior to our arrival in San Juan. Please note that copies of this report are simultaneously being submitted to Professors Susan Vernon-Gerstenfeld and Arthur Gerstenfeld for evaluation. Upon faculty review, the original copy of this report will be catalogued in the Gordon Library at Worcester Polytechnic Institute. We truly appreciate the helpful and professional attitude set forth by yourself and our other contacts within your department throughout the course of this project.

Sincerely,

Sarah Burns

Justin Cox

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ABSTRACT

This report, prepared for the Department of Natural and Environmental Resources in Puerto Rico, discusses the risks associated with the establishment of exotic animals as well as management methods that have been employed throughout the world. Potentially invasive exotic animals are a particular problem in Puerto Rico. However, the Commonwealth does not currently have a protocol for the disposition of acquired animals and their preventative policies require renovation. In this report we make recommendations to alleviate these problems. In addition, we present a template for a centralized database that will allow information regarding smuggled exotic animals in Puerto Rico to be shared among environmental agencies on the Island, which will help these agencies to coordinate and concentrate their efforts.

ACKNOWLEDGEMENTS

First and foremost, we would like to thank the Department of Natural and Environmental Resources for their cooperation throughout this project. In particular, Miguel A. Garcia and Alberto Puente served as our liaisons and were extremely encouraging throughout the entire process. Wendy Boneta provided a great deal of essential information and also went out of her way to ensure that we were able to obtain everything we needed. We would like to send a very special thank you to Marilyn Colón, who was with us every step of the way and managed to brighten each and every workday.

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Our final acknowledgement is to our advisors, Susan Vernon-Gerstenfeld and Arthur Gerstenfeld. Throughout the entire process of this project these professors have been unbelievably encouraging and completely involved with our project. Without their passion and enthusiasm we would not have been inspired to achieve all that we have. We are incredibly grateful.

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EXECUTIVE SUMMARY

The overall goal of this project was to update the exotic species management strategies of Puerto Rico's Department of Natural and Environmental Resources (DNER) in order to protect the biodiversity of the Island. Within this goal we had two objectives; developing concise methods for the disposition of exotics found within the island and improving methods designed to prevent exotics from entering Puerto Rico in the first place. In the process of achieving these objectives we realized the need for information regarding illegal imports to be shared among the agencies on the Island that deal with exotic animals. The first objective was achieved by developing a disposition protocol for the exotic animals that the Department keeps in their confinement center. The second objective was achieved by investigating the border control procedures implemented by the local and federal environmental agencies and making policy recommendations based on this investigation. The policy recommendations were geared toward improving inspection methods and therefore increasing prevention techniques of animals entering Puerto Rico. Based on our findings, we recommended the creation of a centralized exotic animal database in order to make information collected by various environmental agencies easily accessible, which will allow these departments to maximize the effectiveness of their operations.

The entrance of exotic species into new locations and their establishment in the wild has led to billions of dollars in damage and irreversible ecological changes throughout the world. Islands, in particular, are very vulnerable to exotic species because they are isolated, and the native species are not biologically diverse enough to compete

for resources. Exotic species may also introduce diseases that can be devastating to native populations of plants and animals.

Many exotics have already been brought into the Commonwealth of Puerto Rico via smuggling or accidental transportation. In order to deal with the presence of exotic specimens, the Department of Natural and Environmental Resources has allocated a site for holding the exotic animals that are confiscated by DNER Rangers or voluntarily returned to DNER control. These animals are held at Cambalache State Forest in Arecibo until the Rangers decide how to dispose of them.

According to the 2002 document published by the International Union for the Conservation of Nature, three main options exist for processing a confiscated animal: releasing the animal in the wild in its native habitat, maintaining the animal in captivity for the remainder of its natural life, and euthanizing the animal in a humane way. We based our solution for the DNER disposition protocol on the IUCN document, modifying it for the specific needs of Puerto Rico. In our document we defined the captivity option to include relocation to other wildlife centers, display of the animal in zoo exhibits, and inclusion of the animal in state-sponsored programs for educating the general public about the risks of exotic species.

We researched the advantages and disadvantages of the options available for disposing of confined animals and created a disposition protocol with options specific to Puerto Rico. We determined that, while re-introduction to the wild is the most ecologically beneficial option and demonstrates the conservation message to the public, it is also time-consuming and costly due to the predictive studies that must be performed before releasing an animal. One disposition method that is currently used in Puerto Rico

is the relocation of the animals to other wildlife centers and zoos in the mainland United States. The Mayagüez Zoo has been a very valuable resource to the Rangers in the past, as the veterinarian there, Dr. Luis Figueroa, has been able to find homes for many animals by utilizing his list of contacts. This information is included in the disposition protocol. Euthanasia is the last-resort option for DNER since the rangers would prefer not to kill animals unless absolutely necessary.

Along with our creation of the new protocol document, we also created a decision-making tree for the rangers at the Cambalache State Forest to use for processing the animals. The decision tree flows from top to bottom and incorporates yes/no questions which lead the user to specific actions. For example, if the animal has not undergone medical screening before its confinement at the State Forest, the chart prompts the user to perform that medical screening and continue through the chart. The decision tree provides an objective and standardized procedure for processing all animals that DNER rangers acquire. The decision tree promotes ecologically sound actions while remaining easy for the Rangers to use on a daily basis. We recommend to DNER that they publish and use the new disposition protocol document at the Cambalache State Forest.

Our second objective was to review the border control policies of the Commonwealth to determine which changes, if any, needed to be made to ensure that illegal exotic animals were not entering the Island. In order to do this we performed a series of seven interviews with officials working in border control agencies, including the DNER Rangers, U.S. Department of Agriculture APHIS, Puerto Rico State Veterinarian, U.S. Fish & Wildlife, and U.S. Customs and Border Protection.

Puerto Rico has a "clean list" policy, a list of animals that may be allowed into the Island. All other exotic animals are turned away or confiscated as deemed necessary by officials. We discovered that no comprehensive inspection system for domestic passenger and cargo flights is in place. This means that passengers can very easily bring exotics into Puerto Rico from the United States. However, since international flights are inspected thoroughly by the federal agencies, it may be inferred that the majority of illegal animal imports into Puerto Rico enter via flights from the United States or by private sea craft that dock in private marinas where DNER rangers are not present. All of our interviewees agreed that the first issue that needed to be addressed was the lack of a DNER Ranger presence to enforce the clean list restrictions in Luis Muñoz Marín airport between the hours of 10 p.m. and 6 a.m. This is a likely time for animals to pass through unnoticed. We therefore recommended to DNER that a Ranger be placed in Luis Muñoz Marín airport overnight, and that Ranger divisions be reallocated to the airports and marinas throughout the island as necessary.

A number of other concerns about the DNER ranger procedure were mentioned on multiple occasions. DNER rangers are currently lacking a specific set of animal identification methods and so are likely to make mistakes when determining if an imported animal is listed on the clean list or not. In addition, there are currently no regulations in place to guide the activities of DNER rangers. This can lead to a great deal of confusion and rangers acting differently from one another when presented with the same situation. In order to streamline this process, we recommended the creation of regulations specific to ranger procedures. When creating these regulations, the warrant procedure should be carefully examined. Illegal animal owners are often able to relocate

their animals while rangers are in the process of obtaining a search warrant. In one dramatic example, a ranger observed several hundred birds living on a farm. Once the ranger returned with a court order two days later, all of the birds had been removed or possibly released to the wild. Therefore, while rangers have the responsibility of enforcing the DNER permit system for exotic animals, they do not always have the ability to perform effectively their enforcement duties due to the difficulty of quickly obtaining a court order.

During the process of collecting information on exotic animal import inspections, it became evident to us that there is a substantial lack of information available to environmental agencies on the island regarding the prevention of smuggling practices. Statistics regarding illegal animals do not exist in a comprehensive format and so are not available to any agency that may find them useful.

An electronic database would enable all local and federal agencies operating on the Island to share information regarding exotic species movements and general. We created an example database to demonstrate the many trends that could possibly be observed if information were compiled into a central database. For example, APHIS could use this information to pinpoint locations that have a history of importing large quantities of illegal birds, which would help them to better investigate avian diseases. Other agencies could use the information to better concentrate their efforts on areas that are the most popular ports of entry for exotics. The use of the database would enable agencies to coordinate and concentrate their efforts and thus improve preventative methods across the entire island. At our final presentation, which was attended by approximately thirty DNER employees, the centralized database recommendation was

extremely attractive to the audience and was named as one of the most important of our recommendations. We therefore strongly recommend that this database be created in a format that could be easily shared and updated by all environmental agencies operating in Puerto Rico.

The exotic species problem in Puerto Rico is one that deserves a great deal of attention due to the many risks associated with exotics. The recommendations provided in this report, if enforced, will serve to greatly reduce the effects of exotics on the Commonwealth. In addition, islands throughout the world would be able to use the policy in Puerto Rico as a model for their own exotic species management plans.

CHAPTER ONE: INTRODUCTION

This report was prepared by members of Worcester Polytechnic Institute Puerto Rico Project Center. The relationship of the Center to the Department of Natural and Environmental Resources and the relevance of the topic to the DNER are presented in Appendix A.

Exotic species management is a delicate and complicated task for government policymakers. Non-native species invasions have the potential to disrupt ecosystems throughout the world. Invaders can present competition for and native species, resulting in the endangerment of native populations. Aside from ecosystem disruptions, invasive diseases and pests may also pose a significant economic threat to nations whose economies depend on continuous agricultural income. The social policy aspect of these threats is not to be ignored, since it is a critical portion of this project. Policy is important in regulating the movement of species between borders as well as the management of exotics within society.

This project focuses on exotic species as pets, including both the possible repercussions of accidental pet release and the policy issues surrounding the import, confinement, and selling of these animals. The worldwide exotic pet trade is second in net worth only to illegal drug trafficking, and totals to an annual net worth of over $159 billion (Saldajeno, 2005). With such a large volume of exotic animal imports and exports worldwide, the fear of releasing an exotic pet into the wild is very real. Exotic species can have a devastating effect on native populations under the proper circumstances. While some of the most notorious economic and biological damages result from invasions by plants and crop-related diseases, released animal species can cause significant ecological harm as well.

The evidence regarding the impact of these invaders is overwhelming. These invasions typically result in substantial public health risks and changes to the local biosphere. According to Pimentel, a researcher at Cornell University, nearly half of the species in the United States listed as endangered under the Endangered Species Act of 1973 are at risk primarily due to the proximity of invasive species (Pimentel et al., 2000). The National Academy of Sciences (2005) reveals that non-native species frequently carry diseases that can jump to human hosts. When people import pets from overseas, they risk immediate exposure to such pathogens. In 2003, prairie dogs originally imported into the United States as pets carried a disease called 'monkeypox', exposing the virus to seventy human hosts in six different states (NAS, 2005).

Government sponsored agencies have repeatedly attempted to quantify the precise monetary losses associated with invading species. According to Williams and Meffe (1998), in 1993, an Office of Technology Assessment study stated a conservative estimate of $97 billion in losses in the last century. A more inclusive study in 2000 by Pimentel and colleagues considered a larger number of species as well as an analysis of secondary effects, adjusting this figure to be over $137 billion. They also concluded that, while these figures are estimates, the figures are more likely to be underestimates of the actual damage incurred than exaggerations.

The brown tree snake, which has established itself in Guam, is a frequently cited case of the consequences associated with the international movement of species. The snake has caused a substantial amount of grief for the island, directly and indirectly impacting its surroundings by causing power outages and killing off native bird populations (Fritts & Leasman-Tanner, 2001). In Florida, an exotic aquatic weed named

the hydrilla has altered the nutrient cycles of the waterways in which they have established themselves. Those weeds are also affecting native fish populations by disrupting the fishes' natural habitats. The effects are so great that Florida alone spends about $14.5 million per year attempting to control the weed (Pimental et al., 2000).

Outside of the United States, the problem is even more extensive, with approximately 80 percent of all endangered species being labeled as such due to the effects of alien wildlife (Pimental et al., 2000). In order to prevent the accidental or malicious introduction of exotic species into the wild, many nations have introduced regulations prohibiting or severely restricting the import of non-endemic species to the region. Despite the presence of these regulations, Muir (2006) argues, invasive species still pose a continuing threat to native populations. According to Marvier (2004), the number of invasive species cases worldwide has reached the point where they are no longer manageable on a single-case basis and where the costs associated with removal or control programs are staggering. The agencies charged with exotic species management, therefore, need to upgrade their policies in order to keep up with the rising numbers of exotics that are released into the wild.

There are numerous U.S. agencies charged with preventing illegal animals from crossing borders, including the Department of Agriculture, Centers for Disease Control and Prevention, and the Fish and Wildlife Service. Their inspectors serve as the only barrier to a variety of potential invaders and the vicious diseases they may carry (Wittenberg & Cock, 2001). A recent article featured on MSNBC states that these inspectors are not required to undergo disease detection training; this means that potential hazards may go unnoticed until they are too late to fix (2006). According to a U.S.

Department of Agriculture report (2005), the number of inspectors employed to guard U.S. borders against invasive species is wholly insufficient. This lack of detailed inspection results in introductions of animals, plants and pathogens that could have been stopped if the agency had possessed sufficient resources. There are organizational and jurisdictional issues as well; government agencies responsible for border control do not work together, instead preferring to operate under their own individual plans with minimal collaboration (USDA, 2005).

Islands are particularly vulnerable to invasion due to their limited biological resources and isolated ecosystems, as well as evolutionary processes that result in animals which are poorly equipped to handle competition (Williams & Meffe, 1998). Invaders find their way into island ecosystems in a variety of different ways, which can be accidental, purposeful, illegal, or some combination of the three (Williams & Meffe, 1998). In Puerto Rico, a permit process has been established to track the movement of exotics within their borders. Permits are required to import, export, sell, display, breed, or perform scientific research on exotic animals.

The increasing number of threatened or endangered species in Puerto Rico has prompted renewed interest in government conservation efforts. The island is currently struggling under the onslaught of invasive populations, with over a thousand of its native species listed as endangered; and that number is only expected to increase in the future (Department of Natural and Environmental Resources, 2005). Invasive species are known as being one of the leading causes of this decimation of flora and fauna (DNER, 2005). Of equal concern, according to Alamo and Palacios (2005), is the negative effect these

species have on the agricultural revenue of the Commonwealth as they devastate essential crops.

All of these issues have prompted a desperate effort to understand the full breadth of the situation. Puerto Rican agencies are in the process of gathering and analyzing information concerning the native wildlife and possible conservation methods. The Department of Environmental and Natural Resources needs to determine the best method for processing the exotic animals that they confiscate or obtain through other means. The first goal of this project was to create a disposition protocol for the DNER to follow for each animal that they receive. Having an effective disposition protocol gives the Department one of the tools that it needs to minimize the risks associated with the presence of exotic species throughout the island. Investigations into the current process were used to create a protocol and a decision tree to be used in deciding the fate of all confiscated animals in the future.

The larger problem of exotics in Puerto Rico is the fact that they are able to enter the Commonwealth in the first place. The reduction of this problem required that the policy be investigated and altered to better ensure prevention. The second goal of this project was thus to make policy recommendations based on research and information obtained through interviews. We interviewed employees of departments throughout the island and have developed recommendations for improved policy based on our findings. Optimizing communication among departments in Puerto Rico that deal with exotics has the potential to greatly improve prevention methods. Our third goal was therefore to create a method of improving communication to ensure that each department is aware of the current exotic situation. To achieve this, we have composed a database that will serve

to centralize illegal import data including that from confiscated animals and those found in the process of being smuggled. The combined results of the disposition protocol, policy recommendations, and central database are intended to greatly reduce the exotic species problem in Puerto Rico.

CHAPTER II: BACKGROUND

THE INVASIVE SPECIES PROBLEM

Invasive species have a wide variety of traits that make them aggressive natural competitors. Williams & Meffee (1998) state that typical characteristics of invaders include a short reproductive cycle, an aptitude to survive in varied environments and to compete with established plants or animals, and the ability to move into new environments with or without human assistance. These characteristics enable a species to spread quickly, survive, and potentially permanently establish themselves in new environments. The researchers also state that an invader may not require all of the traits described above in order to be successful in a new environment. An animal introduced into an environment with less than ideal available resources, for example, can still integrate into this new environment, according to Shea and Chesson (2000), if the invaders ability to obtain resources is better than that of native competition.

Pimentel et al (2000) state that mammalian pets that are released into the wild or pets that routinely wander outdoors may become dangerous predators to local wildlife. Pet dogs, they explain, typically escape into the wild and form communal packs, roaming free and killing deer, rabbits, cattle, and sheep. According to the 2000 estimate of Pimentel and his colleagues, these types of releases result in over $5 million in annual livestock damages in the United States. These types of escapees, he argues, have the potential to disrupt natural food chains in their surrounding area. In Puerto Rico, the mongoose serves as an example of an introduced predator that has ravaged the readily

available native bird, reptile, and amphibian populations of the island, resulting in a quantifiable loss of species diversity.

Imported exotic pets may also be carriers of diseases which go unnoticed during their transportation, and these diseases may be transmissible to native populations, as well as plants and humans (Coulibaly, 2000). Released pets also cause damage by directly attacking people; in North Carolina, for example, a ten-year-old boy and a fourteen-year-old girl were brutally mauled by captive tigers (Liebman, 2004). These types of threats to public safety are not easily ignored.

Environment Susceptibility to Invasive Species

The features of a vulnerable environment are those that create opportunities for invaders to come in and dominate the region. The availability of abundant resources, absence of local predators, limited variety of species, and human disruption are, according to Williams and Meffee (1998), all factors which define the degree to which an environment is vulnerable to invasion. On a worldwide scale, only 1 percent of introduced exotics will become permanently established and harmful in a new environment (Wagener, 2001). However, there are places in which an increased percentage of successful invasions take place. In Hawaii, for example, about half of the birds transported to the island are successful invaders. Two other islands, Ireland and Newfoundland, have experienced a 100 percent establishment rate for the exotic mammals introduced (Williamson & Fitter, 1996).

The Increased Susceptibility of Islands

According to the World Conservation Organization, which works to understand and reduce the threat of invasive species, the ecological characteristics of islands result in increased susceptibility to invasion by non-indigenous species (IUCN, 2001). Puerto Rico is an island of approximately 8,870 square kilometers (CIA, 2007) and is one of the four largest Greater Antilles islands along with Cuba, Hispaniola, and Jamaica (Rivera, 2007). The tropical climate of the island makes it a lush environment for wildlife and a fertile place for local agriculture. Its isolation as an island places it in the category of easily invaded locations, increasing the need for invasive species control. A large majority of endangered species worldwide owe their endangered status to invaders (Pimentel et Al., 2000). The resulting loss of biodiversity is of particular concern, as islands tend to be home to many species that do not naturally exist elsewhere in the world, known as *endemic* (Williams & Meffee, 1998).

The need for effective control of invasive species is grounded in a number of real-world examples of islands that have fallen victim to invasions in recent memory. Hawaii, for example, has suffered greatly from a substantial influx of exotic species, many of which have proven extremely harmful to the island's native flora and fauna. According to Loope and John (2000), approximately twenty to fifty non-indigenous species find their way onto Hawaii every year, an event that has resulted in the loss or endangerment of many of the island's native species.

The situation on another island, Guam, is similarly disturbing. According to Fritts and Leasman-Tanner (2001), without natural predators and with a large supply of

defenseless prey, the brown tree snake has established itself in alarming numbers. Five endemic bird species have been brought to extinction by the brown tree snake and a number of others have been severely decimated. A list of these birds is located in Appendix B.

On the island of Puerto Rico there are no large native animals; this lack of mammalian predators (Rivera, 2007), Fritts and Leasman-Tanner (2001) argue, could potentially facilitate the introduction of a dominating predatory species such as the brown tree snake. In addition, Puerto Rico is home to many animals that would serve as prey for invasive predators, including, according to Lepage (2007), approximately three-hundred and forty nine bird species. The abundant bird population of Puerto Rico could provide the brown tree snake with a food resource, and if introduced, the snake could cause problems similar to those on Guam (Fritts & Tanner, 2001).

An environment may become vulnerable to infestation by invasive plants and animals for several reasons. According to Byers and colleagues (2002), the most effective way to understand a species' ability to invade a new environment is to study both the climates that the species has previously invaded and the environments in which the species originally evolved. Understanding how a region becomes susceptible to invasion, as well as the characteristics that promote the establishment of non-indigenous species, enables researchers to prevent future invasions because it allows them to know which areas may be particularly susceptible to invasion by specific pests and, therefore, to better protect these areas. For example, according to Cayetano (1999), former governor of Hawaii, the state of Hawaii is aware of the successful establishment and negative impacts of the brown tree snake in Guam and has made preparations for the potential arrival of

this animal. According to 1999 Hawaii Conservation Conference, the state is particularly focused on determining the most likely entry methods of the snake and working to increase inspection in these areas. Since this conference, flights originating in Guam undergo thorough inspection for stowaway snakes (HCC, 1999).

Urbanization and Invasion Result in Disrupted Native Species Populations

Exotic animals, as they become established, can destroy the habitats of native animals and thus cause the native population to decrease. Table 2-1 on the following page displays the causes of the rapid decline of wildlife populations worldwide (2004). It was adapted from a document written by Jessica Gurevitch and Dianna Padilla of Stony Brook University. The information in the table was adapted by the authors from a re-analysis of the data collected for 930 species by a previous study (Wilcove, D.S. et al. (1998) quantifying threats to imperiled species in the United States. Bioscience 48, 607–615)

Table 2-1:
Numbers of species affected by different threats believed to be responsible for causing population declines

Causes of decline	All species [930]	Plants [602]	Birds [68]
Direct human habitat destruction and fragmentation, including logging, road building and diversion of water	497	233	48
Exploitation (hunting, fishing and collecting) and poisoning and/or trapping	90	19	11
Fire and changes in fire regime	102	92	1
Pollution (herbicides, pesticides, oil spills, etc.)	32	4	5
Invasive alien predators and herbivores	131	73	39
Alien plants: competition and indirect habitat effects	431	410	19
Competition with exotic animals (excluding feral and domestic animals)[b]	67	0	14
Feral pigs (herbivory, predation, competition and/or habitat effects)	268	257	8
Grazing and/or trampling by domestic and feral cattle, goats, sheep, horses and burros	327	295	13
Hybridization with alien species	22	5	0
Diseases (including alien and native species)	33	3	23
Parasites (physiological and behavioral)	3	0	2
Other or unknown	169	134	8

[a]Reclassification of data on all of the cases in which species were categorized as being imperiled by aliens by Wilcove *et al.* ([1], http://www.natureserve.org). Categories are nonexclusive and so numbers do not sum to total species numbers.
[b]We believe that domestic cattle should be categorized separately from alien invasive species, even though they are non-native in most areas in which they affect native species. Unlike invasive aliens, the population sizes and distribution of cattle are usually controlled by humans. Thus, cattle are not invasive in any of the usual meanings of the word, although they might have large effects on native populations, communities and ecosystems.

According to the statistics in Table 2-1, over half of the total number of observed species declined in population size as a direct result of habitat destruction by humans. It is important to note that a species may be threatened in multiple ways; a plant population, for example, may be threatened both by direct human destruction and by disease, invasive competitors, or parasites. These causes are not mutually exclusive; Didham et al. (2005) introduced a new theory with their paper, claiming that exotic species dominance does not directly cause native species loss, but does so indirectly by altering the habitat.

Invaders alter the ecological composition of their new habitat by reducing the numbers of native populations and, by disrupting the food chain, allowing additional invaders to become established (Fritts & Tanner, 2001). For example, in the western United States horses were introduced in the late 18th century from the European continent. Now, large wild horse populations have depleted native perennial vegetation, allowing invasive annual plants to establish themselves (Pimentel et al., 2000). The effects of exotic species can be drastic, as in the case of the Serengeti's wildebeest described by Sinclair and Byrom (2006). The wildebeest is a keystone species, meaning

that it has a very large impact on other species. Therefore, when an exotic virus known as rinderpest reduced the wildebeest population density, the local grasses and birds subsequently suffered (Sinclair & Byrom, 2006).

As an island environment and as a tropical economy with a heavy dependency on tourism and agriculture, Puerto Rico is extremely vulnerable to the establishment of alien populations. Puerto Rico is home to a number of endemic species, including 142 species of tree, 15 amphibian species, and 42 species of reptile that are not found anywhere else (Wiley & Francisco, 1998). The small number of native species varieties is one factor that makes invasive species an issue of increasing concern for the nation. The continuing urbanization of the island territory is of particular concern to us, as well as the high volume of international traffic, which serves as a potential pathway for accidental or malicious species transportation as a result of shipping and tourism. Importation of potentially dangerous exotics results in a direct test of the islands' established regulations and of the policies for their enforcement, which is why it is critical to have an effective system in place.

Accidental Introductions

Exotic species commonly enter a new environment accidentally through human activity. Accidental introductions are more difficult to control than intentional scientific introductions, and control measures to prevent accidental introductions are costly and time-consuming due to the vast number of possible methods for exotic species introduction (Huber et al, 2002). Perhaps the most famous accidental introduction is that

of the brown tree snake on Guam, accidentally introduced from the Admiralty Islands in 1962 by the U.S. Navy (Blackford, 2006). Approximately 40% of the alien pests brought into Hawaii are discovered in or on hand luggage in airports, accidentally carried by passengers into Hawaii (Holt, 1999). Human movement is therefore directly linked with the international movements of other organisms. In Puerto Rico, the majority of their necessities are obtained through importation, giving rise to many opportunities for species introduction. Approximately $29.3 billion in imports, including commodities such as food, clothing, machinery, and petroleum products, are imported yearly (CIA, 2007). Through this trade, invasive species can enter as stowaways aboard ships or planes. Additionally, the high level of tourism results in people coming and going on a regular basis which further increases the possibility of accidental species introduction (Rivera, 2007).

According to Wittenberg and Cock, other methods of accidental introduction include the transport of filler soil from one location to another, ballast water released from ships, and seed contaminants in transported seeds (2001). Forest-based industries (such as logging) have been greatly impacted by the accidental introduction of the Asian long-horned beetle into the Northeastern United States (Nature Conservancy, 2007).

The Exotic Pet Trade Contributes to the Invasive Species Problem

Exotic species are commonly brought into new areas willingly through the exotic pet trade. Other methods of introduction are briefly discussed in Appendix B. According to Saldajeno (2005), when legal exotic trade is calculated in addition to illegal, the

amount of money associated with this trade is approximately $159 billion USD annually, making it the highest grossing operation following drug trafficking.

According to Karesh and colleagues (2005), the worldwide pet trade amounts to approximately 4 million birds, over half a million reptiles, and 40,000 primates traded each year in both the legal and illegal markets. In fact, according to the Convention on International Trade in Endangered Species of Flora and Fauna (2005), there was a 200 percent increase in animals intercepted by inspectors from 1999 to 2000 alone.

Problems resulting from exotic animal ownership occur when exotic pets become unwanted by owners and are released and when owners are negligent and allow pets to escape. For example, Pickrell (2004) states that large numbers of aquarium pets are being released into oceans surrounding Florida. Approximately sixteen species commonly bought as pets have been introduced into these waters. This information originally came from a study performed by Simmens et al., (2004), who further cited aquarium release as one of the two greatest causes of aquatic invasion along with the accidental introduction of non-native stowaways from the ballast water of sailing vessels.

Animals and plants are bought for food, medicinal purposes, or to be kept as pets, displayed in zoos, or displayed as decorations (Saldajeno, 2005). In many cases, complete prohibition is not in place and instead potential buyers must have a license for possession of any species they plan to purchase (Liebman, 2004). Possible damage resulting from the trade of endangered species demand the timely implementation of laws and restrictions designed to reduce the smuggling industry (Cleva & Fisher, 2005). In Puerto Rico, for example, importers must file an application for a license to import wildlife; nevertheless we encountered no statistics of possible exotic imports by people who do not

know that a license is required, or those who do not bother to apply for this license (DNER, 2003).

INVASIVE SPECIES CAN HARM HUMAN HEALTH AND ECONOMIES

The integration of an invasive species into a new environment can have direct effects on human beings and effects on national economies. The threat of international dispersal of diseases that affect both humans and animals is significant and troublesome. Of particular concern to human beings are those diseases that jump from animals to human hosts, between crops, and from animal to animal (AP, 2006). An example of one such disease is dengue fever, a deadly disease that is transmitted from mosquitoes to humans. Blackford (2006), a researcher at Ohio State University, argues that increased mosquito population densities indirectly resulting from the brown tree snake invasion in Guam may result in the spread of dengue fever. Thus, the invasive brown tree snake may indirectly cause the introduction of a devastating disease onto the island it has invaded. Another example, H5N1, more commonly known as "bird flu," has killed millions of birds since its emergence in 2003, and has also infected more than 230 humans, killing more than half (SNS, 2006).

A U.S. Senate committee (2003) on exotic wildlife importation cites zoonotic diseases (diseases carried by animals) as accounting for 61 percent of infectious diseases and 75 percent of newly discovered emerging diseases. The same document contains a statement from Senator Allard of Colorado which reports that the health certificates issued by veterinarians to owners of imported exotics have but a single mention of disease, the question reading simply: "Does the animal show any signs of infectious disease?" The doctor is expected to determine the status of the animal based on casual inspection alone, which, Liebman (2004) suggests, is a dangerous practice because

animals may be carriers of human diseases yet show no outward symptoms. Inspections in airports may also be hurried or rushed; proper disease testing cannot take place in such a short time span.

Worries about the international spread of these deadly diseases are easy to justify. In 2004, a man smuggled two expensive rare birds on a flight from Thailand to Belgium. The birds were confiscated and later found to be infected with the H5N1 virus (AP, 2006). While the diseases carried by exotic animals may be benign if the animals are purely carriers, they can become dangerous when placed directly into contact with humans and other non-natural species (Liebman, 2004).

According to a study by the Centers for Disease Control and Prevention (1984), approximately 32,000 non-native turtles were imported into Puerto Rico from the continental U.S. as pets. This is a cause for alarm because turtles, including the imported species, are highly associated with the disease salmonella. While salmonella is part of the natural fauna of many reptiles, salmonella is a condition that has the potential to be harmful to humans. The symptoms of this disease include diarrhea, abdominal pain, and fever, and while symptoms usually improve within three days after infection, the disease can potentially cause death if left untreated (CDC, 2006). The threat of disease transmission from exotic animals is very real and illustrates a clear need for a control and management system in developed countries to prevent further disease transmission and widespread public panic.

Economic Damages

The dangers of exotic species invasion extend far beyond concerns of disease introduction. Economies that are heavily dependent on agriculture or tourism are especially affected when diseases and pest animals are introduced. One of the most devastating economic impacts of harmful exotic pests is the reduction of crop yields through competition and destruction by insects, animals, and diseases (Hoddle, 2002). According to data from the year 2000, non-indigenous crop plant pathogens alone cause over $21 Billion USD in damages each year, with an additional $500 Million spent on control and prevention measures (Pimentel et al, 2000).

Economic dependence on tourism increases the potential for economic damages due to troublesome animals. Tourism is a major source of income for many islands, including Guam, Hawaii and Puerto Rico. In the Territory of Guam specifically, tourism is second only to national defense grants in terms of the island's economy (CIA, 2007). The non-indigenous brown tree snake had immense adverse effects on the tourism industry during the period following its initial establishment on the island. This reptile is responsible for approximately one power outage every three days; these outages prevent the operation of common tourist attractions, such as restaurants, shops, and other forms of nightlife. The loss of potential revenue incurred when businesses cannot operate combined with other power outage related costs results in a total of $1-4 million in yearly expenditures for the territory. (For more information concerning power outages, see Appendix B). The sheer abundance of the snake and its unusual presence in city buildings may deter tourists from visiting the island in the first place (Fritts & Tanner, 2001). The

snake's presence, in causing a decrease in the bird population also allowed for mosquitoes to enter the islands. The fact that mosquitoes can carry dengue fever is yet another deterrent for visitors (Blackford, 2002).

The recent introduction of the native Puerto Rican coqui frog to Hawaii, according to Kirk (2002), is expected to have an effect on the Hawaii's tourism industry. The male coqui frogs produce very loud shrieks in order to attract females. This persistent noise, Kirk argues, has evoked complaints from guests to the island as well as from locals.

The coqui is not the only invader that Hawaii is worried about. Holt states in her 1997 research that the brown tree snake is beginning to establish itself on Hawaii, and that it is feared the island will suffer the same fate as Guam. According to a study done by the University of Hawaii presented by Colvin (2005), potential economic losses for Hawaii range from $28 million to $405 million annually as a result of power outages.

In Puerto Rico, the tourism industry is extremely important. Approximately 7 percent of the nation's Gross National Product is generated through this industry (Rivera, 2007). As stated in a report by the Government Development Bank for Puerto Rico (2003), many island residents are employed through this industry. Additionally, tourism is directly linked with other sources of income, such as transportation, entertainment and lodging (GDBPR, 2003). Thus, the implications of the social effects caused by invasive species could be disastrous to island economy.

POSSIBLE SOLUTIONS FOR EXOTIC SPECIES MANAGEMENT

The invasive species problem has prompted large volumes of research worldwide, and various methods of prevention, control, and eradication have been developed and attempted. In order to determine appropriate methods for preventing invasions, it is important to first understand the characteristics of the exotic species themselves. According to Byers and colleagues (2001), mechanical and physical methods of removal are extremely expensive and ineffective; furthermore, they would only be beneficial for removal of particular species types. Appropriate biological and chemical control cannot be administered unless the characteristics and habits of a potential invader are known.

The success of an invasive species is due in part to the lack of natural predators in the new location (Wittenberg & Cocks, 2000). Therefore, the intentional introduction of a predatory or parasitic species in order to combat the presence of an invasive pest is one method of control that has been implemented in numerous cases. One important benefit of biological control is a reduction in pesticide use as a control method. Hoddle (2004) claims that a reduction in pesticide use would result in secondary benefits for wildlife in the region by preventing the release of dangerous chemicals. In the Caribbean, where biological control was almost completely ignored in favor of chemical solutions, officials are discovering that the old method of competitive introduction is a favorable alternative, especially when public opinion is against the use of pesticides (Cruz & Segarra, 1992).

The intentional addition of a non-native species with the purpose of combating an invasive pest is one of the most complicated methods of introduction is. While this technique may appear to be counterproductive at first glance, many biologists praise its

success, claiming that it is a smarter, more logical option for areas where chemical and physical control are ineffective or impossible to implement (Durham, 2004). Nevertheless, there have been instances in which the efforts backfired, resulting in more damage than the original pest had caused (Pimentel, 2000). Thus, this method has had varying results, but either way involves the addition of a new species to an area.

Remarkably, according to Hoddle (2004), biological control is cost effective, even when many introduction efforts fail. However, Hoddle (2004) cites several disadvantages to biological control; one common criticism is that the introduction of biological control agents dilutes the biodiversity of introduction areas. For example, Hoddle (2004) claims that the introduction of the fire ant into Brazil greatly decreased the biodiversity of native ant populations.

Real-world success stories of biological control are encouraging to policymakers. In a case described by Malakoff (1999), the introduction of long-snouted weevils has helped to eliminate harmful water weeds such as the water hyacinth. Species that negatively affect agriculture, such as the alfalfa weevil, have also been controlled by introduced exotics. For more examples of cases where biological control has been attempted, see Appendix B.

The results of failed attempts are permanent and all but irreversible; Hoddle (2004) recommends careful study of an environment before competitors are bred and released, but, according to Pimentel et al (2000), even a careful study may neglect variables found in nature in many complex environments. The selection of possible introduction areas is a policy issue above all else, and the Global Invasive Species Program Toolkit suggests completing a full risk analysis study of the area and any possible secondary effects of the

introduction before proceeding to breed and release controlling organisms (Wittenberg & Cock, 2001). Hoddle (2004) notes that, while government-level clearances are required to implement these types of programs, the regulations for private import and breeding are far less strict, particularly in the United States; this represents a major legal double standard.

Another method of preventing damage to native species caused by an invader is to attempt to relocate the native animal or plant. This has been done in the past for mussels native to the Great Lakes. The invading Zebra mussel, with an incredible rate of reproduction, had overtaken endangered native mussel species. Biologists had to respond immediately to save the species, and relocated many endangered populations to areas unaffected by the Zebra mussel (Muir, 2006). Through the use of this process, called mitigation, the invader is not directly attacked but its effects are addressed. Mitigation is merely a way of treating the symptoms of invasion and does not provide a cure (Wittenberg & Cocks, 2000). Other control methods for the Zebra mussel are underway (Muir, 2006), but mitigation is generally a temporary solution and is expensive, so eradication would be much more beneficial (Wittenberg & Cocks, 2000). This example demonstrates a non-sustainable remedy for an invasive dilemma.

The most efficient method for avoiding the impact of invaders, as stated by Wittenberg and Cocks (2000), would be to prevent their initial introduction. Prevention requires extremely strict and effective policies to both deter exotic pet smugglers and to increase the rate of success for detecting smuggled animals. Education is one critical portion of a comprehensive prevention policy; it can inform both the public and officials involved of the prevention process of the species that require caution, how to identify

them, and the implications that would result if introduction were to occur (Wittenberg & Cocks, 2000).

Prevention is particularly essential for disease control. In the past three years, over 650 million animals were imported legally into the United States, and many with minimal inspection before passing into the country (AP, 2006). Many disease carrying animals show no visible sign of sickness, and customs inspectors are allegedly not required to undergo disease detection training as part of their employment (AP, 2006). Furthermore, the U.S. government employs only 120 of these inspectors, which casts doubts about the government's ability to detect incoming threats (AP, 2006).

According to the U.S. Senate's National Invasive Species Council (2001), determining the potential risk associated with a given species is necessary for constructing specific regulations for prevention. Intercepting these invaders by means of properly directed inspection is a key component of preventing introduction (NISC, 2001). Proper investigation of popular invasion pathways has the potential to greatly reduce introduction rates (NISC, 2001). However, dealing with invasive species on a case-by-case basis can be time consuming and expensive in their opinion.

The Disposition of Exotic Pets

In cases specific to exotic pets, one management issue is deciding how best to process intercepted exotics. As stated by the 2005 Convention on International Trade in Endangered Species of Flora and Fauna, confiscation of an exotic species as an exporter attempts to bring it into a new area is the best way to ensure that the animal will not immediately re-enter the trade network. Simply refusing the exotic species is not sufficient prevention, since the animal may return to the market. However, confiscation leaves the importing party with the responsibility and expenses associated with keeping the apprehended animal, such as fines and shipping costs.

Once an exotic pet has been confiscated by the government, there are a number of possible options for dealing with the animal. One of the most publicly supported methods, according to a 2002 report by the International Union for Conservation of Nature and Natural Resources, is to release these animals into the wild. However, an animal cannot be released into a non-native habitat, as it may establish itself as an invader and cause one or many of the problems posed by an invasion. Release must take place in the animal's native environment, though this is sometimes difficult to trace, especially if hybridization has taken place. According to a set of guidelines for species re-introduction created by the IUCN (1998) there are several situations in which release back into the wild is a viable option. As stated by the IUCN, (1998) a species can either be re-introduced to an area where the population has become extinct or reinforced in an area when the species populations are small. Both cases involve an extremely complicated process outlined by the guidelines and require long-term planning and financial support.

In order to reintroduce or reinforce a species, the environment must first be assessed to ensure that it contains sufficient resources for the animals (IUCN, 1998). In addition, the animals themselves must be screened for diseases and previous re-introductions of the species in other areas must be carefully studied. The IUCN states that government support of the receiving and exporting locations as well as public support for the project are needed before re-introduction can begin (1998). Due to the difficulties, costs, and potential drawbacks of this method, it is most successfully employed only in the case of endangered exotics (IUCN, 2002).

Alternately, exotic pets could be used by the government to educate the public about wild animals and perhaps explain the possible negative effects of exotic pet release into non-native environments. This education can be provided by traveling wildlife demonstrations or through zoos and aquariums (IUCN, 2002). The Association of Zoos and Aquariums (2003) stresses the role of zoos in the education relating to the effects introduced species can have on native wildlife. Exhibits, the AZA states (2003), can be designed to inform exotic pet owners and others about the risks associated with introduced species. When a zoo or aquarium agrees to take possession of an exotic, it must be capable of caring for the animal and also agree not to sell or trade it (CITES, 2005). Sending animals to academic organizations for scientific research is another option for disposition (CITES, 2005). These alternatives, however, would require funding to sustain the animal and, in the case of education, training individuals to educate. The possibility of escape into the wild is another drawback of this method, as it could result in biological or economical problems for the nation (IUCN, 2002). It may also be unrealistic

to place all confiscated animals into such programs depending on the average number of animals confiscated.

Puerto Rico has quite a few organizations that have permits to exhibit exotic animals. The Mayaguez zoo on the west coast is home to many exotics, for example. There are also other institutions known as El Arque de Noá and the Bayamón Zoo that have exotic animals.

Euthanizing exotic species is the third option for dealing with confiscated animals, and remains a very cheap and effective removal method. It leaves no risk of introduction into the environment or transmission of disease and requires no sustained funding for the upkeep of the animal (IUCN, 2002). Nevertheless, this method generally does not receive a great deal of public support due to moral issues surrounding the killing of individuals (CITES, 2005). Furthermore, this method cannot be utilized for endangered species. This point is particularly important in Puerto Rico, as bird populations throughout various Islands become endangered and may be sold as pets in Puerto Rico. Their endangered status eliminates their candidacy for euthanasia, and so they must therefore be relocated or released back into the wild. Appendix B contains an example decision-making chart for choosing methods of removal.

Management of Exotic Pests on a Worldwide Scale

In the end, the management of the invasive species threat depends entirely on the policies set forth by the nations themselves. Enforcement of policies set forth by government agencies relies directly on the volume of completed research, dedication to the cause, and, most importantly, the availability of discretionary funding. Several

preventative models have been suggested by scientists, including untested theoretical models that may never see the light of day. Policies for action once exotics have established themselves are critical as well, and are time-consuming to develop due to the complexity of biological invasions-in-progress and the need for specific plans for each situation. In this section, we present examples of policy issues at three levels: worldwide, within the United States, and within our subject of interest, Puerto Rico.

According to Lowenstein, Director of Forest Health programs in the Nature Conservancy (a U.S. organization dedicated to conservation practices), national policies are not up to date with the ways in which global trade has evolved (Kahn, 2006). Marvier (2004) and colleagues claim that the rate of non-native species introductions has far outstripped our ability to quantify and respond to them on a single-species basis, and that our new emphasis should be on preventative models and large-scale studies in order to make the best use of available funding and time. She and her colleagues also believe that, due to the limited resources available for management programs, it is critical to develop a yardstick to determine which battles are possible to win and which should be accepted as losses. The need for national- and international-scale policy updates is, therefore, a very pressing objective for biologists worldwide.

Preventative policies

Several models proposed by scientists indicate strongly that preventative policies are the most cost-effective option for invasive species management (Wittenberg & Cock, 2001). Debra Kahn (2006) explains in her article that the lack of funding and resources allocated to invasive species management results in a focus on education and prevention

programs above all else, since large studies and cleanup methods are expensive and often ineffective. Pimental et al (2000) agree with this analysis, recommending a focus on public education, sanitation, and advanced screening methods at airports and other places of entry.

One allegedly advanced model is that of New Zealand, where the government has banned the import of all exotics with the exception of a "clean list," a list of species that are known to be benign and are allowed to enter the country. While this may appear to be a radical approach, Wagener, in 1998, asserted that using a clean list is preferable to allowing exotics into a country and then attempting cleanup programs involving chemicals or physical removal, which are the most expensive control options. The "clean list" is far less expensive to implement than costly cleanup methods. However, it is important to note that the enforcement of a "clean list" policy still relies on available resources and manpower in order to be effective in the real world. The list also does not serve as a barrier to smuggling, since animals being smuggled in would be hidden in order to avoid inspections. Puerto Rico also has a "clean list" policy similar to that of New Zealand. The list of animals that Puerto Rico allows on its clean list is included in Appendix B.

The recurring problem worldwide is a lack of collaboration between nations. Kahn (2006) states that, while international councils have set forth guidelines and toolkits for invasive species management, full-scale task forces lack the resources necessary to promote real change at a regional level. Bruce Knight, an undersecretary responsible for regulatory programs in the United States, believes that even unlimited funding allocations would never fully stop undesirable exotic animal transports (Kahn, 2006). This idea

coincides with Marvier's recommendation in 2004 that careful studies must be performed to determine which species should be controlled and which should be allowed to invade due to the prohibitive costs of eliminating them. The problem of inter-collaboration between governments and agencies is possibly more complex than the biological root cause of the problem; solutions are variable and often difficult to implement, and new methods are difficult to test.

Collaboration between environmental agencies is potentially much easier to encourage. While each organization has its own jurisdictions, information must be shared quickly and effectively at times when these jurisdictions overlap. For example, a diseased bird arriving on a domestic flight would be inspected by local authorities, but the federal agencies would have to test the animal to ensure that the disease is not threatening to local populations.

Management of Exotic Pests in the Commonwealth of Puerto Rico

U.S. constitutional regulations apply to Puerto Rico due to the Island's Commonwealth status. Internal legislation is generated and enforced by Puerto Rico itself, with local laws taking precedence over national law whenever the local law is stricter. Under the Convention for International Trade in Endangered Species of Wild Fauna and Flora act of 1981, importers and exporters of wildlife must apply for a license to transport an animal within Puerto Rican borders or out of the Island (USDA, 1981).

The Puerto Rican Department of Natural and Environmental Resources (DNER) manages the tracking of exotics within the Island. The DNER currently has a database of licenses granted, yet it lacks a database of people and animals that fall under the Exotic

Species Amnesty, which grants owners amnesty from persecution if the exotic pet is brought in to a controlled location. They also require a protocol for the disposition of the collected animals. When appropriate, an animal may be eligible for relocation or reintroduction instead of euthanasia. If the species is endangered in another area of the world, for example, it may be more biologically responsible to transport the animal to that location to facilitate the re-establishment of natural populations.

CHAPTER III: METHODOLOGY

The goal of this project was to improve exotic species management within Puerto Rico. We accomplished this goal through a number of different objectives. Our first objective was to aid DNER in dealing with illegal animals acquired by Cambalache State Forest. We developed a disposition protocol for exotic animals confiscated and held in custody at the Cambalache State Forest. Our second objective was to develop recommendations for improving methods of preventing exotic animals from being smuggled into Puerto Rico. As a result of our investigations into inspection polices we learned that statistics regarding illegal exotic animals are not available because none have been compiled. We developed a template for the creation of a centralized exotic species database that would allow illegal animal statistics to be shared among various environmental agencies throughout the Island. In addition, with some of the information we collected we were able to revise the DNER permit database into a more cohesive format that simplifies the permitting process and allows for the observation of trends.

DEVELOPMENT OF DISPOSITION PROTOCOL

We analyzed the possible options for dealing with each of the animals held in custody. This required an analysis of the benefits, drawbacks, and costs of relocation, maintenance, and euthanasia, the three options available for disposing of the confiscated animals. We decided who to interview based on who would have information most relevant to the disposition protocol, a technique known as purposeful sampling. We interviewed the head ranger at Cambalache State forest, Angel Atienza, in order to determine the specific needs of the Department and incorporate them into our protocol.

We also analyzed the setup of the facility in terms of available space and the current number of animals residing there to determine whether sufficient space existed to house additional specimens. Next, we acquired a breakdown of the annual costs incurred by the State Forest which helped us determine the most practical methods of dealing with the animals confined at that location.

We then conducted an interview at the Juan A. Rivero Zoo in Mayaguez. This interview was performed in order to understand the interaction between the Zoo and Cambalache. Our interview subject was the head veterinarian Dr. Luis Figueroa.

IMPORTATION AND CUSTOMS AGENCIES

We conducted interviews with employees of five agencies on the Island that deal with exotic animal imports in order to determine how prevention policies could be improved. Table 3-1 below summarizes the agencies where interviews were performed, and lists the interviewees and their titles.

TABLE 3-1:

INTERVIEWS PERFORMED ON-SITE

Name	Agency	Title	Date
Angel Atienza	DNER Rangers	Ranger, Cambalache State Forest	3/20/07
Luis Figueroa	Juan A. Rivero Zoo	Zoo Curator	3/22/07
Elvin Monge	U.S. Fish & Wildlife	Wildlife Inspector	3/29/07
Hector Diaz-Collazo	State Veterinarian	State Veterinarian	4/2/07
Carlos Soto-Alberti	Animal and Plant Health Inspection Service	Area Epidemiology Officer	4/9/07
Miguel A. Borri-Díaz	Animal and Plant Health Inspection Service	Area Veterinarian-in-Charge	4/9/07
Juan Hurtado	U.S. Customs and Border Protection	Assistant Area Port Director	4/10/07
Wendy Boneta	DNER	Administrator	4/12/07
Giselle Keating	DNER Rangers	Ranger, Airport	4/17/07
Miguel Garcia	DNER	Director, Fish and Wildlife Division	4/17/07

The interviews were semi-structured. We arrived at each meeting with a set of questions and some sub questions. However, because we were not sure at the onset of each interview what the exact function of each organization was, we were prepared to modify the questioning process in order to fit the interviewee's area of expertise. Each interview began with a request for a description of the interviewee's position and the function of their organization so that we could tailor questions to fit the interviewee's area of expertise. This method allowed us to extract as much useful information as possible from each person we interviewed. The individuals we interviewed throughout the entire process were found by requesting further contacts from our initial interviewees.

After each meeting with an official, we requested information for other contacts who may have information that would be useful to us and were able to arrange further interviews with this information, a technique known as snowball sampling. By performing interviews outside of DNER, we were able to better define the current status of border control and inspections and to develop our policy recommendations for the DNER.

Our interviews with agencies outside of DNER began with Elvin Monge, one of only two U.S. Fish and Wildlife Department representatives in the Caribbean, for information regarding the functions of his agency and its relationship to the Department of Natural and Environmental Resources. In order to discover more procedures that could be improved to prevent undesired animals from entering Puerto Rico, we discussed preventative measures with the state veterinarian, Dr. Hector Diaz-Collazo. From this discussion we gained a better understanding of the importation process and the role of the state veterinarian's office in the border control process.

We visited the Puerto Rico offices of the Animal and Plant Health Inspection Service (APHIS) and U.S. Customs and Border Protection to obtain more information concerning animal imports and inspections. At APHIS we questioned the area epidemiology officer, Dr. Carlos H Soto-Alberti, and the area veterinarian-in-charge, Dr. Miguel A. Borri. At the U.S. Customs station in Luis Muñoz Marín airport we interviewed Juan Hurtado, the Assistant Area Port Director (Tactical). He informed us of the operations U.S. Customs performs at the airport for incoming international cargo and passenger flights.

Interviews with Wendy Boneta and Dr. Miguel Garcia of DNER gave us a better idea of the functions of the Department in the exotic species field and also helped us

determine which recommendations may be most beneficial to the DNER. Giselle Keating, a DNER ranger working in the airport office, alerted us to the specific obstacles they encounter at the airport dealing with luggage and package inspections. All of these interviews enabled us to make recommendations to policy for improved protection against the smuggling of exotics.

We researched the laws and regulations of Hawaii. This state is also an island with a warm climate and so has experienced problems similar to those of Puerto Rico in dealing with exotic animals. We researched their laws as a benchmark for importation and smuggling management.

INTERAGENCY COMMUNICATION

As a result of our initial interviews we realized that information concerning illegal exotic animals on Puerto Rico is not easily available to agencies throughout the island that have jurisdiction over various aspects of the problem. In order to confirm that this accessibility did not exist, we investigated which information would be most useful to have available at the various agencies that work with exotics throughout the Island. To begin, we assessed the current record-keeping practices of Cambalache to determine which information would be most useful to be included in a database. We decided that the database should contain information about the animal's original location, suspected entry method, current owner, method of capture, and other information specific to the animal.

In order to determine the possible uses for this database, we asked all of our interviewees (see Table 3-1) what types of information they were lacking and what information would be most useful to them. This helped us to justify recommending the creation of a database containing information on all illegal animals discovered on the Island. We developed a small example database to demonstrate the benefits of compiling and sharing information regarding smuggled animals.

REVISION OF PERMIT DATABASE

We analyzed the concerns that were brought to us by Marilyn Colón about the permit database currently in use. Based on these findings the permit database was converted to a new format and columns were added so that permit expiration dates and other information were clearly visible.

CHAPTER IV: RESULTS AND ANALYSIS

CAMBALACHE STATE FOREST DISPOSITION PROTOCOL

The Cambalache State Forest in Arecibo serves as the holding area for animals confiscated or otherwise collected by the DNER *Cuerpo de Vigilantes* (Rangers). The facility contains a small office for the rangers and an adjacent cement building approximately ten meters away with indoor and outdoor storage spaces where animals are kept in their cages. According to Angel Atienza, the head ranger at the facility, the majority of the animals they receive each week are birds and reptiles, but they occasionally receive mammals as well. In the past they have acquired tigers, monkeys, and other large mammals.

At the time of our visit to Cambalache, the center contained approximately 65 birds, reptiles, amphibians and mammals. During our visit, we noted that it was not uncommon for animals to share cages. For example, several of the glass tanks holding snakes were holding three or more individuals in a small place. Atienza explained to us that the facility is overcrowded and in need of either more space for collected animals or a faster method of relocating them. Table 4-1 on the following page displays a list of the animals living at the facility. This list changes significantly on a weekly basis.

Table 4-2:

Animals residing at Cambalache State Forest by type

Type	**Quantity**
Snakes	19
Turtles	18
Birds	19
Mammals	11
Lizards/Amphibians	11
Total:	**63**

Expansion plans for the Cambalache facility are in the process of being executed. Once construction is complete, the Rangers will have a larger confinement center with forms of containment better suited to the types of animals received. For example, high security cages will be added for confiscated tigers, pumas, and other dangerous specimens. Secure storage of these types of animals is a concern due to the proximity of the State Forest to nearby Arecibo. Groups of schoolchildren also visit the holding center frequently to see the animals. Their safety is also of great concern to the rangers. The expansion plan was mentioned in passing during our discussion with Atienza, and the project will be moving ahead in the near future.

While the rangers have an informal procedure in place for deciding what to do with the animals they receive, they have no official procedural document to use. Miguel Garcia, Director of the Fish and Wildlife Division of DNER explained to us that the disposition protocol document was always a "work in progress" project but it was something that they had never fine-tuned or finalized. The current normal disposition procedure was explained by Atienza. When the animals arrive, they are screened by him for disease and other threatening conditions. When an animal is very sick they call a

volunteer veterinarian to inspect the individual and administer treatment. Otherwise, the animals do not undergo full medical screening or testing by a veterinarian.

After the animals are inspected, they are placed in appropriate cages or containers. They are then held at Cambalache for a period of time while the rangers attempt to find a new place to send the animal. It is important to note that some animal confiscations require that the agencies with local authority, such as DNER, contact the federal authorities, such as U.S. Fish and Wildlife and the Department of Agriculture, to make the existence of the animal known to all parties. Some species may fall under federal jurisdiction or ownership, while others may be legally possessed by the State agencies, such as DNER.

If an animal is endangered or threatened, the rangers must determine the animal's location of origin (if possible) and contact the authorities there. If a new location for the animal cannot be found, the rangers would prefer to keep the animal alive at Cambalache than to kill it. Euthanasia is currently used by the rangers as a disposition method only in cases where all other options have been explored. Animals with terminal illnesses or infectious diseases are the only animals that rangers would consider killing. Some of the individuals being held in the confinement center have been there for several months because the rangers cannot find a facility that is willing to receive them.

Atienza explained to us that he would prefer remove animals from Cambalache as quickly as possible, preferably within two to three days, in order to reduce the upkeep costs of the animal. One common course of action is for the rangers to contact Dr. Luis Figueroa at the Mayaguez zoo upon reception of the animal and explore his contacts at zoos and institutions in the mainland U.S. in order to find an institution that is willing to

take it. According to Dr. Figueroa, a typical arrangement for the transport of the animal includes the transport containers and shipping costs for the animal being paid for by the receiving institution.

The Mayaguez Zoo

The Mayaguez Zoo, officially known as the Juan A. Rivero Zoo, serves as a bridge between Cambalache and the zoos and wildlife centers of the United States. The staff of the zoo focuses on conservation practices above all else, and they take in many animals from rehabilitation facilities and centers like Cambalache. Dr. Luis Figueroa, the head veterinarian and an administrator at the zoo, has many contacts for moving animals to and from the United States and other places worldwide. While space is limited in current exhibits, the Zoo is ready for future expansion, since only 8 of the approximately 80 acres of land owned by the Zoo have been developed. According to Dr. Figueroa, the zoo has plans for expanding its exhibits into the remaining 72 acres of undeveloped land.

The Zoo requires approximately $1.3 million yearly for expenses. About 70 percent of the Zoos expenses are achieved through ticket sales and the rest come from the National Park system budget. According to Dr. Figueroa, the U.S. Senate allocates the budget to the national park system, and then the budget is divided among all of the parks in the system. The zoo also engages in other endeavors to finance their maintenance and expansion. For example, they recently employed an adoption program in which individuals can adopt various animals at the zoo and help pay for their upkeep. In addition, the zoo asks for donations from the Friends of the Parks and has received some very useful monetary assistance through this program.

One of the problems associated with the processing of exotic animals in Puerto Rico is that they do not always go to Cambalache first and are sometimes kept for extended periods at other sites scattered throughout the Island. DNER would prefer to have all of these animals be processed through the Cambalache facility so they are known to the government agencies. If animals do not go through the Cambalache center, it is more difficult to track the animals and makes it possible for some animals to be stolen. A centralized system in which Cambalache is defined as the base for confiscated exotics would help to reduce, if not eliminate, the problem of tracking animal movements within Puerto Rico. Once the disposition protocol is in place and the facility is upgraded to accommodate future influxes of animals, DNER would like to declare Cambalache to be the site through which all recovered exotic animals must pass before they are allowed to stay on the Island.

Disposition Protocol Development

In order to create a disposition protocol for the DNER, we searched for similar documents that we could adapt to satisfy the requirements of the rangers. Based on our interviews and research, we identified several key requirements for our disposition protocol:

- Must include a decision-making process that is focused on the conservation and protection of wildlife on the Island
- Should be easy to use so that animals may be quickly processed
- All options for final destination of animal must be humane in nature
- Must serve as a standardized protocol for all species

These requirements serve as the foundation for our development of the disposition protocol. Our goal was to create a document that identifies the benefits and risks of all of the options available for the final destination of the animals in the Cambalache center and to do so without compromising the focus of Puerto Rico's environmental agencies on the conservation of natural resources.

The IUCN (International Union for Conservation of Nature) 2002 document *IUCN Guidelines for the Placement of Confiscated Animals* outlines the potential benefits and risks of three possible options for processing confiscated animals. These options are summarized in Table 4-2 on the following page.

Table 4-3:

Disposition options adapted from 2002 document IUCN Guidelines for the Placement of Confiscated Animals

Disposition Option	*Benefits*	*Risks*
Re-introduce to the wild	- Can bolster depleted populations in the wild - Can re-introduce endangered species to their original habitat - Sends conservation message to the public	- Most difficult option to implement (must identify site of capture, subspecies, perform study of long-term risks) - Expensive in terms of manpower and time spent in preparation - Not possible for animals that have become domesticated or exhibit behavioral abnormalities
Maintain in captivity	- No risk of escape in Puerto Rico if sent overseas - Receiving institution typically pays for transportation	- Risk of animal escaping to wild when kept within Puerto Rico - Cost of upkeep can be significant - Limited space in many facilities - Personnel required to take care of animals and maintain their health - Requires many inspections and permits
Euthanize	- Fast and inexpensive - Unlimited option - One-time cost - Prevents spread of disease	- Cannot be used for endangered or threatened species - Requires medical testing - Moral issues

The full disposition protocol document is included in Appendix C.

CURRENT PRACTICES AND POLICIES

Hawaii's State Policies

The State of Hawaii is in a situation very similar to Puerto Rico in terms of the exotic species problem. Both Puerto Rico and Hawaii are tropical islands and are therefore extremely susceptible to invasion by exotic species. In addition, imports from the United States are considered domestic for both Hawaii and Puerto Rico and therefore do not go through customs. Hawaii, unlike Puerto Rico, has developed an Invasive Species Council (HISC) that works to minimize the exotic species problem on the Island.

The Invasive Species Council

According to a report written by the Hawaii Invasive Species Program (2007), it was stated in a 2003 State Legislature that invasive species are the greatest threat to the economy and environmental health of Hawaii. In response to this threat, Hawaii created the Invasive Species Council. The coqui frog in particular is an invader that concerns the Hawaiian government. The frog is not native to the Island but had managed to establish itself. The tiny frogs have caused a great deal of damage already. The species serves as a food source to other unwanted animals, such as rats, and is also damaging the local horticulture industry. The noise pollution problem caused by the frog on the Island was so great that in 2004 the governor called the situation a state of emergency.

The role of the Hawaii Invasive Species Council, as stated by their report, is to suggest legislation and also make efforts to improve prevention, detection, response, and control of exotic animals. The HISC worked to develop ways of improving inspection and thus reduce the number of exotic animals coming into the Island. After inspections

were improved, the findings as a result of the changes were recorded from March to June. In this period about 3,000 packages were inspected and 38 species of exotic insects were intercepted.

The HISC developed working groups comprised of the agencies on the Island that work with exotic animal imports. These groups have a number of different functions, such as determining the risks associated with different species or the best method of removal. According to the Prevention Working Group Meeting Minutes from a working group meeting held in 2005, 10 to 12 additional inspectors were allocated to sites where usually only 1% of incoming commodities were inspected. This lead to the discovery of exotic insects on plants shipped in from Florida and California. The plants the insects were found on had been sprayed with pesticides and inspected by U.S. Customs and Border Control and yet the bugs were still present.

The Invasive Species Council of Hawaii has worked to alter the policy of the island and direct funding to specific prevention and clean-up methods. The success of these methods in Hawaii is promising for other tropical islands. The findings of the HISC can help to guide future management plans for Puerto Rico.

Puerto Rico's Current Policies- Agency Roles

Of the five agencies where we conducted interviews, three expressed concern about the inspections of domestic flights and that their organization does not deal with these imports. The federal agencies on the Island are all concerned with foreign imports and so only one department on the Island deals with the actual importation of animals from domestic locations. The DNER is responsible for permits, inspection, and confiscation of exotic animals that have arrived from the United States.

U.S. Fish and Wildlife

According to Elvin Monge, U.S. Fish and Wildlife Service exists to protect fish and wildlife populations for the benefit of the people of the United States. In Puerto Rico, part of the U.S. Fish and Wildlife Service's responsibility is to inspect imported animals from foreign locations. The inspectors are informed of incoming packages from international locations and will investigate any unexpected arrival. If an import arrives and it is found upon investigation that the package is not approved, the animals will be sedated and sent back to their place of origin. U.S. Fish and Wildlife deals with a small number of animal imports mostly consisting of live tropical fish from Thailand or Columbia. These imports come in approximately six times a year. Of all the shipments coming into Puerto Rico, U.S. Fish and Wildlife inspects 85 percent of them while the remainder are inspected by other departments.

U.S. Fish and Wildlife has the authority to seize illegal exotics that they discover. When an exotic bird is found to be in violation of federal law, U.S. Fish and Wildlife has specific procedures that must be followed. The animals are seized and immediately sent to a holding facility in Miami, Florida. Exotic birds that are not in violation of a federal law can be confiscated by the DNER rangers. The rangers are responsible for determining a final disposition for the animal. The Endangered Species Act 50 CFR 17.21 (c)(3) allows the DNER to confiscate and relocate exotic birds.

State Veterinarian

Hector Diaz-Collazo works for the Puerto Rican government as a veterinarian and is responsible for inspecting health certificates of incoming animals to ensure that they meet the heath regulations of Puerto Rico. His office handles about two animal shipments

per month, and he explained to us that the majority of these shipments are birds. All of the shipments that the State Veterinarian deals with are domestic; internationally imported animals are inspected by the USDA APHIS or Veterinary Services offices. The State Veterinarian does not deal with the animals themselves when the animals come into the Commonwealth, but will look at the health certificates that are included in the package to ensure compliance with regulations.

Documentation of animals that come into Puerto Rico are kept in the State Veterinarian's office for three years and then moved to a government depository where they remain for an additional six years. Puerto Rico's Department of Agriculture (PRDoA) office is responsible for inspecting animals when they enter a given point of entry and must confirm that the health certificates and permits match up. They also perform a brief inspection to ensure that the animal is in good medical condition. No one performs a complete veterinary inspection on incoming animals because the resources for this do not exist. However, if the health certificate shows that the animal does not meet regulations or if PRDoA notices that the animal is unhealthy the animal will be sent back.

USDA APHIS and Veterinary Services

The USDA itself is concerned with international imports, though APHIS (Animal and Plant Health Inspection Service) is more concerned with preventing disease from spreading within the Island. Dr. Carlos Soto-Alberti works with the APHIS division of USDA and is responsible for tracking avian diseases such as bird flu and preventing outbreaks of these diseases within the Island's bird populations. For example, when bird owners notice that their animal is sick, they are encouraged to call the USDA and the USDA performs testing on the animal.

The disease problem, Dr. Soto-Alberti explained, is a concern but not a growing one for Puerto Rico. APHIS only receives a small number of cases each month. There was an outbreak of Newcastle disease in the 1940s, but that was quickly eradicated from the Island. APHIS receives 1 or 2 calls per week for dying birds, mostly for respiratory or nasal illnesses. There has never been an outbreak of bird flu on the Island of Puerto Rico.

APHIS also hopes to increase public awareness of the potential dangers of exotic animal diseases. Dr. Soto-Alberti explained to us that all of the exotic birds on the Island fall under the jurisdiction of the federal agencies. However, Law #241 gives DNER the ability to regulate movement, selling, and possession of exotic birds within the Island.

U.S. Customs and Border Protection

U.S. Customs and border protection deals only with international imports and does no inspections on incoming domestic flights. The agency has begun to do some inspections on cargo planes coming into the Commonwealth, but these are minimal inspections. When they happen to come into contact with an exotic animal, they immediately report it to U.S. Fish and Wildlife service. Therefore, they do not work with DNER on a daily basis. Narcotics and weapons smuggling are larger problems that they focus on.

Department of Natural and Environmental Resources

According to an airport ranger, Giselle Keating, the DNER inspects all non-commercial animal imports from the United States. The rangers investigate shipments of animals to confirm that the package contains animals that are on Puerto Rico's "clean" list. The clean list is a list of all animals that are allowed to be imported into the Commonwealth. The rangers have the authority to confiscate any animals being imported that are not on the clean list.

Exotic Pet Smuggling in Puerto Rico

The smuggling of exotic animals into Puerto Rico has increased the number of non native species on the island. All of the individuals interviewed cited smuggling as a growing problem in Puerto Rico. Exotic animal trafficking is therefore a crisis that every organization involved has noted.

Illegal animals

According to Wendy Boneta, an administrator for DNER, permits are required for exotic animals not listed on the clean list to be brought into Puerto Rico. Exotic animals can be extremely detrimental to the biodiversity of Puerto Rico, so special prohibitions are in place for potentially dangerous exotics that are not found on the clean list.

There are a number of species on Puerto Rico that are endangered and therefore protected by law. Puerto Rico is currently struggling with maintaining and increasing the populations of the Puerto Rican parrot on the Island. Therefore, permits are not granted for Amazon parrots of the same genus as the Puerto Rican parrot, because the birds from the Amazon may compete with the Puerto Rican Parrot. In general, if a person wants to own an animal that is not on the list of acceptable animals for permits, it is that individual's responsibility to prove that the animal they want does not pose a threat to Puerto Rican wildlife.

According to Dr. Garcia, the exotic species trade is allowed to flourish partially because pet owners are not aware that animals they purchase are illegal. It is assumed that animals sold at pet stores are legal. For example, ferrets are not legal in Puerto Rico but when they are sold in pet stores they are believed to be legal. Thus, animals are bought and the potential damages they could cause are not known.

Miguel Garcia explained that an amnesty was put into place in 1998 that allowed pet owners to come forward with their illegal exotics. The DNER granted the individuals permits to keep the animal, but not to breed or sell it. The amnesty was put in place so that individuals would come forward with animals and DNER would be aware of how many exotic animals were present in Puerto Rico. The amnesty is no longer in place, so when a person comes forward with an animal that is illegal it will be confiscated and taken to Cambalache State Forest.

Drugs

During the process of investigating the border inspection procedures of the Commonwealth and federal agencies, we came upon a number of worrisome theories regarding smuggling activities in the Caribbean. The most unsettling realization was that if exotic animals are being smuggled into the islands on domestic flights, smugglers could also use these channels to transport firearms and narcotics. According to a 2002 document written by the Regional Research Institute, illegal wildlife trade can be linked to drug trade in three ways:

- "parallel trafficking of drugs and wildlife among shared routes, with the latter as a subsidiary trade
- The use of ostensibly legal shipments of wildlife to conceal drugs; and
- Using wildlife products as currency to 'barter' for drugs, and the exchange of drugs for wildlife as part of the laundering of drug traffic proceeds." (Cook et al. 2002)

Of these three, the second is particularly disturbing for Puerto Rico. According to the same document, in the United Kingdom it is estimated that approximately half of all

people prosecuted for wildlife crimes over a twelve month period also had prior convictions for crimes related to narcotics trafficking. This indicates a strong potential link between narcotics transportation and illegal wildlife trade.

Dr. Miguel Garcia of the DNER also expressed concern at the possibility of drug smuggling occurring through exotic species. Shipments of animals that are perfectly legal in Puerto Rico could be carrying illegal substances embedded in or swallowed by the animals. In the past, for example, smugglers have hidden cocaine and other narcotics inside containers of coffee. Drug-sniffing dogs have difficulty detecting the presence of the drugs due to the strong smell of the coffee. These smuggling methods are very creative and difficult for inspectors to predict.

Inspections

The overall consensus from the interviews conducted with agencies throughout the Commonwealth was that the current inspections process has weaknesses that are allowing exotic animals to enter the Commonwealth. Every DNER employee interviewed stressed a lack of funding and structure of the ranger program and also cited instances in which smuggling has been observed and was only caught by chance.

According to our interview with the rangers stationed at the Luis Muñoz Marín airport in San Juan, the rangers routinely inspect domestic shipments of wildlife at the airport. Most of the exotics that come through the airport via domestic flights are thought to come from either Florida or California. The job of all of the DNER rangers, as described by Giselle Keating, is to ensure that the people comply with the laws and regulations set forth by DNER, specifically Law 241 and regulations 6765 and 6775 for exotic species. In the airport, rangers conduct inspections of cargo and luggage for

domestic flights in cases where animals have been declared during the transport process. Rangers record information about the shipments that come in and compile it on a weekly basis. This information is then sent to the Lieutenant, who holds onto the information and compiles it for each month.

There is no DNER ranger shift between 10 p.m. and 6 a.m. in the Luis Muñoz Marín Airport**.** If an animal arrives at night when no ranger is present, it must be retained at the airport overnight until the next ranger shift begins. However, there are no clearly defined procedures for dealing with suspicious packages. If a Ranger sees something suspicious, such as a package that makes animal noises or a package labeled with an animal name, he has the legal authority to investigate it. The ranger can ask to open the package, but if the person refuses, no regulations are in place to guide the rangers' course of action. The lack of standard procedures forces the Rangers to make judgment calls on a case-by-case basis, a practice that could potentially cause a great deal of confusion.

Sra. Keating also expressed concern that exotic animals could be entering the country through a variety of other channels. Puerto Rico has hundreds of private marinas throughout its coastline, and personal watercrafts have the ability to travel to Puerto Rico from other Caribbean islands without undergoing a formal inspection process. This indicates a lack of personnel resources once again, since it is impossible to have rangers or police at every marina and airport throughout the Island. Sra. Boneta of the DNER agreed that private marinas are a troublesome issue for their department. She claimed that the Commonwealth does not perform inspections at marinas because these areas are considered to be places of recreation and not for commercial use. However, rangers have

caught people attempting to transport animals through marinas in the past, such as a shipment of macaws from South America.

Another obstacle encountered by rangers, according to Wendy Boneta, is that they are unable to investigate homes in which they suspect there is an exotic animal without first obtaining a court order. In the past, this has given the pet owner time to move illegal animals to a different location. In one story told to us, a farmer was able to relocate an estimated 500 exotic birds before the rangers were granted permission to search his property. The birds were never found.

According to Sra. Keating, in order to identify animal species and determine whether or not they are legal the rangers use the white list combined with pictures that they have printed off from the internet. The complete white list is included in Appendix E. This method works, but is not flawless. For example, according to Dewey and Loup (2004), the Common garter snake, an allowed exotic, is almost identical in appearance to Butler's garter snake. The difference between the two snakes is that the common garter has a head that is noticeably larger than its neck while Butler's garter snake has a head and neck that are the same width. This difference may not be visible in a picture from the internet. Furthermore, the animals that come into Puerto Rico are required to be labeled with their common name, but since this name can vary greatly it would be useful to have the scientific name present as well.

Domestic flights, according to U.S. Customs and Border Protection, are not subject to random inspections by either federal or state agencies. If an individual claims to have an animal, the animal's paperwork will be evaluated to make sure that the animal is in compliance with health regulations. Sra. Keating explained that consigners are

supposed to call at least twenty-four hours in advance of an animal shipment's arrival in the airport. When an animal is to arrive from the states, the airline should inform the DNER rangers so that the animal will be inspected before being allowed to enter. Exotic pets may be declared to the airlines when they board a plane, but the airline has no legal responsibility to notify local authorities of the animal.

In the past, air freight carriers such as UPS and FedEx have received shipments of animals in the past without notifying the DNER rangers at all. On the day of our interview with Giselle Keating, she was informed by a USDA official that a shipment of turtles had arrived in Guaynabo when the airline itself should have notified DNER. If the animal shipments are mislabeled or simply not claimed, then the airlines would be completely unaware of the animal's presence.

The standard methods of transportation and the inspection methods employed are summarized in Table 4-3.

TABLE 4-4:

POSSIBLE AVENUES OF SMUGGLING AND INSPECTIONS

Method of Transport	**Inspections**
International flights (passenger, cargo)	U.S. Customs and Border Control, U.S. Department of Agriculture
Domestic flights (passenger, cargo)	DNER Rangers (not between 10pm and 6am), other local agencies
Marinas and private sea craft	No formal inspections
Small airports	No formal inspections
Shipments via FedEx/UPS/Etc	If firearms or animals are present, should notify local authorities (does not always occur)

Financial Constraints

According to Wendy Boneta, the largest difficulty for the DNER in dealing with the exotic species problem is a lack of funding and legal jurisdiction to perform the necessary inspections. The majority of funding that comes to DNER is from the U.S. government and not the Commonwealth itself. The overall funding has remained the same for the past seven years despite the fact that costs have increased substantially over the same period. According to Sra. Keating, only a tiny fraction of the total government budget is allocated for the DNER each year. With this money, Sra. Boneta explained, DNER is allowed to do scientific research, buy land, or build facilities. The Department does not have the funds necessary to allocate a significant amount to the rangers for

purchasing equipment Therefore, rangers do not have the all the equipment necessary to perform inspections that would greatly reduce the influx of undesired exotic animals.

According to Sra. Keating, in the case that an illegal animal is discovered it will either be returned to its original location or confiscated and brought to Cambalache, depending on whether the sender can afford to pay the cost of the animal's return shipping. The person who shipped the animal is also charged a fine for their actions. The amount of the fine depends primarily on the animal's current market value. The money acquired from these tickets goes into a special DNER account, but it would be useful if the rangers were able to access that money for purchasing equipment. These fines could also be used to pay the shipping to return all illegal imports back to their original location instead of confiscating the animals and taking them to Cambalache.

INTER-AGENCY COLLABORATION ON PUERTO RICO

During our research we discovered that many of difficulties of exotic species management in Puerto Rico result from insufficient communication between environmental agencies. We performed interviews at five different agencies throughout the Island, including federal and local organizations. In this section, we summarize the relationship of each agency with DNER in order to illustrate the difficulties in communication that exist. The agencies are not always aware of what others are doing, which makes it difficult for efforts to be coordinated. Additional difficulties arise because the agencies are not always clear on which agency has jurisdiction in certain circumstances. According to Miguel Garcia, agencies sometimes dispute who has the lead role and complications can result from this.

USDA APHIS

Dr. Carlos Soto-Alberti, the Area Epidemiology Officer for the USDA's Animal and Plant Health Inspection Service (APHIS) explained to us that APHIS's relationship with DNER is generally open and friendly. Whenever they need information or help from DNER, they will call and get the issue resolved as quickly as possible. However, one of the obstacles is the stipulations associated with Law #241. According to Law #241, owners must state whether or not they plan on keeping the bird or handing it over to authorities. If the owner does not have the proper permit for the bird and decides to keep it, the DNER may confiscate the animal. While APHIS is concerned with diseases carried by birds and would like all bird owners to report sicknesses, the DNER is focused on removing illegal animals from the Commonwealth.

U.S. Fish and Wildlife Service

U.S. Fish and Wildlife is beginning to build a relationship with the DNER in dealing with domestic smuggling problems, domestic smuggling is primarily the responsibility of the local Puerto Rican agencies. Information flows freely between the DNER and U.S. Fish and Wildlife Service, but statistics on domestic animals movements could help USFW significantly. On the opposite end of the spectrum, the federal statistics are classified and must be obtained by contacting the Atlanta offices and making a request, which makes it difficult for Puerto Rican agencies such as DNER to obtain the information they require. U.S. Fish and Wildlife also does work with the USDA, Veterinary Services, and the CDC to prevent the spread of exotic animal diseases.

Miguel Garcia maintains that the communication between Departments that deal with exotics is very open. When an issue arises, several agencies will meet and discuss the problem. The last times the Departments met to have discussion were when West Nile Virus and Avian Influenza were first brought up as concerns. There is no regular interaction apart from when there is a specific current event to discuss.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Illegal exotic animals, when discovered on the island of Puerto Rico, are confiscated by DNER rangers. The rangers must then decide what to do with the animal, whether it is to relocate it to a zoo in the United States, relocate and release into the wild, or euthanize. All confiscated animals should be sent to Cambalache State Forest, which is a wildlife center in Arecibo, where their final disposition can be determined. At the current time there is no protocol in place for processing these animals. Therefore, the animals end up in different wildlife containment centers throughout the island and the determination of the final destination of these exotics does not follow a specific procedure. Therefore, the DNER is in need of a systematic method for dealing with confiscated exotics.

The rangers at Cambalache State Forest have difficulty communicating their current situation, in terms of the numbers and types of animals that they have, due to the fact that they have no internet access. The Mayaguez Zoo in particular is an extremely important contact for finding places to send confiscated exotics, but the rangers are not able to communicate quickly with the Zoo to expedite the animal relocation process. The lack of internet also makes it difficult to keep the DNER main offices up to date with the number of animals at Cambalache State Forest.

Inspections of exotic animals coming into Puerto Rico are done by a number of agencies on the island. US Fish and Wildlife along with US Customs and Border Patrol are responsible for imports from international locations. Héctor J. Díaz Collazo, the State

Veterinarian, Puerto Rico's Department of Agriculture, and DNER are responsible for imports coming from the United States. US Fish and Wildlife inspects incoming animal imports from foreign locations to make sure that the animals are allowable and will return any illegal animals to the sender. US Customs and Border Protection inspects incoming packages and passengers from international locations and if they discover an animal they will call US Fish and Wildlife to investigate it. The State Veterinarian inspects health certificates to make sure that incoming animals are following Puerto Rico's health regulations. Puerto Rico's Department of Agriculture inspects commercial imports of animals and plants. All other importations from the United States are handled by DNER rangers. When animal imports are inspected, the rangers use the clean list, which lists every animal that is allowed into Puerto Rico. Any animal not on the list is not allowed unless extenuating circumstances exist and a permit has been granted. Rangers are responsible for identifying an animal as illegal or legal based on this list, and many have individually gone through and printed out internet pictures to help them identify species.

There are currently no rangers in marinas throughout Puerto Rico and there is no ranger working the night shift at the San Juan Airport. Animals are entering the Commonwealth at these places and have been discovered by rangers just passing through.

The rangers inspect packages and make sure that nothing is in violation of law #241. They can also confiscate illegal animals that are clearly visible and request to investigate suspicious packages. However, no standard set of regulations exists to guide the actions of the rangers and so procedures are not defined.

Throughout our search for information concerning exotic animals in Puerto Rico, it was obvious that recorded information regarding smuggling or confiscated animals is

either extremely difficult to obtain or does not exist at all. It is imperative for numerous agencies throughout the island that the numbers of illegal animals smuggled into Puerto Rico as well as the locations from which they are being sent from and to are compiled and made available. APHIS could use this information to pinpoint locations that have a history of importing large quantities of illegal birds, which would help them to better investigate avian diseases. Other agencies, such as DNER, US Customs and Border Protection, PRDoA, and the State Veterinarian could use the information to better concentrate their efforts on areas that are the most popular ports of entry for exotics.

RECOMMENDATIONS

Recommendation: Education

The Department of Natural and Environmental Resources currently has a program in place to educate the children of Puerto Rico about many issues related to the environment and conservation. In particular, they have a newsletter dedicated to the conservation of resources and one that discusses endangered species. As stated in the background, education is one of the most important steps in the prevention of exotics becoming established in new locations.

Due to the fact that exotic animals are a large problem in Puerto Rico, and have the potential to cause great damage, preventing them from becoming established is extremely important. Therefore, ***we recommend that the information contained in the background chapter of this report be adapted for use in the DNER educational program.***

Recommendation: Permit Database

The permit and amnesty databases have been updated and transferred to Microsoft Office Visio. This program allows more flexibility for data entry and usage. Additional columns have been added to that these databases contain all necessary information to observe permit trends and keep track of expiration dates. The new setup makes it easier for the Department to see the locations of animal owners on the island. ***We recommend that the revised database be used and all old database information transferred to the new setup.***

Recommendation: Zoo

The Mayaguez Zoo provides an extremely useful service to Cambalache State forest by finding new homes for confiscated animals. Many animals that come into Cambalache would not find new homes without the help of Dr. Figueroa at the Mayaguez Zoo. Thus, it is important that the zoo be well funded and maintained. In addition, it is important that the conservation efforts provided by the zoo be displayed to the public so that more individuals become aware of the necessity of species conservation as well as the problems with having exotic animals as pets. Therefore, we have recommendations to make concerning the zoo.

The current permit process requires that all permits for importation and exportation be renewed every year. This has proven to be an obstacle for the zoo in aiding Cambalache because they must frequently renew many permits in order to export animals sent to them by Cambalache***. We recommend that a permit extension be granted to the Mayaguez zoo for all activities related to the relocation of animals that have gone through Cambalache.***

The Mayaguez Zoo has a substantial number of attractive exhibits and presents a great deal of educational information to its visitors. However, the existence of the zoo is not widely known and it is virtually impossible to gather information about the zoo, its activities, and its goals via the internet. A website designed specifically for the zoo would be an extremely effective means of showcasing this attraction. The zoo's conservation goals, the aid they provide to Cambalache and the educational value of their exhibits are some of the most notable facts to display on a website. Directions to the zoo and hours of operation should be published on a site to encourage and influx of visitors. In addition, descriptions of the various animals at the zoo may entice visitation. Research institutions as well as other zoos can use contact information provided on the site to gain information from Mayaguez employees or even to provide contacts for potential homes for animals in custody at Cambalache. The Mayaguez Zoo is an important resource for Cambalache, a potentially avenue for education, and a place with the potential for attracting tourists. Providing a wealth of information about this attraction via the web will have enormous positive impacts for conservation, tourism, and education on Puerto Rico. ***We recommend that a website be developed for the Mayaguez Zoo containing the information discussed.***

Recommendation: Use of Protocol

The disposition of confiscated animals is becoming a common issue among government environmental agencies worldwide. Tighter enforcement of existing regulations as well as new legislation put into place have resulted in an increased number of confiscated animals per time period. In Puerto Rico, the situation is no different.

Increased enforcement by el Cuerpo de Vilgilantes in the arena of exotic pets and exotic animal trade have resulted in an increased rate of confiscations.

Cambalache State Forest is meant as a temporary location for confiscated exotics. However, some animals have been kept there for over a year. We have developed a protocol for the disposition of the animals, which can be found in Appendix C. This protocol should improve the process of relocating exotics and increase the speed of the process. ***We recommend that the Disposition Protocol be followed for every animal acquired by DNER rangers.***

Recommendation: Rangers

Hawaii, much like Puerto Rico, uses a clean list for allowable animals. The state is beginning to reduce the number of exotics entering the country and has specific focus groups to deal with issues of particular concern, such as the brown tree snake. In order for this list to be effective in Puerto Rico, enforcement must be very strong. Increasing the thoroughness of inspections, as well as the number of officials in ports of entry throughout the island would help to reduce the number of illegal animals being smuggled into Puerto Rico. We have made a number of recommendations specific to DNER Rangers in order to improve prevention on the island.

The DNER rangers inspect incoming animals from the states and do so using the "clean list" and pictures that they have found on the internet. Internet pictures are not a very reliable source especially since some species may be only subtly different from others. The Butler/Common garter snake example demonstrates that the difference between animals is not always visible in pictures. It is essential that rangers are able to identify the animals they are inspecting. ***We recommend that a clean list booklet be***

created so that rangers are familiar with the physical appearance of species on the clean list. This booklet should include clear pictures of allowable animals along with a physical description of each species. In addition, descriptions of similar species and the differences should also be included to avoid any confusion.

It is imperative that the marinas and smaller airports throughout the island be under the surveillance of DNER rangers. Also, there needs to be a ranger at the Luis Muñoz Marín airport after 10pm. DNER employs a sufficient number of rangers to work in these areas, but these rangers are currently stationed elsewhere. ***We recommend that rangers be relocated to marinas and airports throughout the island and at the Luis Muñoz Marín between 10pm and 6am.***

If the drastic reallocation of rangers to all of these locations is not feasible at the current time, then we recommend a trial period. This would involve placing a ranger at the airport after 10pm and also at one or two marinas. These rangers must record the number of illegal animals they intercept within several months and in this way the need for rangers can be assessed. If many animals are intercepted, DNER should station rangers at the remaining ports of entry.

The money that is collected from fines when an illegal animal is caught in the process of being imported is put into a DNER account. This money is intended to be used for ranger equipment to help them do their job more effectively. Also, as prevention is the most efficient method for dealing with exotic species, it is important that illegal animals found at ports of entry be sent back to the sender and not be confiscated and kept in Puerto Rico. ***We recommend that the fund generated from fines be specifically***

designated to the purchasing of ranger equipment and also to send animals back to their sender.

There is currently no set of regulations in place to guide the actions of DNER rangers. This lack of guidelines can lead to confusion and interfere with the duties of the rangers. *We* ***recommend that a set of regulations be developed specifically for rangers.*** Within these regulations, the warrant process should be redefined to better ensure that rangers can investigate a suspicious situation quickly enough that individuals involved do not have the opportunity to relocate any illegal exotics that they may own.

Recommendation: Centralized database

The information exchange among departments, if improved, could substantially lower the exotic species problem by improving coordination. ***We recommend that a database containing information about smuggled and confiscated animals be created in order to increase the availability of information and have it complied in a centralized location.*** Once filled, this database will allow the departments to see, all at once, information regarding which animals are making it into Puerto Rico, which are being caught at the border, where the majority of illegal exotics come from, and where people buy them once they are on the island. In addition, the database will allow Cambalache to have an organized system for processing animals are acquired by the State Forest and will make disposition trends very clear. The date discovered, species, quantity, location discovered, time discovered, origin, and final disposition of each illegal animal discovered should be included in the database. In addition, the name of the agency that discovered the animals as well as the name of the specific agent who discovered the animal(s) should be

included. This information would give any individual viewing the database to obtain more detailed information by contacting the agency or agent.

In order for this database to be most successful, it will have to be an online system that is accessible to all the agencies on the island that deal with exotics. This is a particular problem for the State Forest because Cambalache has inadequate computers and no internet access. ***We recommend that the State Forest be provided with up to date computers as well as internet access so that they can input information into the database.*** In addition, this has the potential of expediting the disposition process by giving the rangers a tool for finding new locations for confiscated animals to be sent.

The eleven recommendations given in this paper are essential for minimizing the exotic species problem in Puerto Rico. The risks associated with exotics make it imperative that prevention methods be enhanced. The implementation of the recommendations presented in this paper will both reduce the exotic animal impact on the island and make Puerto Rico a model for exotic species management for tropical islands throughout the world.

APPENDICES

APPENDIX A: DESCRIPTION OF SPONSORING AGENCY

The Puerto Rican Department of Natural and Environmental Resources (*Departamento de Recursos Naturales y Ambientales)* has jurisdiction over all natural resources contained in the Commonwealth. They are responsible for the implementation of the Environmental Quality laws of the Commonwealth of Puerto Rico (Cody et al, 2002). The department was created in the Constitution of Puerto Rico under Section Nineteen of Article Six.

The DNER maintains a number of state forests and nature preserves, as well as state reservoirs and nearby small islands. They also protect the natural ecosystems of the island, such as waterways, land formations, swamps and wetlands, and all animal and plant life, including aquatic species. They are responsible for the control and organization of human activities in these areas; for example, they protect natural bodies of water and parcels of land from overuse and human disruption. The Department also sponsors educational programs that call attention to the public's responsibility to protect Puerto Rico's natural resources and use them sensibly.

In terms of organization, the agency is broken down into three major subdivisions, each with its own sub-offices: Direction, Programs, and Administration. Furthermore, the agency also owns regional offices in seven locations throughout the island. The mission of the agency is to promote fair use and conservation of natural resources in order to keep this land enjoyable and clean for future generations. Sustainable use is one of their major

concerns, and they believe that conservation is a national effort that requires the participation of all islanders in order to be successful.

APPENDIX B: ADDITIONAL INFORMATION AND FIGURES

This appendix includes charts, figures, and descriptions of additional case studies related to the information contained in the literature review. The charts and figures are supplements intended to provide a visual display for the reader to better understand the background we have presented. The case studies presented in this appendix provide a more detailed background of invasive species and the impacts they have had. Also included is a brief discussion of methods for introducing invasive species other than pet imports.

Causes of Species Decline

Bird Species Affected by the Brown Tree Snake in Guam

Adapted from the information provided by the Smithsonian National Zoological Park at http://nationalzoo.si.edu

TABLE 1:

BIRD SPECIES AFFECTED ON GUAM

Species	Native location(s)	Status
Mariana Fruit-dove	Guam, Rota, Agiguan, Tinian, and Saipan	Has not been seen on Guam since 1985
Guam Rail	Guam	Exists only in captivity
Micronesian Kingfisher	Guam	Exists only in captivity
Guam Flycatchers	Guam	Has not been seen on Guam since 1984
Rufous Fantail	Southern Pacific	The native Guam subspecies has not been seen since 1984
Cardinal Honeyeater	Southern Pacific	The native Guam subspecies has not been seen since 1984
White-throated Ground Dove	Mariana islands	The native Guam subspecies has not been seen since 1986
Nightingale Reed-Warbler	Mariana islands	The native Guam subspecies has not been seen since 1970

How the Brown Tree Snake causes power outages:

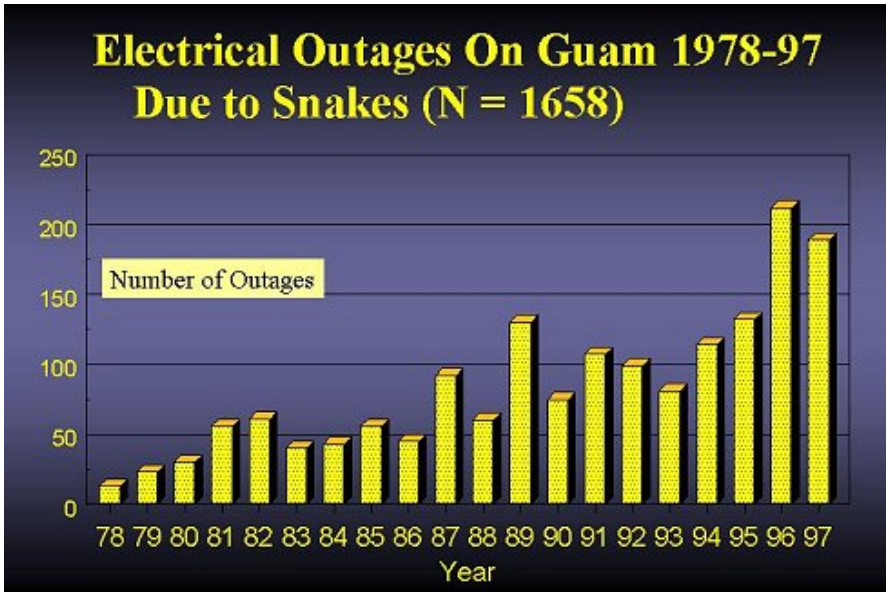
The brown tree snake frequently climbs trees and vertical vegetation. The guy wires supporting electrical lines are easy to climb surfaces for the reptile, and it will frequently ascend these manmade constructs. In the process of climbing, a snake can cause a power outage by connecting live and grounded conductors. In an effort to reduce power outages, disks have been installed on various guy wires. However, the Brown Tree

Snake is still able to climb vegetation surrounding the electrical lines and cause the same problems. An additional prevention method is eliminating guy wires all together. (Fritts & Tanner, 2001) Other costs associated with the brown tree snake include the necessary replacement of transformers and other electrical equipment as well as shipment losses on Guam due to snake induced delays.

Electrical Outages Caused by the Brown Tree Snake from 1978-1997

FIGURE 1:

OUTAGES CAUSED BY THE BROWN TREE SNAKE IN GUAM



Source: http://www.fort.usgs.gov/resources/education/brown tree snake/images/from_Tom/78-97outages2.jpg

The Coffee Berry Borer

One tiny insect, the coffee bean borer (*Hypothenemus hampei*), is causing significant problems in the Caribbean, especially in countries that depend on income

from coffee exports as a means of livelihood. Fernando Vega, of the U.S. Department of Agriculture, explains that the presence of the borer in Puerto Rico is contested by some biologists (Vega et al, 2002), though elsewhere the insect as of 2004 was spreading uncontrollably, causing an estimated $500 Million USD in damages each year (Durham, 2004). Eradication efforts are underway, including the introduction of new parasite fungi to combat the borer. Cruz and Segarra believe that this approach will lead to very positive results (1992). In light of the damages resulting from this pest, if is not yet present in Puerto Rico, efforts to prevent the coffee berry borer introduction should be employed as soon as possible. Coffee is the most important of the crops in Puerto Rico, and therefore, according to Rivera (2007) the coffee berry borer could have substantial negative impacts for the island.

Coffee beans are not the only crops threatened by insect invaders. Other projects in the Caribbean basin have attempted to battle the sugarcane borer, the citrus blackfly, and the diamondback moth (Cruz & Segarra, 1992). Pest insects reduce crop production in the U.S. by 13 percent every year, a figure resulting in over $34.7 Billion in lost revenue. A significant majority of these pests are non-endemic species. For example, non-native insect species make up some 98 percent of all crop pest insects in Hawaii, one of many remarkable statistics for an island battling invaders of every type (Pimentel et al, 2000).

Decision-making flow charts for Exotic Species Management:

FIGURE 2

DECISION-MAKING FLOWCHART #1

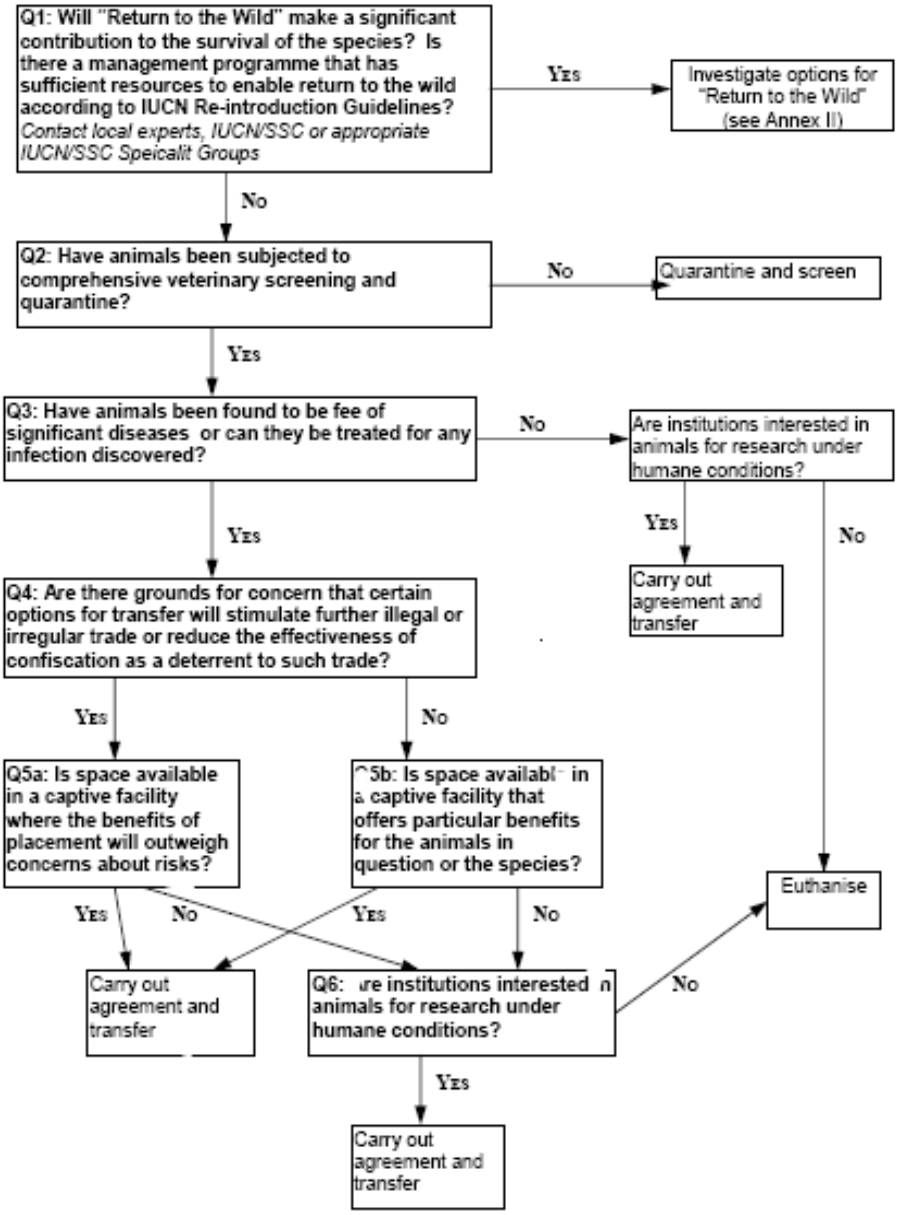
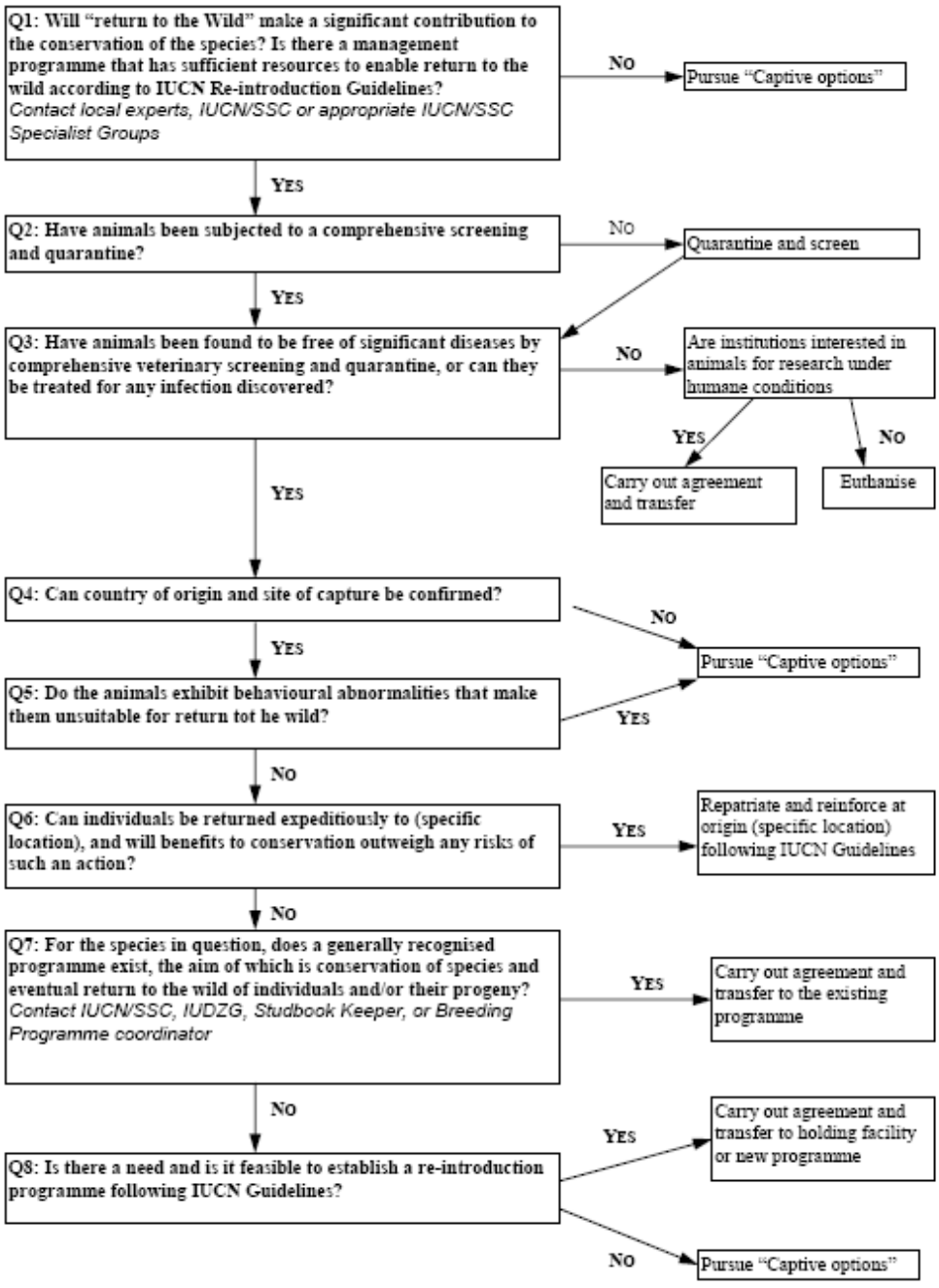


FIGURE 2:

DECISION-MAKING FLOWCHART #2



APPENDIX C: DISPOSITION PROTOCOL

Disposition Protocol

Outline:

A. Introduction and Executive Summary
B. Statement of Need
C. Options
    a. Re-introduction
        i. Benefits
        ii. Costs and Risks
    b. Captivity
        i. Benefits
        ii. Costs and Risks
    c. Euthanasia
        i. Benefits
        ii. Costs and Risks

D. Decision-Making Tree

Introduction and Executive Summary

Puerto Rican environmental agencies frequently come in contact with undesirable or potentially harmful exotic species. Environmental agencies carry the responsibility of safely and humanely disposing of each exotic species that is found. The sorting and processing of these species must be performed in the shortest possible period of time. From a conservation point of view, any animals acquired should be safely transferred or otherwise processed in order to minimize the negative impact on populations of endemic species.

An *exotic species* is defined here as a species of animal that is not native to an area. On the other hand, an *invasive species* is defined as an exotic species that is capable of entering a new area and establishing themselves, resulting in potentially dangerous situations for native populations. The risks associated with invasive species management are explained in more detail in later sections.

This document summarizes a disposition protocol for the animals sent to the DRNA confinement center located at Cambalache State Forest. All confiscated or found exotic species are sent to this center to be properly evaluated and disposed of as deemed necessary. This protocol is adapted for the DRNA directly from the IUCN Guidelines for the Placement of Confiscated Animals published in 2002, with permission from the original authors.

Historically, the following options are used for the disposition of an exotic species:

1. Keep the animal in captivity for the remainder of its natural life
2. Return the animal to its natural environment
3. Euthanize the animal humanely

The choice of one of these options is often a time-consuming and stressful task for the officials charged with determining the fate of a given animal. It is important to note that any actions taken involving the individual must be in compliance with any local or federal laws and regulations which are applicable to the species. The decision may also be influenced by the financial, technological, and personnel resources available to the agency currently in possession of the animal. This protocol includes a simple decision-making tree that is designed to optimize the decision-making process. This guide ensures that the final destination of each animal is determined quickly, objectively, and

ecologically. Furthermore, agencies should strive to adhere to the goals stated in the IUCN Guidelines for the Placement of Confiscated Animals, which are stated as follows:

1. "To maximize the conservation value of the animals without in any way endangering the health, behavioral repertoire, genetic characteristics, or conservation status of wild or captive populations of the species or any other wild living organism
2. To discourage further illegal or irregular trade in the species
3. To provide a humane solution, whether this involves maintaining the animals in captivity, returning them to the wild, or employing euthanasia…" (2002)

Once the framework for following these guidelines is in place, the DRNA will rapidly and efficiently process the exotic species it obtains.

Statement of Need

The disposition of acquired animals is becoming a common issue among government environmental agencies worldwide. Tighter enforcement of existing regulations as well as new legislation put into place have resulted in an increased number of acquired animals per time period (IUCN 2002). In Puerto Rico, the situation is no different. Increased enforcement by the DRNA Rangers in the arena of exotic pets and exotic animal trade have resulted in an increased rate of confiscations. The number of acquired animals can vary wildly from week to week, a fact that only reinforces the need for a protocol to regulate the processing and disposition of the specimens.

Even though zoos and wildlife centers exist in Puerto Rico, it is impossible to guarantee space for all acquired exotic specimens. If a site does not have sufficient space or funding to support more animals, it is futile to expect these places to open their doors for donations. Furthermore, space and funding are primary constraints in Puerto Rico due to the limited funding allocated by the government for environmental programs, lack of wildlife shelters, and lack of overall space due to the island condition.

One of the most significant risks involved with exotic species is the possibility of an exotic population establishing itself in its new environment. Exotic populations compete with and prey on local species, threatening to disrupt the local ecological balance. These *invasive species* can cause severe economic damage for human populations. Crop plant pathogens alone, for example, cause billions of dollars in lost revenue for farmers in the United States. A significant majority of endangered species worldwide owe their endangered status to habitat displacement and competition with invasive species. Exotic species traffic in Puerto Rico is dangerous due to the risk of animals escaping or being

released to the wild indiscriminately. Another danger is the risk of introducing disease carriers to new areas.

A standardized disposition protocol is also necessary due to the risks of poorly executed programs for re-introduction to the wild and the dangers of improper placement of animals in captivity. Animals that are introduced to the wild without a prior exploratory study are frequently doomed to starvation or elimination. Depending on how long the animal has been in captivity, it may not be have the necessary skills to survive on its own in the wild. Furthermore, a release into the wild without a preliminary study can result in the species becoming invasive to the new environment (harming local populations) or simply dying (eliminating the benefit of re-introduction). Individuals surviving their initial period of reintroduction can also pollute the local gene pool if they are of a different subspecies than the local variety. In Puerto Rico, only endemic species are considered for re-introduction. All other exotic animals must be exported from Puerto Rico if they are needed for re-introduction programs elsewhere.

Combined with the innate risk of releasing diseases acquired while in captivity, all of these risks outline the fundamental reasons for promoting the responsible management of acquired animals. A standardized protocol for processing the wide range of animals acquired by the DRNA eliminates many of the difficult and often arbitrary decisions involved in the processing of these animals, and (most importantly) keeps the process scientific in nature and objective in execution. Human error and emotional sentiments towards an individual animal are poor excuses for wrongly made decisions which may lead to losses in biodiversity or even extinction for a given population. Return to the wild is not always the most logical option for an animal held in captivity, despite any false perceptions that the public may have to the contrary. Prevention is always the best policy.

The disposition of acquired animals remains a complex and delicate subject which requires careful study and review before actions are taken. For all these reasons, this document and the research that will follow in the future will serve as necessary and invaluable tools for Puerto Rico.

Animal Confiscation

The following steps must be followed for each exotic or injured animal confiscated or found by DRNA Rangers:

1. All exotic species confiscated or found in the wild will be brought to the confinement center at Cambalache State Forest within 36 hours.

2. A paper file will be created for the animal and submitted to the DNER offices within 48 hours of arrival to Cambalache State Forest. This file includes the animal's medical history sheet and a transport log that includes arrival and departure dates for each site the animal was transported to and from. These files will be kept at Cambalache while the animal is living there. Otherwise, they should be sent to the DRNA offices.
3. The animal's arrival will be recorded in its transport log within six hours of its arrival at the Cambalache center.
4. The animal's information will also be entered into an electronic database program, along with any notes about the animal's condition. The updated database file will be sent (via email etc) to DRNA offices each month.

Removal of Exotic Specimens from Cambalache State Forest

The following protocol will be followed whenever an animal is to leave the State Forest for any reason:

1. The travel paperwork will be completed and signed by a state forest ranger prior to transportation of the animal. This paperwork must include the time of departure from the State Forest, time of arrival to the new location, reason for transportation, and estimated length of stay.
2. The electronic database file will be updated with the animal's intended destination and anticipated return date.
3. If the animal is traveling to its final destination, this must be specified on all documentation.
4. If the animal is not traveling to its final destination then it must be returned to the State Forest in Cambalache. The return must be noted on the animal's transport log in order to maintain the chain of evidence.

Management Solutions for Animals in the State Forest

As previously stated, three fundamental options exist for the disposition of a confined animal:

1. *Return the animal to the wild in its native habitat*
2. *Keep the animal in captivity for the remainder of its natural life at its current location or by relocating the animal to other available facilities*
3. *Euthanize the animal*

This section offers a detailed analysis of the benefits and downfalls of each of these options, along with the appropriate procedures for implementation. It is intended as a supplementary expansion of the decision-making flow charts in the next section.

OPTION 1: RETURN TO THE WILD

Returning an animal to its native habitat is an extremely risky endeavor. The potential to keep the animal alive in its natural environment without the cost of upkeep and maintenance makes this option attractive to the general public. A careful study must be performed before re-introduction to better predict the impact of the re-introduction on the potential site of release. It should be noted, however, that even the most detailed and careful study is still only a prediction of the events that will unfold upon the animal's release. For animals that are non-endemic in Puerto Rico, DRNA must coordinate with agencies from the specimen's country of origin.

According to the original IUCN Guideline document, there are three distinct types of reintroductions:

1. Re-introduction, attempting to re-introduce a population in an area that was once a native habitat for the species but is now entirely devoid of their presence
2. Reinforcement of an existing population to boost population strength or recover downward mobility
3. Conservation introduction, where scientists attempt to establish a species outside of its natural range in a safe manner in order to preserve its existence

Of these, the second type is by far the most common. The IUCN Guidelines introduce the concept of *conservation value*, the amount of potential positive contribution the animal can have in the wild. Following this idea, endangered or threatened species have a much higher conservation value than others, while species with large populations in the wild have a lower conservation value since the species is widely established in a stable environment. Bolstering of small populations gives a species less risk of extinction if the efforts are successful.

There are several factors that must be considered to determine which animals are suitable for relocation:

- Animals that have been in captivity for long periods of time are not candidates for reintroduction, as they have likely not developed the skills necessary to survive in the wild. However, if a rehabilitation program is in place in the animal's place of origin that is willing to retrain the animal, then this option is still a possibility.
- Animals must be extensively screened as required by the country into which they are being released. All tests required by the receiving institution must be conducted by a veterinarian before the animal can be exported. Animals that have been in captivity may have been exposed to diseases not native to their natural

habitat. Foreign diseases could significantly harm the animal in its new environment.

- Special attention must be paid to ensure that the animal is released within its natural range. Animals released outside of their natural range or original capture site may not be able to survive in their new surroundings. The location of release is a key factor for success, but the animal's original site of origin may not be known.
- It is important to determine whether cross-breeding had occurred among different species. Species in the wild commonly develop specialized genetic mutations depending on their environmental conditions. The mixture of one subspecies with another may be disastrous for the population as a whole. The welfare of the species must be emphasized over the welfare of the individual.
- Animals released outside of their natural range may become invasive and displace local populations, resulting in an overall loss of biodiversity and a decrease in population densities.

The return of an exotic animal to the wild requires careful study, observation, and technical efforts on the animal's behalf. These are costly and time consuming for environmental agencies in terms of manpower and finances. The conservation value of the animal must be weighed against the real-world costs of re-introduction.

The following process will be used to evaluate endemic species for potential release:

1. Perform medical screening or testing on the animal as necessary by a trained veterinarian and document any conditions observed.
2. Determine whether the species is endangered or otherwise threatened in the wild. These species have a higher priority than others when being considered for re-introduction.
3. Determine whether a re-introduction program exists for the species. If possible, determine the theoretical costs of placing the animal into that program. This may involve contacting federal and local conservation organizations and asking about any release programs that are currently underway.
4. If a re-introduction effort is not currently underway, compare the costs of creating such a program to the conservation value of the animal. Are the ecological benefits worth it?
5. If the introduction effort is a feasible option, perform a study to ensure that the benefits of releasing the animal outweigh any impacts the animal may have on other species currently living in the site of potential release.

Considering the many risks of re-introduction efforts, it would seem that they are not a very viable option for agencies such as the DRNA to consider. However, there are multiple benefits as well:

- Re-introduction demonstrates the importance of conservation to the public.
- Re-introduction could potentially resurrect populations in some areas.
- There is no long term maintenance cost associated with re-introduction.

In summation, the return of an individual animal or small group of animals into the wild is a complex and often expensive project that should only be performed for animals with a high conservation value or animals for which re-introduction programs are already well-established and documented.

OPTION 2: CAPTIVITY

Exotic animals are kept in captivity for a number of reasons. Some animals are very attractive for exhibition and so may be kept by a zoo or other facility that exhibits animals. In addition, an exotic may be used as an educational tool to teach the public about the environment, conservation, or the animal itself. An animal can either be kept in captivity at a site within Puerto Rico or sent to a location outside the island.

The process for finding permanent homes for exotics is as follows:

1. Contact the Juan A. Rivero zoo in Mayaguez with a list of species at Cambalache State Forest. The zoo staff can contact zoos outside of Puerto Rico to see if any of them are interested in a particular animal. Captivity is an option that can be investigated for all acquired exotics and is the best option if re-introduction is not possible.
2. If the animal demonstrates a characteristic that would be useful in the Cambalache State Forest education program and the resources to maintain the animal are present, then it can be kept by the State Forest.
3. Any interested party can be granted ownership if a permit can be obtained for the animal and ownership is allowable under federal or local laws
4. Animals that are sent outside of the United States must be screened before export in accordance with the requirements of the receiving institution

An animal that is to be kept in Puerto Rico must meet the following stipulations:

- The animal must be free of infectious diseases. Exceptions may exist, such as the presence of salmonella in reptiles as part of their native fauna. Some diseases have the potential to be transferred to other animals and even human beings. In

order to eliminate all possible risks, therefore, any animal that will be kept on the island must be disease free.
- The individual must not pose a substantial risk to native flora and fauna. Accidental releases can occur, and the risk of release must be considered when deciding to maintain an animal in a given location.
- A permit must be obtainable for any animal that is kept in Puerto Rico

OPTION 3: EUTHANASIA

Euthanasia (the humane killing of an animal) as a method for the disposition of exotics is presented in this protocol as a last resort to be used only when all other options have failed.

Euthanasia may **not** be used if:

- Reintroduction and captivity options have not been fully explored
- The animal is endangered or threatened

Euthanasia **must** be used if:

- The animal has been held at the state forest for more than 3 months and is not being used for education
- The animal has a dangerous disease that could potentially harm other animals or human beings, or is otherwise terminally ill
- The resources to maintain the animal in humane conditions and keep the individual in good physical health are not present

Once again, euthanasia may only be used if the animal cannot be released to the wild and cannot be relocated to another location. For euthanasia procedures and options for implementation, see the Euthanasia Appendix.

Decision-Making Tree

This document also includes a decision-making tree designed to assist the Rangers at the Cambalache State forest when deciding the fate of each animal specimen. It is designed to be followed in a linear fashion. The animal's eligibility for re-introduction into the wild is first evaluated. If the specimen cannot be released within Puerto Rico or in its native habitat elsewhere, then the Rangers will attempt to find an academic, educational, or wildlife refuge location where the animal may live out the rest of its

natural life. Lastly, if the animal is deathly ill or cannot be kept alive without significant risk, the rangers have no choice but to euthanize the animal.

The decision tree (2 pages) must be included with copies of this document in Adobe PDF format or in paper form as a legal-size printout (11”x17”).

APPENDIX: Euthanasia Methods

The charts in this appendix are adapted from the 2000 Report of the AVMA Panel on Euthanasia (JAVMA, Vol. 218, No. 5, pp. 669-696, March 1, 2001)

Appendix 1

Agents and methods of euthanasia by species (refer to Appendix 4 for unacceptable agents and methods.)

Species	Acceptable* (refer to Appendix 2 and text for details)	Conditionally acceptable† (refer to Appendix 3 and text for details)
Amphibians	Barbiturates, inhalant anesthetics (in appropriate species), CO_2, CO, tricaine methane sulfonate (TMS, MS 222), benzocaine hydrochloride, double pithing	Penetrating captive bolt, gunshot, stunning and decapitation, decapitation and pithing
Birds	Barbiturates, inhalant anesthetics, CO_2, CO, gunshot (free-ranging only)	N_2, Ar, cervical dislocation, decapitation, thoracic compression (small, free-ranging only)
Cats	Barbiturates, inhalant anesthetics, CO_2, CO, potassium chloride in conjunction with general anesthesia	N_2, Ar
Dogs	Barbiturates, inhalant anesthetics, CO_2, CO, potassium chloride in conjunction with general anesthesia	N_2, Ar, penetrating captive bolt, electrocution
Fish	Barbiturates, inhalant anesthetics, CO_2, tricaine methane sulfonate (TMS, MS 222), benzocaine hydrochloride, 2-phenoxyethanol	Decapitation and pithing, stunning and decapitation/pithing
Horses	Barbiturates, potassium chloride in conjunction with general anesthesia, penetrating captive bolt	Chloral hydrate (IV, after sedation), gunshot, electrocution
Marine mammals	Barbiturates, etorphine hydrochloride	Gunshot (cetaceans < 4 meters long)
Mink, fox, and other mammals produced for fur	Barbiturates, inhalant anesthetics, CO_2 (mink require high concentrations for euthanasia without supplemental agents), CO, potassium chloride in conjunction with general anesthesia	N_2, Ar, electrocution followed by cervical dislocation
Nonhuman primates	Barbiturates	Inhalant anesthetics, CO_2, CO, N_2, Ar
Rabbits	Barbiturates, inhalant anesthetics, CO_2, CO, potassium chloride in conjunction with general anesthesia	N_2, Ar, cervical dislocation (< 1 kg), decapitation, penetrating captive bolt
Reptiles	Barbiturates, inhalant anesthetics (in appropriate species), CO_2 (in appropriate species)	Penetrating captive bolt, gunshot, decapitation and pithing, stunning and decapitation
Rodents and other small mammals	Barbiturates, inhalant anesthetics, CO_2, CO, potassium chloride in conjunction with general anesthesia, microwave irradiation	Methoxyflurane, ether, N_2, Ar, cervical dislocation (rats < 200 g), decapitation
Ruminants	Barbiturates, potassium chloride in conjunction with general anesthesia, penetrating captive bolt	Chloral hydrate (IV, after sedation), gunshot, electrocution
Swine	Barbiturates, CO_2, potassium chloride in conjunction with general anesthesia, penetrating captive bolt	Inhalant anesthetics, CO, chloral hydrate (IV, after sedation), gunshot, electrocution, blow to the head (< 3 weeks of age)
Zoo animals	Barbiturates, inhalant anesthetics, CO_2, CO, potassium chloride in conjunction with general anesthesia	N_2, Ar, penetrating captive bolt, gunshot
Free-ranging wildlife	Barbiturates IV or IP, inhalant anesthetics, potassium chloride in conjunction with general anesthesia	CO_2, CO, N_2, Ar, penetrating captive bolt, gunshot, kill traps (scientifically tested)

*Acceptable methods are those that consistently produce a humane death when used as the sole means of euthanasia. †Conditionally acceptable methods are those that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature.

Appendix 4

Some unacceptable agents and methods of euthanasia (refer to text for details)

Agent or method	Comments
Air embolism	Air embolism may be accompanied by convulsions, opisthotonos, and vocalization. If used, it should be done only in anesthetized animals.
Blow to the head	Unacceptable for most species.
Burning	Chemical or thermal burning of an animal is not an acceptable method of euthanasia.
Chloral hydrate	Unacceptable in dogs, cats, and small mammals.
Chloroform	Chloroform is a known hepatotoxin and suspected carcinogen and, therefore, is extremely hazardous to personnel.
Cyanide	Cyanide poses an extreme danger to personnel and the manner of death is aesthetically objectionable.
Decompression	Decompression is unacceptable for euthanasia because of numerous disadvantages. (1) Many chambers are designed to produce decompression at a rate 15 to 60 times faster than that recommended as optimum for animals, resulting in pain and distress attributable to expanding gases trapped in body cavities. (2) Immature animals are tolerant of hypoxia, and longer periods of decompression are required before respiration ceases. (3) Accidental recompression, with recovery of injured animals, can occur. (4) Bleeding, vomiting, convulsions, urination, and defecation, which are aesthetically unpleasant, may develop in unconscious animals.
Drowning	Drowning is not a means of euthanasia and is inhumane.
Exsanguination	Because of the anxiety associated with extreme hypovolemia, exsanguination should be done only in sedated, stunned, or anesthetized animals.
Formalin	Direct immersion of an animal into formalin, as a means of euthanasia, is inhumane.
Household products and solvents	Acetone, quaternary compounds (including CCl_4), laxatives, clove oil, dimethylketone, quaternary ammonium products*, antacids, and other commercial and household products or solvents are not acceptable agents for euthanasia.
Hypothermia	Hypothermia is not an appropriate method of euthanasia.
Neuromuscular blocking agents (nicotine, magnesium sulafte, potassiumchloride, all curariform agents)	When used alone, these drugs all cause respiratory arrest before loss of consciousness, so the animal may perceive pain and distress after it is immobilized.
Rapid freezing	Rapid freezing as a sole means of euthanasia is not considered to be humane. If used, animals should be anesthetized prior to freezing.
Strychnine	Strychnine causes violent convulsions and painful muscle contractions.
Stunning	Stunning may render an animal unconscious, but it is not a method of euthanasia (except for neonatal animals with thin craniums). If used, it must be immediately followed by a method that ensures death.
Tricaine methane sulfonate (TMS, MS 222)	Should not be used for euthanasia of animals intended as food.

*Roccal D Plus, Pharmacia & Upjohn, Kalamazoo, Mich.

Appendix 2

Acceptable agents and methods of euthanasia—characteristics and modes of action (refer to text for details)

Agent	Classification	Mode of action	Rapidity	Ease of performance	Safety for personnel	Species suitability	Efficacy and comments
Barbiturates	Hypoxia attributable to depression of vital centers	Direct depression of cerebral cortex, subcortical structures, and vital centers; direct depression of heart muscle	Rapid onset of anesthesia	Animal must be restrained; personnel must be skilled to perform IV injection	Safe except human abuse potential; DEA-controlled substance	Most species	Highly effective when appropriately administered; acceptable IP in small animals and IV
Benzocaine hydrochloride	Hypoxia attributable to depression of vital centers	Depression of CNS	Very rapid, depending on dose	Easily used	Safe	Fish, amphibians	Effective but expensive
Carbon dioxide (bottled gas only)	Hypoxia attributable to depression of vital centers	Direct depression of cerebral cortex, subcortical structures, and vital centers; direct depression of heart muscle	Moderately rapid	Used in closed container	Minimal hazard	Small laboratory animals, birds, cats, small dogs, rabbits, mink (high concentrations required), zoo animals, amphibians, fish, some reptiles, swine	Effective, but time required may be prolonged in immature and neonatal animals
Carbon monoxide (bottled gas only)	Hypoxia	Combines with hemoglobin, preventing its combination with oxygen	Moderate onset time, but insidious so animal is unaware of onset	Requires appropriately maintained equipment	Extremely hazardous, toxic, and difficult to detect	Most small species including dogs, cats, rodents, mink, chinchillas, birds, reptiles, amphibians, zoo animals, rabbits	Effective; acceptable only when equipment is properly designed and operated
Inhalant anesthetics	Hypoxia attributable to depression of vital centers	Direct depression of cerebral cortex, subcortical structures, and vital centers	Moderately rapid onset of anesthesia, excitation may develop during induction	Easily performed with closed container; can be administered to large animals by means of a mask	Must be properly scavenged or vented to minimize exposure to personnel	Some amphibians, birds, cats, dogs, furbearing animals, rabbits, some reptiles, rodents and other small mammals, zoo animals, fish, free-ranging wildlife	Highly effective provided that subject is sufficiently exposed; either is conditionally acceptable
Microwave irradiation	Brain enzyme inactivation	Direct inactivation of brain enzymes by rapid heating of brain	Very rapid	Requires training and highly specialized equipment	Safe	Mice, rats	Highly effective for special needs
Penetrating captive bolt	Physical damage to brain	Direct concussion of brain tissue	Rapid	Requires skill, adequate restraint, and proper placement of captive bolt	Safe	Horses, ruminants, swine	Instant loss of consciousness, but motor activity may continue
2-Phenoxyethanol	Hypoxia attributable to depression of vital centers	Depression of CNS	Very rapid, depending on dose	Easily used	Safe	Fish	Effective but expensive
Potassium chloride (intracardially or intravenously in conjunction with general anesthesia only)	Hypoxia	Direct depression of cerebral cortex, subcortical structures, and vital centers secondary to cardiac arrest.	Rapid	Requires training and specialized equipment for remote injection anesthesia, and ability to give IV injection of potassium chloride	Anesthetics may be hazardous with accidental human exposure	Most species	Highly effective, some clonic muscle spasms may be observed
Tricaine methane sulfonate (TMS, MS 222)	Hypoxia attributable to depression of vital centers	Depression of CNS	Very rapid, depending on dose	Easily used	Safe	Fish, amphibians	Effective but expensive

Appendix 3

Conditionally acceptable agents and methods of euthanasia—characteristics and modes of action (refer to text for details)

Agent	Classification	Mode of action	Rapidity	Ease of performance	Safety	Species suitability	Efficacy and comments
Blow to the head	Physical damage to brain	Direct concussion of brain tissue	Rapid	Requires skill, adequate restraint, and appropriate force	Safe	Young pigs < 3 weeks old	Must be properly applied to be humane and effective
Carbon dioxide (bottled gas only)	Hypoxia due to depression of vital centers	Direct depression of cerebral cortex, subcortical structures and vital centers; direct depression of heart muscle	Moderately rapid	Used in closed container	Minimal hazard	Nonhuman primates, free-ranging wildlife	Effective, but time required may be prolonged in immature and neonatal animals
Carbon monoxide (bottled gas only)	Hypoxia	Combines with hemoglobin, preventing its combination with oxygen	Moderate onset time, but insidious so animal is unaware of onset	Requires appropriately maintained equipment	Extremely hazardous, toxic, and difficult to detect	Nonhuman primates, free-ranging wildlife	Effective; acceptable only when equipment is properly designed and operated
Cervical dislocation	Hypoxia due to disruption of vital centers	Direct depression of brain	Moderately rapid	Requires training and skill	Safe	Poultry, birds, laboratory mice, rats (< 200 g), rabbits (< 1 kg)	Irreversible; violent muscle contractions can occur after cervical dislocation
Chloral hydrate	Hypoxia from depression of respiratory center	Direct depression of brain	Rapid	Personnel must be skilled to perform IV injection	Safe	Horses, ruminants, swine	Animals should be sedated prior to administration
Decapitation	Hypoxia due to disruption of vital centers	Direct depression of brain	Rapid	Requires training and skill	Guillotine poses potential employee injury hazard	Laboratory rodents; small rabbits; birds; some fish, amphibians, and reptiles (latter 3 with pithing)	Irreversible; violent muscle contraction can occur after decapitation
Electrocution	Hypoxia	Direct depression of brain and cardiac fibrillation	Can be rapid	Not easily performed in all instances	Hazardous to personnel	Used primarily in sheep, swine, foxes, mink (with cervical dislocation), ruminants, animals > 5 kg	Violent muscle contractions occur at same time as loss of consciousness
Gunshot	Hypoxia due to disruption of vital centers	Direct concussion of brain tissue	Rapid	Requires skill and appropriate firearm	May be dangerous	Large domestic and zoo animals, reptiles, amphibians, wildlife, cetaceans (< 4 meters long)	Instant loss of consciousness, but motor activity may continue
Inhalant anesthetics	Hypoxia due to depression of vital centers	Direct depression of cerebral cortex, subcortical structures, and vital centers	Moderately rapid onset of anesthesia; excitation may develop during induction	Easily performed with closed container; can be administered to large animals by means of a mask	Must be properly scavenged or vented to minimize exposure to personnel; ether has explosive potential and exposure to ether may be stressful	Nonhuman primates, swine; ether is conditionally acceptable for rodents and small mamals; methoxyflurane is conditionally acceptable for rodents and small mammals.	Highly effective provided that subject is sufficiently exposed
Nitrogen, argon	Hypoxia	Reduces partial pressure of oxygen available to blood	Rapid	Used in closed chamber with rapid filling	Safe if used with ventilation	Cats, small dogs, birds, rodents, rabbits, other small species, mink, zoo animals, nonhuman primates, free-ranging wildlife	Effective except in young and neonates; an effective agent, but other methods are preferable
Penetrating captive bolt	Physical damage to brain	Direct concussion of brain tissue	Rapid	Requires skill, adequate restraint and proper placement of captive bolt	Safe	Dogs, rabbits, zoo animals, reptiles, amphibians, free-ranging wildlife	Instant loss of consciousness but motor activity may continue
Pithing	Hypoxia due to disrution of vital centers, physical damage to brain	Trauma of brain and spinal cord tissue	Rapid	Easily performed but requires skill	Safe	Some ectotherms	Effective, but death not immediate unless brain and spinal cord are pithed
Thoracic compresion	Hypoxia and cardiac arrest	Physical interference with cardiac and respiratory function	Moderately rapid	Requires training	Safe	Small- to medium-sized free-ranging birds	Apparently effective

APPENDIX D: LETTER OF PERMISSION FOR USE OF IUCN DOCUMENT

-----Original Message-----

From: Cox, Justin [mailto:jcox08@WPI.EDU]

Sent: Monday, April 02, 2007 3:38 PM

To: MURITH Deborah

Subject: IUCN Guidelines for the Placement of Confiscated Animals

To whom it may concern:

We are a group of undergraduate students from Worcester Polytechnic Institute in the U.S. performing a project on exotic species management for the Puerto Rican Department of Natural Resources (DNER). The DNER is interested in creating a disposition protocol for the illegal or exotic animals it acquires through donations and confiscations.

We have read the 2002 IUCN guidelines document and would like to use its ideas as the base for our disposition protocol, adapting it to suit the needs of the Puerto Rican government as seen fit. We ask for your permission to use, revise, and adapt the ideas in this document for the uses of our project, assuming due credit is given to the original authors. Also, if there is a more recent edition of this document, we would appreciate having a copy of a newer edition if it exists.

Please let us know if there is any process or forms we need to submit in order to respect the copyright of this document.

Thank you for your time,

Justin Cox (jcox08@wpi.edu)

Sarah Burns (antimony@wpi.edu)

Worcester Polytechnic Institute 2008

From: HELD, Alicia [mailto:Alicia.held@iucn.org]

Sent: Tuesday, April 03, 2007 4:14 AM

To: Cox, Justin

Subject: RE: IUCN Guidelines for the Placement of Confiscated Animals

Dear Justin,

I have taken note of your request to reproduce the attached IUCN copyright material :

IUCN (2002) Guidelines for the placement of confiscated animals. Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and ERWDA, Abu Dhabi, UAE. 24 pp.

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Sincerely yours,

Alicia Held

Alicia HELD

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APPEMDIX E: PUERTO RICO CLEAN LIST

Familia Nombre cientifico	Nombre en español	Nombre en inglés
ANFIBIOS		
Salamandridae		
Triturus spp.	Salamandras europeas	Knewt
Necturus spp.	Salamandra	Mudpuppy
REPTILES		
Chamaeleonidae		
Chamaeleo chamaeleon	Camaleón común	Common chamaleon
Chamaeleo jacksoni	Camaleon de Jackson	Jackson chamaleon
Boidae		
Python regious		Ball Python
Colubridae		
Thamnophis sirtalis	Culebra jarretera	Garter snake
Testudinidae		
Geochelone sulcata		Sulcata tortoise
Geochelone carbonaria		Red footed tortoise
Geochelone denticulata		Yellow footed tortoise
Geochelone pardalis		African leopard tortois
Emydinae		
Terrapene sp.		Box turtle
AVES		
Anatidae		
*Anas spp.**	Pato doméstico	Peking duck
Anas platyrhynchos*	Pato inglés doméstico	Mallard duck
Anser spp.	Ganso doméstico	Chinese goose
*Cairiana moschata**	Pato muscovy doméstico	Muscovy duck
*Cygnus olor**	Cisne doméstico	Black swan bred
Columbidae		
*Columba livia**	Paloma común	Rock pigeon
Fringillidae		
Serinus canaria	Canario	Canary
Serinus mozambicus	Canario	Green singing finch
Paroaria cucullata	Cardenal de Brazil	Brazilian crested cardinal

Ramphastidae		
Ramphastos discolorus	Tucán	Red breasted toucan
MAMIFEROS		
Bovidae		
*Bos taurus**	Ganado vacuno	Cattle
*Capra hircus**	Cabra doméstica	Domestic goat
*Equus sp.**	Caballo doméstico	Domestic horse
*Ovis spp.**	Oveja doméstica	Domestic sheep
Canidae		
*Canis familiaris**	Perro doméstico	Domestic dog
Cavidae		
Cavia porcellus	Güimo conejillo de indias	Guinea pig
Critecidae		
Gerbillus gerbillus		Gerbil
Mesocricetus auratus	Hamster dorado	Golden hamster
Felidae		
*Felis catus**	Gato doméstico	Domestic cat
Leporidae		
Oryctolaus spp.	Conejo doméstico	Domestic rabbit
Muridae		
Mus musculus	Ratón casero (variedades de laboratorio)	House mice
Rattus norvegicus	Rata de Noruega (variedades de laboratorio)	Norway rat
Rattus rattus	Rata negra (variedad de laboratorio)	Black rat
Suidae		
*Sus scrofa**	Cerdo doméstico	Domestic pig

Meleagrididae		
Meleagris gallopavo *	Pavo doméstico	Domestic turkey
Numididae		
*Numida meleagris**	Guinea	Helmeted guinea fowl
Phasianidae		
Alectoris graeca		Chuckar partridge
Colinus virginianus	Codorniz	Bobwhite quail
Coturnix coturnix	Codorniz	
*Gallus gallus**	Pollo común	Red jungle fowl
*Pavo cristatus**	Pavo real	Peacock
Perdiz perdiz	Perdiz	
Phasianus sp.	Faisán	Pheasant
Ploceidae		
Amadina fasciata	Gorrión	Cutthroat finch
Poephila castanotis	Gorrión zebra	Zebra finch
Poephila g. gouldiae	Gorrión de Gould	Gouldian finch
Uraeginthus angolensis	Gorrión	Blue-crested cordon blew
Uraeginthus bengalus	Gorrión	Cordon blew
Psittacidae		
Agapornis spp.	Cotorrita	
Anodorhychus hyacinthinus **	Guacamayo	Hyacinth macaw
*Amazona aestiva**	Cotorra de frente azul	Blue-fronted amazon
*Amazona ochrocephala**	Cotorra	Yellow-naped amazon
*Ara ararauna**	Guacamayo	Blue-gold macaw
*Ara chloroptera**	Guacamayo	Green-winged macaw
*Ara macao**	Guacamayo escarlata	Scarlet macaw
*Ara militaris**	Guacamayo	Military macaw
Melopsittaccus undulatus	Periquito australiano	Budgerigar
*Psephotus haematonotus**	Perico	Red-rumped parrotlet
*Psittacus e. erithacus**	Cotorra africana	African grey parrot
*Psittacus erithacus**	Cotorra africana timneh	Timneh parrot
Aratinga solstitialis		**Sun Conure**
Aratinga jandaya		**Jandaya Conure**
Cocatuidae		
*Cacatua goffini**	Cacatúa de Goffin	Goffin's cockatoo
*Cacatua alba**	Cacatúa común	Umbrella cockatoo
*Cacatua moluccensis**	Cacatúa	Salmon crested
Cacatua galerita	Cacatúa	Sulphur Crested cockatoo
Nymphicus hollandicus		Cockatiel
Strildidae		
Lonchura striata	Gorrión (var. doméstica)	Society finch
Sturnidae		
Gracula religiosa	Myna	Hill mynah

APPENDIX F: INTERVIEW SUMMARIES

Angel A. Atienza
State Forest Ranger, DNER
March 20, 2007

Purpose: The purpose of this visit was to gain a better understanding of the inner workings of Cambalache State Forest, how it is set up, and its specific needs in terms of a disposition protocol

The visit to Cambalache State Forest was informative on multiple levels. It included a tour of the facility and an interview with the State Forest Ranger Angel Atienza, both of which gave insight into the functions of the state forest. Confiscated exotics are brought to the state forest and held there until a new, permanent, home is found and the animal is relocated. There is a large influx of animals into the state forest weekly and most of the incoming animals are either birds or reptiles. These animals are kept in cages located in a two room building with some outside enclosures as well. One of the rooms is dedicated entirely to birds, with dozens of cages and multitudes of birds housed there. In the main room there were a great many reptiles, sometimes up to six or seven in one cage, and some mammals. Cambalache also deals with many monkeys and had two when we visited.

From the State Forest Ranger we discovered that Cambalache receives large quantities of animals on a daily basis. They document the transportation of animals from one location to another on a form that is kept in the office. There is only one computer and no internet access at the forest, and so no information is kept electronically. The ranger emphasized the need to DNER rangers in the airport to help prevent the smuggling of animals into Puerto Rico.

The function of Cambalache was defined as being a temporary location for confiscated exotics as well as a rehabilitation center for injured native animals. The state forest does not function as a zoo and so animals must be quickly relocated. In terms of veterinary screening, it only occurs when an animal is very sick and requires medical attention. Animals are not screened upon arrival to the State forest except by the ranger, who is not a certified veterinarian. An animal will not be euthanized, the ranger stated, unless it is deathly ill or dangerous and must be killed.

The Cambalache State Forest is in need of an organized protocol for disposing of exotic animals. In particular, it must be required that all confiscated animals are brought to Cambalache and not other locations. This will help reduce the risk of theft while the animal is in transit or being housed at another facility. In addition, a better form that would be filled out when an animal arrives at the forest or travels would help keep the process organized.

Luis Figueroa DVM
Curator
Mayaguez Zoological Park
March 22, 2007

Purpose: The purpose of our interview with Luis Figueroa was to determine the Zoo's role in terms of species disposition

Luis Figueroa is the Mayaguez Zoo veterinarian who also works as a curator. He was in private practice for ten to eleven years before becoming the Zoo veterinarian, though he worked with the Zoo as a young boy as well.

The interview with Dr. Figueroa helped us to understand the interaction between the Zoo, Cambalache, and the institutions to which exotics are sent permanently. The Mayaguez Zoo serves as a bridge between Cambalache and receiving institutions. Zoos in the states will not take animals from non-zoological locations, and so without the Mayaguez Zoo Cambalache would find it difficult to relocate many confiscated exotics. Dr. Figueroa receives calls from zoos in the states and is given lists of which animals they have available; he can then sometimes arrange a trade for an exotic that has been held at Cambalache. There is no cost associated with the animals themselves when they are sent to new locations from Cambalache, though the receiving zoo must pay for the transportation costs associated with moving the animal from Puerto Rico to its new location. The Mayaguez zoo will find the packaging for the animal, though they have had difficulty with this aspect of the process. Domestic transfers are not complicated by required veterinary screening, as there are no laws governing inspection of medical testing for transportation within the United States. One interesting fact is that all reptiles are assumed to have salmonella, which is not a substantial problem because it is part of the normal flora.

In general the Zoo has had little difficulty finding homes for confiscated exotics. Some animals, though, such as Rhesus monkeys, will not be accepted by any zoos because they are so common. In this case euthanasia is an acceptable option for disposition.

Luis Figueroa is very focused on conservation, and so makes a strong effort to only receive rehabilitated or unwanted animals and in turn does a service for Cambalache. He also does a great deal of rehabilitation of native species, and is concerned with educating the public. All of the animals on exhibition at the Zoo are educational animals and are in exhibits designed to convey information to the Zoo's visitors. Some of the most recent additions to the zoo were two lions and two cougars. The Zoo is also in the process of obtaining three elephants from the states, increasing their collection to four, an acquisition that may lead to the accreditation of the Zoo by the Association of Zoos and Aquariums, which does not accredit zoos that have only one elephant.

The Mayaguez Zoo has an overall expansion plan and is looking to add new exhibits. The majority of the new exhibits will be African in nature, but the Zoo is also looking into Central and South American exhibits. The Zoo owns approximately eighty acres of land but is only currently using eight of these. Thus, the potential for expansion is great.

One of the obstacles associated with relocating exotics is the permit process, which requires that a permit be renewed on a yearly basis. A longer permit would make it easier for the Zoo to help Cambalache without the hassle of updating permits every year.

Elvin Monge
Wildlife Inspector
U.S. Fish and Wildlife
March 29, 2007

Purpose: Our objective for this interview with Elvin Monge from the U.S. Fish and Wildlife Department was to get an idea of the scope of the exotic animal problem in Puerto Rico.
The interview was conducted in person with a few follow questions via email

Sr. Monge works with international imports, which is slightly separate from or primary focus of animals that are smuggled in from the states. US Fish and Wild life deals with a small amount of animal imports mostly consisting of live tropical fish from Thailand or Columbia. These imports come in approximately six times a year. In the case that an exotic animal import is not expected it will be investigated, and if it is found to be illegal the animals will be sedated and sent back to their original location. Approximately, 85% of shipments are covered by U.S. Fish and Wildlife. Puerto Rico has one Wildlife agent that is shared among all of the Virgin Islands, and so manpower is sometimes an issue in preventing smuggling.

In terms of domestic issues, which are mainly the responsibility of the DNER and customs, investigations have pointed to California and Florida as the primary source of animals from the mainland. There is a 100% inspection for all packages from most incoming flights, though some flights are not held to this. If a package is deemed as suspicious there is a statute in place that allows officials to inspect this package and seize illegal exotics. In order to improve smuggling prevention in airports it would be useful to have a DNER ranger work the overnight shift, which begins at 10pm. The most common route by which exotics are smuggled into the country is via the postal service, because mail is not inspected as thoroughly as luggage and packages are in the airport. This insufficient inspection leads to smuggling of weapons and drugs in addition to exotic animals.

U.S. Fish and Wildlife is beginning to build a relationship with the state in dealing with domestic smuggling problems, but these issues are primarily the responsibility of the state. Information is flowing between the DNER and US Fish and Wildlife, but domestic statistics would be of great help to the federal agency. The federal statistics are classified and must be obtained by contacting the Atlanta offices and making a request. US Fish and Wildlife also does work with the USDA, Vet Services, and the CDC in dealing with diseased exotic imports.

When it comes to exotic birds, how do the roles of US Fish and Wildlife and DNER differentiate?

"The US Fish and Wildlife Service only forfeits birds related to federal wildlife violations in which case the birds are seized by me or our agent, and immediately sent to Miami, FL Evidence Custodian, which runs with the quarantine at USDA, the temporary and permanent housing. Temporary housing is when: 1) the case is submitted to the solicitor or 2) the time period of 60 days after the person decided to abandon the property to the government. This is called Forfeiture process. Permanent housing is when the property has been forfeited by the government and donated to a Zoo, Educational Facility, etc..

Animals confiscated by the Rangers, that are not part of a federal investigation do not pass under our custody. The state can handle this animals in the course of official duty under 50 CFR 17.21(c)(3) Endangered Species Act. All Statutes gives authority to state official to handle these animals on the course of official duty.

The Rangers will move these animals from one state to the other and to credited institutions, which they do not need permits for. The Rangers duty is to find out if the institution accepting the animals has the proper permits to house this animals and that is State permits and federal permits in the case that the animals are protected under a federal statute."

If an unexpected import arrives and the animals are not supposed to be in Puerto Rico, how is that situation handled? Are the animals returned to the sender, or confiscated?

"About the question of an illegal import from foreign country, if possible the animals are seized immediately and taken to a housing facility as soon as possible. In case that health issues are priority then the animal is put to sleep or return to the country of origin. Examples of these situations are: import of a non-human primate, import of a sick bird from a country with possible Avian Influenza, etc... The Service will assess the situation individually and with the point of view of other agencies (USDA, CDC, CBP, etc.), a decision is made."

Hector Diaz Collazo
State Veterinarian
April 2, 2007

Purpose: The goal of this interview was to determine the role of the State Veterinarian in exotic animal imports and also to better understand the inspection process overall. The interview was conducted via email.

1. **How many animals do you work with in a given day/week?**
   We handle about one shipment every two weeks and they mainly consist of avian species. Numbers of animals vary with each shipment. Exotic species other than birds are handled by DNER rangers.

2. **How long have you worked for your current employer?**
   I have been the State Veterinarian for almost four years.

3. **Do you work mostly with foreign or domestic imports?**
   Our office handles domestic imports. Animals coming from outside the USA are the responsibility of USDA/APHIS/VS.

4. **How closely do you work with the DNER in terms of permits for domestically imported exotic pets?**
   DNER will provide permits based on species but the health requirements are our responsibility.

5. **What is the most difficult part of collaborating with the other agencies on the island? Is information stored and shared adequately?**
   Getting everyone in the same page is the most difficult part of inter-agency cooperation. If it is not clear which agency will have the lead role it can get messy dealing with cases. When no problems arise every agency wants the lead but when there are problems they want to have someone else make the hard decisions but that is the reason we get paid for. Import documents are held in our office for three years and then an additional six at a government depository.

6. **How do you record or document the medical histories for the animals you work with? How are they stored?**
   We do not handle individual animals we deal with the health certificates that are included with each shipment for compliance with our regulations.

7. **Where do veterinary inspections take place?**
   Puerto Rico's Department of Agriculture (PRDoA) VS officers inspect animals at the port of entry for correlation of the submitted paper work (health certificates and import

permits) and to evaluate the condition of the animals. Complete veterinary evaluations are not done because we do not have the resources for that.

8. **What is the course of action if an animal is found to be infected with a dangerous disease?**
   Sick animals are denied entry into the Island and are sent back to the port of origin. Again we do not have the resources or facilities to confiscate animals not complying with our regulations.

9. **In your professional opinion, is exotic animal trafficking an increasing/significant problem for Puerto Rico?**
   Animal trafficking is a growing problem and shadows the illegal drug problem. It is extremely difficult to derail.

10. **Could you provide us with any statistics on the frequency of disease occurrence among imported animals or number of imported animals in general?**
    Exotics we do not follow through after they reach their final destination they are then handled by private practitioners on the Island. I do not have statistics about the health status of exotics in PR. You might want to reach the Colegio de Medicos Veterinarios (PR Veterinary Medical Association) to get information about the subject directly from practitioners working with exotics.

Carlos H. Soto-Alberti
Area Epidemiology Officer
Miguel A. Borri-Díaz
Area Veterinarian-in-Charge
USDA APHIS VS
April 9, 2007

Purpose: The purpose of this interview was to better understand the function of the APHIS in relation to the DNER and the handling of exotic animals entering Puerto Rico.

Dr. Carlos Soto-Alberti's job involves the tracking and prevention of disease outbreaks within the island of Puerto Rico. His primary concern is avian diseases such as bird flu. When birds on the island are sick, people call the USDA and the USDA performs testing on the animal. They hope that people will call their agency whenever bird diseases are found. They work primarily with domestic animals, and their mission is to prevent the outbreak of diseases within the island's bird populations. They also hope to make people aware of the potential dangers of exotic animal diseases. He explained to us that all of the exotic birds on the island fall under the jurisdiction of the federal agencies. Law #241 gives DNER the ability to regulate movement, selling, and possession of exotic birds within the island, however. Dr. Soto-Alberti stated that their agency's

relationship with DNER is open and friendly. Whenever they need information or help from DNER, they will call and get the issue resolved as quickly as possible.

In his opinion, the disease problem is not a growing concern for Puerto Rico. They only receive a small number of cases each month. There was an outbreak of Newcastle disease in the 1940s, but that was quickly eradicated from the island. They get 1 or 2 calls per week for dying birds, mostly for respiratory or nasal illnesses. There has never been an outbreak of bird flu on the island of Puerto Rico.

If they come into contact with illegal birds or birds being smuggled into the island, the case is handed off to the Investigation Enforcement Agency, which then takes legal action if deemed necessary. The USDA controls the international movement of birds, but if the animals come from the U.S., the movement is considered domestic. A database of illegal animals and permits would only be useful to the USDA office as a secondary source, since the DNER doesn't deal with international shipments. They would, however, like to be able to plot the concentrations of pet birds on the island- a map or something so they know where the highest concentrations of birds are (in case there was an outbreak). It is important to them to know where the exotic birds on the island are located.

He also commented that the exotic birds on the island are under the jurisdiction of the federal agencies, and the DNER should not be euthanizing or keeping the exotic birds without notifying the USDA of their existence. He also noted that a significant number of smuggling cases are birds brought illegally into Puerto Rico from the Dominican Republic on the ferry.

One possible solution to the financial strain of keeping a ranger in the airport from 10pm to 6am is to hold the animal's owner responsible for the cost of transporting a ranger to the airport for the number of hours required to pass it through the customs process. The USDA cannot be in the airport at all times of the day either.

According to the new law, 241, birds should be declared; you need to state whether you are going to keep the bird. This essentially makes these imported birds illegal. As a result, some sick birds go unreported because they owners are afraid of being labeled as lawbreakers. The Doctor also indicated interest in a new program the USDA is working on with DNER: making a certification and inspection process for street vendors and vendors in small-town markets to ensure that no dangerous animals are being sold to the public.

Juan Hurtado
Assistant Area Port Director
U.S. Customs and Border Protection
April 10, 2007

Purpose: The purpose of this interview was to determine what customs procedures are used at Luis Muñoz Marín airport for domestic and international flights.

In response to our first question, "What are the procedures for luggage coming in from the United States," Mr. Hurtado clarified that the U.S. Customs and Border Control

agency does not deal with domestic flights or shipments, but only international flights. Domestic (between states) inspections are the responsibility of the Puerto Rican agencies and the airlines themselves. According to his information, the largest problems that the IRS does inspections for are narcotics and weapons smuggling. When they happen to come into contact with an exotic animal, they immediately contact the U.S. Fish and Wildlife service about it. Therefore, they do not work with DNER on a daily basis. He believes that no domestic agencies on the island conduct full inspections of cargo and luggage on domestic flights to Puerto Rico from the U.S. mainland. Narcotics and weapons smuggling are larger problems. Federal agencies do not have the authority to inspect domestic flights, and local agencies similarly do not have the authority to inspect international flights.

Exotic pets may be declared to the airlines when they board a plane, but the airline has no legal responsibility to notify local authorities of the animal. This is the same for firearms. The airlines are not required to notify local police of weapons transported on their planes.

One of the two women also present at this interview, Rivera (the Director) used to own a pet store. She said that she picked up a lot of her animals in Florida and shipped them to Puerto Rico via air freight or on an airline flight. As long as the shipment is paid for and properly packed (dogs in carriers, etc) then it will almost always go through.

One subject discussed was the potential of placing rangers in the airports in the 10pm-6am shift. The rangers have an office in the American Airlines cargo section and currently have shifts from 6am-2pm and 2pm-10pm. Another option is changing the laws to allow rangers in the airport to inspect domestic flights and shipments. The local authorities need to be able to regulate what passengers are bringing in; they need to make sure that airlines are doing their job to notify local authorities about firearms, exotic animals, and other potentially dangerous cargo. The laws must be re-written to allow all of this.

They mentioned finally that we should get in touch with some other USFW contacts, as well as the public health agency.

Wendy Boneta
DNER Administrator
April 12, 2007

Purpose: The purpose of this interview was to gain information about the DNER role in exotic species inspections and to better understand the obstacles faced by the Department.

Wendy Boneta has worked with the Department of Natural and Environmental Resources for 13 years. Initially she was responsible for administering permits and is now working in the administration department. We had questions for her that dealt with each of the parts of our project. For the permit database Sra. Boneta explained that a well-structured database would help the person currently responsible for administering permits to note trends and permit volumes in different municipalities. It is important that

excessive numbers of permits are not granted within one area. Also, in terms of scientific research if too many permits are administered for the study of one particular animal, such as bats, which are most prevalent in only 5 municipalities of Puerto Rico, the result could be a decimation of bat populations. The study of exotics should not be done in areas where native studies are taking place, as an escape could result in competition between the two species. A risk assessment of animals for which individuals are granted permits would be very useful for determining whether or not these species should be granted permits. For the disposition protocol it was suggested that we look into foreign institutions, such as zoos.

When an exotic animal is being brought into the country a permit is required in order for it to be allowed. Puerto Rico has a clean list, and so any animals that are not on this list will not be granted permits. Although there is some flexibility with the animals permitted to be in Puerto Rico, about 95% of permits are for animals on the white list. When an animal is to arrive from the states, the airline must inform DNER rangers, who are present in the airport during the day, so that the animal will be inspected before it is allowed entry. If an animal arrives at night, when no ranger is present, it must be retained at the airport for the night until the next ranger shift begins. However, there is no standard inspection process in place to find animals that are concealed. Thus, inspections only occur when a person claims the animal they are bringing into the country. Sra. Boneta described a few scenarios of animals being smuggled. She had once seen a woman from Europe with a fox fur scarf, which turned out to be an actual live fox. She also mentioned that people will sometimes package something, such as office supplies, in thick foam and will cut holes in the foam for scorpions, spiders, or other exotic animals.

In addition to airports, Sra. Boneta sited marinas as locations that smugglers use to get illegal animals into Puerto Rico. The Commonwealth does not inspect marinas because these locations are looked at as places of recreation and not commerce. However, a ranger once caught a person attempting to bring Macaws in from South America, and so an exotic problem does exist at marinas. The administration of the marinas does not ask incoming individuals to claim anything, whether it is animals, drugs, etc. before they are allowed onto the island. It would be useful, Sra. Boneta stated, to have an office at marinas for DNER rangers. Another obstacle encountered by rangers is that they are unable to investigate homes in which they suspect there is an exotic animal without first going to court. In the past this has given the pet owner time to move the animal(s) to a different location. In one case, a farmer was able to relocate an estimated 500 exotic birds before the rangers were granted permission to search his property. The animals were never found.

The largest difficulties for the DNER in dealing with the exotic species problem are a lack of funding and jurisdiction to perform the necessary inspections. The majority of funding that comes to DNER is from the US and not the Commonwealth. The overall funding has remained the same for the past seven years despite the fact that costs have increased substantially over the years. With this money DNER is allowed to do scientific research, buy land, or build facilities. The Department is not allowed to allocate the money to rangers for equipment. Therefore, rangers do not have the necessary equipment or the jurisdiction to do inspections that would, if allowed, greatly reduce the exotic problem in Puerto Rico.

Giselle Keating
Ranger
DNER
April 17, 2007

Purpose: Being that our recommendations are largely geared towards inspection and the rangers are the individuals that perform these inspections, it was important to interview a ranger and discuss their duties and obstacles that they face.

We met with a member of the ranger division at the airport named Keating Giselle around 2pm on 4/17/07. She was able to give us some facts about exotic species inspections practices that we had not previously known before our visit. She began by stating that the job of all of the DNER rangers is to ensure that the people comply with the laws and regulations set forth by DNER, specifically Law 241 and regulations 6765/6775 for exotic species. In the airport, she helps to conduct inspections of cargo and luggage for domestic flights in cases where animals have been declared during the transport process. Consigners are supposed to call at last 24 hours in advance of a shipment's arrival in the airport. Once the shipment arrives, they open all of the containers, or, if the shipment is very large) more than 50 packages) they will open random containers as a representative sample.

Sra. Keating explained that they have had problems in the past with UPS, Fedex, and USPS receiving and processing shipments of animals without bothering to notify DNER. On the day of the interview, for example, someone from USDA (not the shipping agency) called her and notified her that a shipment of turtles was coming in at Guaynabo.

According to her, one of the challenges in her work is the identification of some exotic and potentially dangerous species. They know from their books and pictures what is and is not allowed, but she wishes that they had internet access at their office so that they could quickly research and identify animals when they are not sure. She suggested that DNER create a guidebook for its inspectors which would contain a list of species that are regulated and specific methods for identifying them. For example, fish species are sometimes only differentiated from each other by a single speck of color or other small characteristic. The guidebook could explain where to look for these distinguishing marks on each animal. This would make it much easier for inspectors to differentiate between animals that are commonly confused with one another. She also suggested that the state require the scientific name of each animal to be on its commercial invoice instead of just the common name, which can vary widely.

Another significant barrier to the inspection process is the lack of equipment resources for the rangers at the airport. According to what she has heard, DNER receives less than 1% of the total government budget each year, yet they have significantly more responsibilities than federal agencies like U.S. Fish and Wildlife. She explained that illegal animals are subjected to a fine. The amount of the fine depends primarily on the animal's current market value. The money acquired from these tickets goes into a special

DNER account, but she would like to be able to access that money for purchasing equipment for the rangers at the airport.

While animals are typically either sent back to their site of origin, sometimes people claim to not have the money to pay for the return shipment of the animal, leaving DNER to decide whether to fund the shipment or risk transporting the animal to Cambalache. Ideally, the rangers would have an account they could access to pay for the shipping costs and keep dangerous animals out of the island.

The rangers make weekly or monthly reports of the animals they inspect, but these records are compiled and stored in the lieutenant's office elsewhere.

In her opinion as a law school student, random luggage inspections are not feasible; people have the right to say yes or no when the rangers ask to take a look at their bags, and if the person says no then the rangers would have to request a court order for a search of the luggage in question. However, requesting such a court order is practically impossible outside of normal working hours (like late at night). For the majority of cases, it is up to the ranger doing the inspections to make the judgment call and decide how to proceed. This makes things difficult because judgment calls are different for each ranger depending on their point of view on the situation. A written procedure for inspections and the issuing of fines and tickets would standardize the process much like the disposition protocol streamlines the process at Cambalache. For example, the protocol could state that if a ranger wants to see inside a person's bags, they would be required to follow the ranger and put their luggage through an x-ray machine. If any illegal animals were observed, then the ranger could open the baggage and proceed from there.

From what she has seen on the job, she claims that avenues almost certainly exist for animals to enter the country without DNER's knowledge. Puerto Rico has a large number of private ports and marinas around the coastline, as well as airports in cities other than San Juan. Smugglers know which channels are being watched by DNER, and so they are smart enough to avoid them. She stated that animals may be entering through the U.S. Post Office or through airline shipments that DNER is not notified about by the airlines. While the airlines are required by law to notify local authorities of animal shipments and firearms, they do not always do so, creating major headaches for the rangers.

Miguel A. Garcia
Director; Division of Fish and Wildlife
DNER
April 17, 2007

Purpose: The purpose of this interview was to understand the perspective of the specific Department of DNER in which we work and therefore to better direct our findings.

Miguel A. Garcia has worked at DNER since 1991. He got his bachelors and masters in Puerto Rico and his PhD in the states. He was granted a paid leave of absence for the two years he was in the states and then came back to Puerto Rico and did his dissertation while working full time at DNER.

According to Dr. Garcia, the communication between Departments that deal with exotics is very open. When an issue arises, the Departments, such as Customs, APHIS, and DNER will sit down together and discuss the problem. The last times the Departments met to have discussion were when West Nile Virus and Avian Influenza were first brought up as a concern. There is no regular interaction apart from when there is an issue to discuss. Thus system works well for the time being, but there is an opportunity to make communication better.

Exotics on the island are dealt with by US Fish and Wildlife, DNER, Customs, and Puerto Rico's Department of Agriculture. US Fish and wildlife deals with foreign animal imports while customs will intercept animals while doing standard customs procedures. Puerto Rico's Department of Agriculture deals with imports of commercial animals such as cows as well as plants. DNER is responsible for inspecting domestic animal imports that have been claimed by the animal owner. However, the rangers do not have the jurisdiction to randomly search baggage or passengers arriving from the United States. They may search a package that is labeled as an animal and they do have the power to investigate illegal animals that they happen to see in a person's house or that someone had called and told them about. People who come into Puerto Rico via private boats are not subject to any inspection and so could be brining in exotic animals.

Drugs and firearm smuggling is an issue that gets a lot more attention than that of exotic species. Drugs have been smuggled into Puerto Rico in very creative ways, for example, cocaine has been smuggled by hiding it in coffee. The smell of the coffee conceals the smell of the drugs, which can then be brought past the drug smelling dogs. Exotic species are not seen as a big problem, and so the issue is not seen as a substantial one.

The amnesty in Puerto Rico was imposed in 1998 but is no longer in place. It allowed pet owners to come forward and claim their illegal animal and in return they received a permit for the animal until it died. They were not allowed to breed this animal, or to own more than what they claimed. The DNER had intended to keep track of individuals that were granted amnesty, but they did not have the resources and they still do not. The amnesty was put in place so that individuals would come forward with animals and DNER would be aware of how many exotic animals were present in Puerto Rico. Now that the amnesty is not in place whenever an exotic is found it is confiscated and taken to Cambalache state forest.

One of the problems with exotic animals is that people may not know when they purchase an animal that it is illegal. It is assumed that animals sold at pet stores are legal. For example, ferrets are not legal in Puerto Rico, but when they are sold in pet stores they are believed to be legal.

Puerto Rico is currently struggling with maintaining and increasing the population of the Puerto Rican parrot on the island. Therefore, permits are not granted for Amazon of the same genus as the Puerto Rican parrot, because the birds from the Amazon may compete with the Puerto Rican Parrot. In general, if a person wants to own an animal that is not on the list of acceptable animals for permits, then it is that individual's responsibility to prove that the animal they want does not pose a threat to Puerto Rican wildlife.

Prevention is the best method for minimizing the exotic species problem. There are many times when an animal does not seem like it would be harmful, but then it

escapes and becomes established. For example, an individual was breeding crayfish for commercial purposes and keeping them in ponds. The animals we contained within these ponds, but then a flood occurred and washed them into a nearby river and they shortly became an established species. The problem of exotic species should thus be dealt with by DNER because they confiscate animals and have a center, Cambalache, to keep them. There was a general movement to put PRDoA in charge of the problem because many people equate any kind of animal breeding with agriculture. However, the problem of exotic establishment is one that DNER is trained to deal with.

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