

The Impact of Feral Dogs on the Ecuadorian Ecosystem

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## Abstract

Multiple studies have been performed in order to determine the effects that feral dog populations have on native marine iguana populations in different regions of Ecuador. This paper showcases multiple different case studies in order to make a conclusive piece regarding the impact that feral dogs have on marine iguanas and the surrounding ecosystem. Dogs first came to the Galapagos Islands when colonization first began. These domestic dogs eventually were abandoned by their owners and became feral with time. The feral dogs formed packs and began to terrorize the marine iguana populations. Several islands have a significant number of dogs, while some have little to no feral dog presence. On the mainland of Ecuador, there is seldom a place where you cannot find a feral dog. Although the Ecuadorian government is working on facilitating programs to control the feral dog populations, a large portion of the local communities believe that feral dogs are treated unfairly and are dealt with inhumanely.

One study had the objective of determining the different factors in prey selection on the marine iguana population by the feral dog population. The carcasses of marine iguanas were examined in order to determine if there was evidence of dog predation. It was concluded that larger marine iguanas were hunted more often by feral dogs. It was also noted in this study that the anti-predator behaviors of the marine iguanas were not sufficient enough to ensure survival. Another study referenced in this paper determined if behavior and endocrine responses could be altered in response to the introduction of a predator. To measure this, researchers analyzed the corticosteroid (CORT) levels of marine iguanas on an isolated island and not on an isolated island. Researchers were able to solidify the claim that marine iguanas were able to develop anti-predator behaviors in areas of isolation. The researchers were also able to conclude the marine iguanas that had acute predation pressure from feral cats and dogs showed larger (FIDs) when compared to sites with or without low predation pressure. A similar study tested CORT levels and flight initiation distances of marine iguanas on Caamaño, Punta Nuñez, and San Cristobal Island. The results of this study was that the marine iguanas with acute predation had higher levels of CORT. It was also found that the flight initiation distances were highest in the area with predation with the marine iguana population that had been caught previously by the researchers. The final study referenced in this paper dealt with evaluating the effects of dogs on

the native mammal community in the Northern Ecuadorian Andes. At the end of the study period, it was concluded that these dogs are a substantial threat to the species in this area and can drive their species populations to extinction.

The implications of the findings in all four case studies were substantial. The overarching theme is that feral dog populations negatively impact the marine iguana populations in Ecuador. Feral dogs hunt marine iguanas and terrorize them. Since some of the marine iguana populations have existed without major predators, they struggle to have efficient enough responses to their predators. This then results in many marine iguana deaths. Since the dogs eat the iguanas to survive, this quickly dwindles the marine iguana population.

Suggestions for the future include the education of the public about sterilizing the feral male dog population and the impacts that dogs have when released from a domestic home. This will highlight that although friendly and sociable, the canines can be detrimental to the environment around them. Funding for government programs is also necessary to give financial backing to the sterilization of stray dogs in local communities. The creation of new policies regarding feral dog populations is necessary and the old laws need to be upheld, enforced, and potentially rewritten.

## **Introduction**

Feral dogs are dogs that have lacked stable human interaction for a large portion of their life. This can be seen when owners abandon their dogs once they are out of their puppy stage of development. The purpose of this paper is to describe the impacts that feral dogs have on Ecuador's ecosystem. Since feral dogs are prominent in almost any area of Ecuador, it is important to determine their impacts on the environment in each region.

### **Introduction of Feral Dogs to the Galapagos Islands**

Domesticated dogs were first introduced to the Galapagos Islands during the time of its colonization. In 1832, the Ecuadorian government had allowed Jose Villamil to found a colony on the islands in order to compensate him for his contributions toward the country's liberation. He first settled on Floreana and later moved to San Cristobal. His settlement coincides and is thought to be connected with dogs beginning to populate these areas. The earliest report of a feral dog population on Isabela Island was in 1868. Santa Cruz also had reports of feral dog groups, but the introduction of dogs on this island was undetermined until 1983 (Barnett and Rudd, 1983). On Isabela Island, there are records of feral dog packs beginning to prey on native marine iguanas as early as 1933 (Kruuk and Snell, 1981).

### **The Feral Dog's Impact on the Ecuadorian Ecosystems**

Marine iguanas lived in isolation from predators from anywhere in between five million to 15 million years prior to the feral dog infestation (Berger, et. al, 2007). Since these endemic marine iguanas evolved from populations on the mainland, they lack the innate anti-predator behaviors. When the marine iguanas respond to the presence of an introduced predator, most of the time the response is ineffective or not present at all. Not all of the islands have feral dog populations, so marine iguanas are safer on some islands than on others. Alfred Russel Wallace was concerned when he visited the islands in 1835 that the stray animals that had been released by humans would negatively impact the fauna of the area. Based on recent developments and the current effects the introduced species has on the ecosystem this concern is well-founded. (Kutschera and Kleinhans, 2013).

Since feral dogs can be both scavengers and predators, there are many different fauna in which they can prey upon. For the majority of the time, feral dogs tend to hunt the endemic fauna

of the galapagos islands, especially the land and marine iguana populations, tortoises, and nesting marine birds (Barnett and Rudd, 1983). In some areas, feral dogs are the most abundant carnivore and thus have a strong negative impact on its ecosystem. Not only do they kill or harm wildlife, but they spread disease and compete with the native species. Feral dogs harass and increase stress levels among native fauna causing delayed growth and increased population strain. Feral dogs also take up the habitats of native fauna which is problematic due to the fact that this reduces the grounds for reproduction of the native species (Young, et. al, 2011).

Even though there is a lack of area for living and reproducing and the issue is increasing in scope, not much research has been done on the impact that the canines have on biodiversity in the Ecuadorian Andes region. The feral dog population in South America totals over 82 million individuals. In the Ecuadorian Andes, the area that the feral dog population occupies is approximately 3,000 meters. This would make the feral dog population density about 1.15 individuals per square kilometer. The average 20 kilogram dog would need approximately 0.7 kilograms of food a day to survive. Since there are about 4,000 dogs in this region, this would mean that 28,000 kilograms would need to be consumed in this ecosystem (Zapata-Ríos, 2014).

### **Public Opinion of Feral Dog Population**

Ecuadorians and expatriots of Ecuador have noticed the trend in feral dog populations and how detrimental the dogs can be to the surrounding ecosystem. Dogs are a known source of harm to the fauna and flora of the Ecuadorian regions, but there is little to no action being taken in regard to this issue.

There are claims that a feral dog presence exists in any region of the country (Living in Ecuador, 2018). Based on the region the feral dogs are geographically situated, behavioral changes follow. In urban environments, the dogs have been known to stay busy and not relax with the locals instead opting to look for food and stay in packs. On the other hand, dogs in smaller villages do the opposite and are more social.



*Image-1:* A photograph of a feral dog sleeping in a shaded area of a commercial area.

One of the major problems with domestic dogs is that their male owners do not want to get their male dogs neutered (Living in Ecuador, 2018). Since most male dogs are not neutered, a large portion of the stray female canine population is pregnant (Kay, 2016).

The feral dog populations are also often malnourished or diseased. Locals complain that there is no animal control infrastructure and no help for the malnourished and diseased animal populations. Locals deeply pity the feral dogs because the dogs are often very friendly regardless of their environmental damage. (Living in Ecuador, 2018).



*Image-2:* An image of a very friendly and social stray dog at Cajas National Park.

A large portion of the stray dog population have owners who use them for a time before releasing the animals. Initially, the dogs are used to protect a family and typically there is not an affectionate bond between the owners and the dog. Although this bond does not exist, the dogs take comfort and find joy in spending time with their owners as the alternative is much less pleasant (Kay, 2016).



*Image-3:* A photograph of a stray dog enjoying the attention and affection of tourists at Quilotoa Lake.

A discussion board of expats had mentioned an issue regarding locals throwing poisoned meat into their yards. Although domestic dogs are an issue, it is not beneficial to work to deplete those populations. There is no proof that the owners would release the dogs at any point. It was also noted in this discussion board that domestic dogs cannot coexist with feral dogs, making it difficult to walk domesticated dogs on the streets (Dogs in Ecuador, 2014).

### **Ecuador's Attempts to Manage the Feral Dog Population**

Eradication efforts have been taking place since the late 1970s. It was recorded that a coordinated eradication and study program was started. This program would span multiple islands in the Galapagos Archipelago and have a combined effort to reduce the population of feral dogs (Barnett and Rudd, 1983).

Research is one of the major tools that Ecuador is using to deal with its feral dog populations. Domestic dogs are considered to be invasive in eight countries, but Ecuador is one of the three countries that has started to conduct research. These three countries are also working to implement programs to combat this issue. These programs consist of five main parts which include: reducing the number of free-ranging dogs, eliminating feral dog populations, developing and enforcing legislation related to dog ownership to prevent cruelty and abandonment, promoting responsible ownership of domestic animals, and implementing neutering, sterilization, and vaccination campaigns (Zapata-Ríos, 2014).

A study, published in 2007, had the goal to study the effectiveness of calcium chloride as a sterilization chemical for adult stray males. The study began with a single intratesticular injection of calcium chloride in different dosages dependent on the subject's body weight. 45



days after the initial injection, sterilization was performed. Through this methodology, it was found that the injection would prove to be a suitable method of sterilization (Jana, K and Samantha, P.K., 2007).

Funding for sterilizing and neutering feral dogs was provided by the Galapagos Conservancy. These funds provided medicines that were necessary to perform medical and sterilization procedures. To find individuals who could perform these operations, the Galapagos National Park and the Galapagos Biosecurity Agency partnered with Animal Balance and several Ecuadorian veterinary groups. Two main animal hospitals were established and combined and helped neuter nearly 250 stray cats and dogs in their first week. Over the last decade, this initiative has sterilized more than 4,500 feral cats and dogs (Managing the Pet Population in Galapagos, n.d).

Some organizations in Ecuador are trying to play their part in contributing positively to the issues surrounding feral dogs. For example, the Society for the Prevention of Cruelty to Animals Kota Kinabalu had started its pilot project, trap neuter release, in order to try to remove stray dogs from residential communities (Kinabalu, 2013). Since a five year study of stimulating the effects of sterilization and euthanasia on stray dog populations found that sterilization is less efficient than euthanasia to control the feral dog populations, euthanasia should be utilized in order to have immediate control of the feral dog populations. In a longer termed program to make the dog populations of Ecuador more sustainable, sterilization would be effective because it would take multiple generations to see the effect of this on the population size (Amaku, et. al, 2010).

Although this solves one part of the issue, there are multiple others with this topic. A major issue that is unsolved is that the community is not educated about this topic. Neutering stray dogs solves the issue to feral dogs breeding, but it does not solve the issue of domestic dogs being released. The majority of dogs should be neutered in order to stabilize the population. It is important to provide these programs and education in tandem so that the government could effectively control the populations of stray dogs (Kinabalu, 2013). Other main issues surrounding feral dog populations include a need for more research, a need for public awareness campaigns,

as well as more policies and enforcement of the policies in place regarding this issue (Young, et. al, 2011).

### Case Studies

#### **Prey Selection by Feral Dogs from a Population of Marine Iguanas**

##### *Methodology*

The goal of this study was to determine factors of prey selection by the feral dog population on the marine iguana population on Isabela Island, Ecuador. The researchers involved with this study looked at the varying size classes of marine iguana populations and their probability of predation. In conjunction to this measurement, researchers recorded the different fleeing distances when in the presence of a feral dog or other major predator. The study began on February 27, 1979 and concluded on March 12, 1979. The study area consisted of a three kilometer stretch of land on Isabela Island. In this area, approximately 20 dogs were present that had a shoulder height of 60-70 centimeters. These dogs had been in that area for at least a year, but had not been there since 1969. Researchers had also analyzed feral dog interactions with marine iguanas on Santa Cruz and Isabela Island. To examine the interactions, dog feces were collected in a specific area and its contents were examined as well as looking at different sized marine iguanas that had perished. These carcasses were examined for signs of feral dog predation and researchers recorded what areas of the body displayed signs of damage (Kruuk and Snell, 1981).

##### *Results and Discussion*

Through the methods conducted in this research, several results were able to be concluded. When the researchers looked at the varying size classes of the marine iguana, data was found that supported the claim that when the size of the marine iguana increases, the probability of predation increases (Kruuk and Snell, 1981). The significance of this is that the male marine iguanas typically are larger than the females, so the territorial males are preyed upon more often.

The researchers also found that the fleeing behavior of the marine iguanas was not efficient enough in order to protect the individuals against the feral dogs due to the fact that the population size of the feral dogs is so massive. When looking at the fecal content of the feral dog populations on Santa Cruz and Isabela Island, it was found that 58% of the feral dog feces that

were collected contained marine iguana remains. In the fecal samples that contained marine iguana remains, approximately half were the most prevalent component. It was noted that during this study period and the year following, at least one marine iguana population had been reduced to the point where they were considered to be virtually eliminated by dogs (Kruuk and Snell, 1981). This is significant because it shows that the anti-predator responses exhibited by marine iguanas are not effective enough to guarantee survival.

### **Behavioral and physiological adjustments to new predators in an endemic island species, the Galápagos marine iguana**

#### *Methodology*

Research has shown that when animals are isolated on an island with little to no predators, they do not exhibit efficient escape responses when compared to their mainland species. This study's goal was to determine if behavior and endocrine responses could be changed in response to the introduction of a predator. To achieve this, researchers analyzed the anti-predator responses of marine iguanas on an isolated island and not on an isolated island. A sample would be taken from the marine iguanas in order to determine if there was a change in plasma glucocorticoid concentrations in response to the presence of a predator. Each marine iguana in the study had its age and sex recorded in order to determine if these two factors influenced their reactions.

This study began in 2002 and lasted until 2005 and had a sample population that consisted of marine iguanas that had not moved for at least ten minutes prior to data collection. A total of eight different sites were studied in the Galapagos Archipelago with varying levels of feral cat and dog presence. In order to collect data for this experiment, researchers began their observations at a distance of 20 meters away from the marine iguanas. At this distance, the escape tactics used were recorded as well as their age classes, estimated body size, and other morphological traits. The different distances that were recorded were the distance between the investigator and the point of initial alert distance as well as the flight initiation distance of the marine iguanas (Berger, et. al, 2007).

#### *Results and Discussion*

Through the recorded observations of this study, researchers were able to solidify the claim that marine iguanas were able to develop anti-predator behaviors in areas of isolation. They were also

able to conclude that the claim “marine iguanas that had acute predation pressure from feral cats and dogs showed larger (FIDs) when compared to sites with or without low predation pressure” was supported (See Figure-1) (Berger, et. al, 2007). The results of this study are significant because it provides complex support to the concept that acute predation forces the marine iguanas to flee further distances regardless of an age bracket.

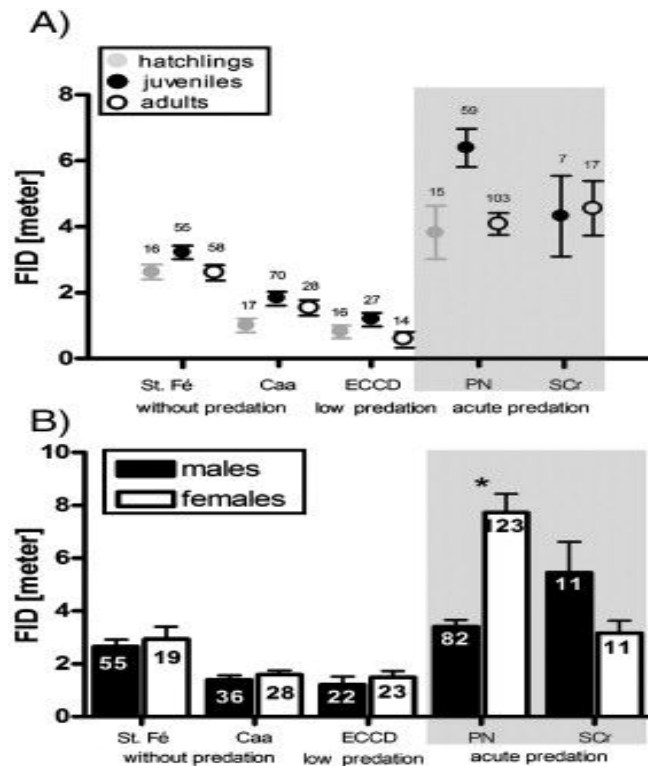


Figure-1: Flight initiation distance graphs - This figure demonstrates the varying flight initiation distances of marine iguanas at different ages and different study sites with varying amounts of predation (Berger, et. al, 2007).

### Tameness and stress physiology in a predator-naive island species confronted with novel predation threat

#### Methodology

This study was focused on testing the levels of plasma corticosterone, CORT. CORT is the stress hormone that is present in reptiles. To determine this, researchers compared CORT levels of undisturbed and disturbed marine iguanas at three different sites. These sites were on Caamaño, Punta Nuñez, and San Cristobal Island. The measurement of this study was CORT levels as well as the flight initiation distances as they are good indicators to measure prey wariness.

CORT levels were taken from undisturbed marine iguanas approximately 30 minutes after restraint with a cloth bag. CORT levels were taken from disturbed marine iguanas after they had been chased for 15 minutes. To study the longevity that predator stress could have on a marine iguana, some individuals were recaptured three to four weeks after initial collection.

In order to analyze flight initiation distances among marine iguanas in these three different locations, random territorial males were selected. These random males were observed at a distance where an observer approached the animal in a straight line at a constant speed. The location of the observer when the male started to move was recorded as well as the shortest distance to the animals original location. Some of these males were grouped into the native control group and some of them had previously been captured in order to determine if prolonged stress has a significant impact on flight initiation distances (Rödl, et. al, 2007).

### *Results and Discussion*

Researchers had found that after the 15 minute restraint of native marine iguanas, the CORT concentrations were significantly elevated when compared to the sample collected at two minutes. There was no significant difference between the sample collected at the 15 minute time interval and the 30 minute time interval (See Figure-2). It was also found that previously caught marine iguanas exhibited larger flight initiation distances when compared to the marine iguanas who had not previously been captured. Researchers had concluded that the native restrained displayed a higher CORT level than any of the other types of marine iguana specimens (See Figure-3)(Rödl, et. al, 2007). These results are impactful because it shows that native species that are isolated from predators have significantly shorter fleeing distances than native species that experience acute predation. Another important aspect of this study highlights that the marine iguanas can develop anti-predator responses, although it often is not enough to escape their predators.

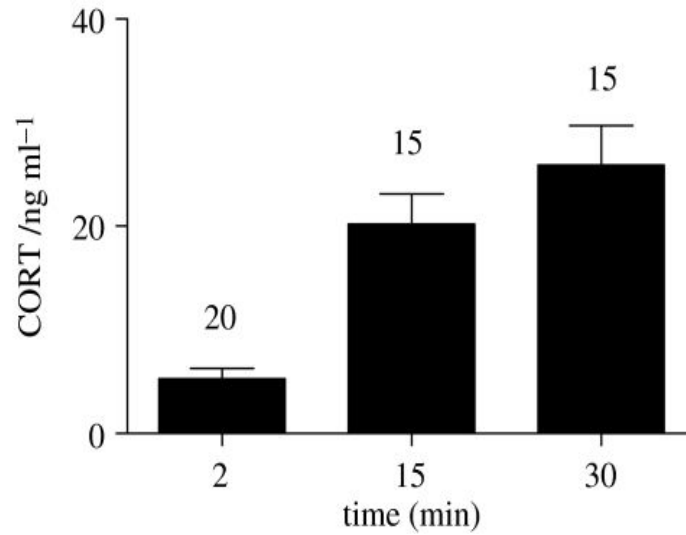


Figure-2: CORT level bar graph - This figure demonstrates the CORT levels of marine iguanas in the Galapagos Islands at different time intervals (Rödl, et. al, 2007).

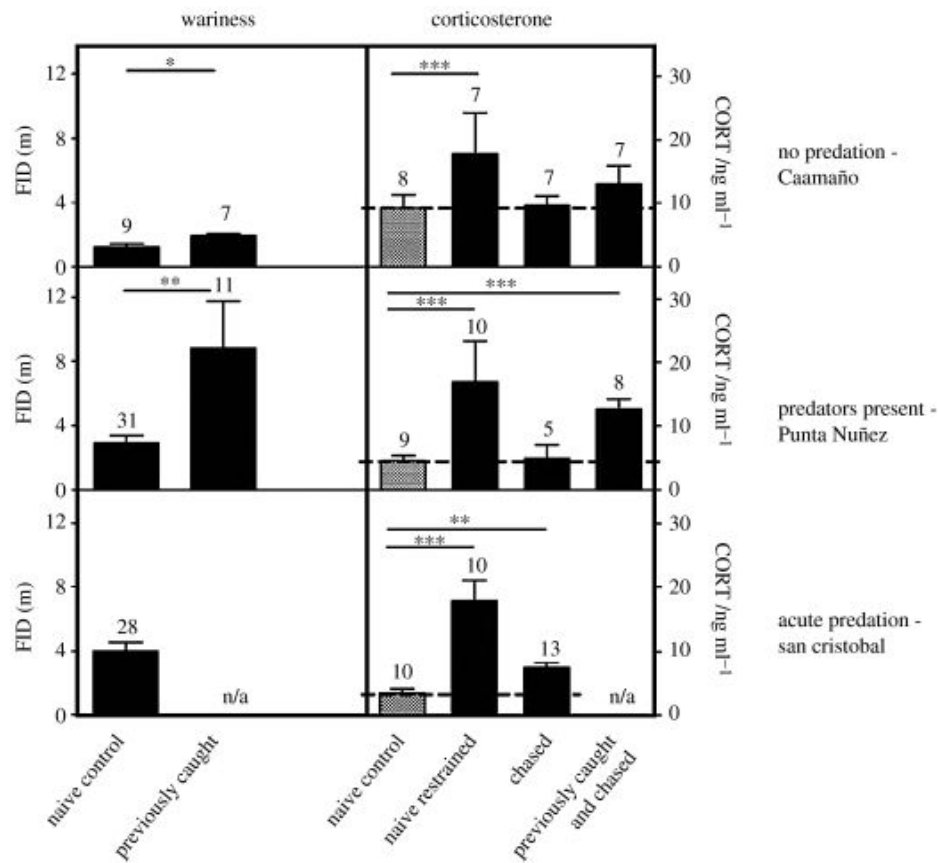


Figure-3: Flight initiation distances and CORT level bar graph - This figure demonstrates the wariness and corticosterone levels at the three different sites that this experiment was conducted (Rödl, et. al, 2007).

## **Impacts of Domestic Dogs on the Native Mammalian Fauna of the Ecuadorian Andes**

### *Methodology*

For this study, researchers wanted to evaluate the effects of dogs on the native mammal community in the Northern Ecuadorian Andes. Five study areas in Cayambe-coca National Park were chosen along its eastern mountain range. This study began April of 2009 and concluded in July of 2010. To evaluate potential effects of the feral dog population on native species, presence-absence surveys were conducted using camera traps. The five study areas were divided into 16 cells of 25 square kilometers and seven camera traps were randomly placed 1000 meters apart. The camera traps were set out to collect data for five consecutive days at the beginning of the study in order to establish a capture history. Measurements of this study were detectability and occupancy (Zapata-Ríos, 2014).

### *Results and Discussion*

Through conducting this experiment, it was found that feral dogs are detrimental for native species. Four native species in this study were extirpated where feral dog populations were greater. Six native species showed a reduction in abundance since the beginning of the study. It was noted that the presence of feral dogs had altered the activity patterns of three different species in Cayambe-coca National Park. It was concluded that these dogs are a substantial threat to the species in this area and can drive their species populations to extinction. It was also noted that the native vegetation at these sites at the end of the study was anywhere from 56% to 73% less than it was at the beginning of the study (Zapata-Ríos, 2014). This is significant because it provides conclusive evidence that the feral dog population does statistical damage to native species populations and can drive them close to extinction. For a country built upon preservationist ideals, this poses a clear and imminent threat to the sanctity of the natural flora and fauna.

### **Conclusion**

The main purpose in the prey selection study was to determine which characteristics or physical traits influenced predation on the marine iguana population from the stray dog population. The experimental design allowed the researchers to draw the conclusions that the main factor that drove predation was size. The researchers of this study were able to conclude that there was a

significant increase in predation with the increase in sizes of the marine iguanas. The second study was on the different behavioral and physiological adjustments in isolated marine iguanas that are now adapting to predator species. The main objective of this study was to determine if behavior and endocrine responses could be changed into the stimulus of an introduction of a predator. After taking some controlled experimental measurements, researchers were able to conclude that they were able to make changes, but those changes were not enough to maintain survival. Another study focused on the tameness and stress physiology in marine iguanas when they are in varying levels of predator presence. After collecting data from their experiment, researchers concluded that the marine iguanas who had a history of predation were more likely to take bigger preventative measures and they also exhibited greater stress levels. The final study had the goal of determining if feral dog presence impacted the fauna in the Ecuadorian Andes region. By using camera traps, researchers were able to determine that the feral dog population in this region lead to the total removal of four native species, the reduction of six native species, as well as the alteration of activity patterns of three native species.

From the results of the case studies included in this paper, it is apparent that actions need to be taken to resolve the issues that feral dogs have on the Ecuadorian communities. Allocating more funding should be a priority in order to continue sterilization programs and implement educational programs. Sterilizing stray dogs is one part of the solution, but education of the locals is imperative due to the fact that many release their dogs once they no longer find them useful. If owners of domestic dogs sterilize their animals, then this would prevent them from breeding with other stray dogs once they are released. These objectives combined with additional research should be efficient in taking control of the feral dog population in the different regions of Ecuador.



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