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Developing Guidance for the Costa Rican Fire Department (BCBCR) on Successful Wildlife Management

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Developing Guidance for the Costa Rican Fire Department (BCBCR) on Successful Wildlife
Management

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Benemérito Cuerpo de Bomberos de Costa Rica (BCBCR)

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Abstract

An increase in human-animal interactions has led to a rise in the number of wild animal related calls the National Fire Department of Costa Rica (BCBCR) has received. However, the firefighters lack guidance to safely and effectively respond to these calls. The goal of our project was to develop, for the BCBCR, a field guide and a manual with training material, including interactive maps with locational information on animal organizations that accept the animals. We interviewed firefighters, wild animal experts, and animal center staff members to determine safe and effective methods of animal management. We recommended that more resources be devoted to expanding the contents of the field guide and manual, providing training workshops, and creating an improved system for gathering data.

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- Katherine Rodriguez de la Rocha
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The six stations we visited include:

- Cartago
- Santa Ana
- Heredia
- Guapiles
- El Roble
- Quepos

Experts who dedicated time and resources to revising the guide

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- Fabienne Miller

Executive Summary

Although there are many animal organizations in Costa Rica to protect and manage the country's wildlife none operate on a 24-7 basis or are well-equipped to handle the high number of emergency calls regarding animals intruding on human-inhabited areas. The Benemérito de Cuerpo de Bomberos de Costa Rica, the BCBCR, is the main responder to animal calls in Costa Rica. Despite the fact that some firefighters have had some minimal training on animal management, the BCBCR lacks an effective training program and field guide to ensure safe and effective animal call responses. Their main priority is responding to fires, but part of their mission statement requires them to manage calls about wild animals.

In the past six years, the BCBCR has seen over a 600% increase in animal related calls (Coto, 2016). In a survey sent to all 74 fire stations in Costa Rica by the administrative assistant at the Academy of the BCBCR, almost half of all respondents indicated that they have never had any formal training on animal management. Almost 70% indicated that they do not know how to correctly respond to an animal call (Monge Mora, 2016). Furthermore, the new Animal Welfare Act, Law 18.298, states that any human that causes tangible harm to an animal can be sentenced to up to two years in prison, making it even more imperative that the firefighters have procedures to avoid injuring themselves or the animals (Animal Welfare Act, 2016).

Project Goal, Research Objectives, and Methodology

In order to address the absence of formal wild animal management procedures for the Costa Rican firefighters, the goal for this project was to develop guidance for the BCBCR's firefighters to handle animal calls in ways that are effective, safe for the responders and secure for the animals. To achieve this goal, we completed three research objectives. We:

1. Developed an understanding of how other Costa Rican organizations can aid the BCBCR in their animal rescue process.
2. Investigated what firefighters believe are the best methods to use in an animal related response call.
3. Gathered content and received feedback on guidance from animal experts.

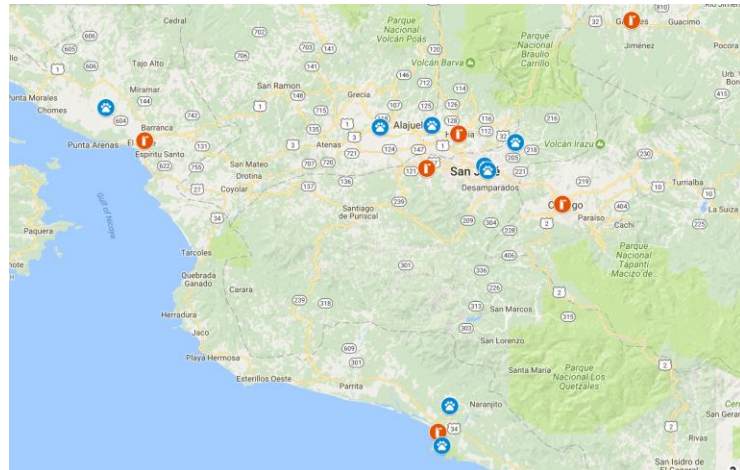
Our team accomplished these objectives by analyzing data from surveys sent to the BCBCR's fire stations, determining the most common animals attended to, contacting more than 50 various types of animal organizations across the country (zoos, rescue centers, universities and sanctuaries), and visiting fire stations and animal organizations. We conducted interviews with:

- Four to five firefighters at six stations. The stations visited represented the main geographic regions in Costa Rica to learn how animal equipment, knowledge and perceptions differ through the country. The six stations chosen represent various climates and terrains, namely: mountainous, valley, city, dryland, wetlands and coastal terrain. The selected stations were Cartago, Heredia, Santa Ana, Guapiles, El Roble and Quepos.
- Three wild animal experts at multiples universities. Their expertise ranged from reptiles and mammals to birds.
- Nine administrators at zoos, rescue centers and sanctuaries.

Based on the information from interviews and our research of animal management, we developed our guidance in the form of a field guide for use on wild animal calls and a manual containing information for educational courses.

Findings

Our five main findings from our research, interviews, observations, and visits facilitated our final deliverables for the fire department. We used the information from our findings and our own research to construct the field guide and manual.



Fires stations (red) and organizations (blue) we visited

Finding 1: Firefighters lack the capacity to respond effectively to animal calls.

We learned about the current methods and equipment the firefighters use to capture the most common animals they respond to. The BCBCR only supplies each station with a catchpole, a hook, and snake tongs for animal management; all other equipment is bought out-of-pocket by the firefighters. We determined the type of equipment each station we visited should have based on the animals they deal with most, then compared the types of calls they receive to the equipment they currently have available.

Of the six stations we visited, none of them were as well-equipped as they should be to respond safely to wild animals, which suggests many other stations could have the same problem. Without proper equipment for their common calls, there is a risk of an unsafe environment for the animals and firefighters. In addition, when asked what courses they have taken on wild animal management, half of the firefighters mentioned that they had taken snake and bee management courses in the past, but nothing beyond that.

Finding 2: Perceptions on the importance of wild animal management throughout stations vary, but they are generally positive.

During our interviews with firefighters conducted at their station, we asked about their perception of animal management. We learned how interested they would be in learning more about animal management and if they believe that a guide would be helpful.

Firefighters at five of the six stations were supportive of the idea of extensive training and a field guide. Almost every firefighter responded favorably to this guidance. The head of the Quepos station said, “The guide would help not only with the safety of the firefighters and the animal, but it would also help the firefighters comply with the law.” Many firefighters also expressed the need for connections between the BCBCR and animal organizations.

However, one station in the city did not seem as enthusiastic about the concept of the guide. In our interviews with its firefighters, they stated that when an animal is captured, they do whatever they can to quickly relocate it to a sufficient area nearby; regardless if the area is not the animal’s proper habitat. Unlike most stations, they do not allow any animals to be kept at the

station overnight. Because of these practices, animal management guidance is not as much of a priority to them as other emergency calls.

Finding 3: Creating a long-lasting and legal relationship between the BCBCR and animal organizations is challenging.

The Ministry of Environment and Energy is the governing body in Costa Rica that protects animals. They regulate the organizations that are authorized to take in animals for further care. Every organization must comply with the regulations the MINAE creates to be considered legal. For this reason, and because only legal ones can be recommended for use to the BCBCR, we investigated the legality of each organization we encountered. We contacted over 50 organizations throughout all the seven Costa Rican provinces, including zoos, rescue centers, sanctuaries, and universities. After further investigation, we found that only 60% of those organizations are officially recognized by the government. It became difficult to establish connections with useful animal organization, as their legal status may inhibit their availability for association with the BCBCR.

Finding organizations that were willing to partner with the BCBCR was also complicated due to previous history. For example, we learned of a misunderstanding between the BCBCR and the Instituto Clodomiro Picado. The institute had put many resources into providing workshops, equipment, and educational material for the BCBCR on animal management. However, the BCBCR did not recognize it for these efforts and ceased communication with the institute. We found many similar situations. Despite these past experiences, there is still a chance that meetings between organizations could resolve their issues and create a partnership in the future.

However, due to a law reformation on protection of animals the long-term status of supportive animal organizations for the BCBCR is becoming challenged. Currently, the MINAE is working to modify the Wildlife Conservation Law, which is creating a change in the way animal organizations are categorized (Important Laws of Costa Rica, 2016). The Vice Minister of the MINAE indicated that the proposed law will lead to stricter classifications of different animal organizations (MINAE, 2017). This information was reiterated during an interview with the Macaw Sanctuary where he explained the law will force rescue centers, zoos, and sanctuaries to develop new protocols and infrastructures in order to be considered legal, among other requirements. Because of this, organizations with low income or lack of resources may be shut down. This might pose a problem for establishing connections with the BCBCR, since this could decrease the amount of organizations that they can bring animals to for further care.

Finding 4: Animal organizations often give higher priorities to certain animal groups and injured animals.



Henry the sloth from Fundazoo

Through interviews, we learned how each organization could aid the BCBCR with the animal rescue process. Many only accept certain animals, resulting in constraints for the firefighters when deciding where to bring an animal for further care. For example, due to the overpopulation of raccoons Simon Bolivar has limited the amount they will receive per year.

Sometimes a firefighter has an injured animal that needs medical attention but there are not organizations within a realistic distance that accept that type of animal. Waiting days or even hours could put the life of the animal at risk. We found, through our interviews, that almost all organizations put a high priority on injured animals even if they are not in the typical animal group they accept. In addition, the Director of Fundazoo Simon Bolivar, Yolanda Matamoros, stated, "Although there are certain animals that we do not accept due to overpopulation, if they are injured then we have to accept them". This was a very common theme among the organizations we visited.

Wild Animal Management Field Guide and Manual

We created two deliverables for the BCBCR: a field guide for the use of firefighters when responding to wild animal calls and a manual for Allan Rodriguez, the head of course education, to use for creating training courses on wild animal management. We used information obtained from our research to create a field guide for the firefighters. We incorporated information gathered from interviews with the firefighters, experts in the field, and animal organization staff members. Both documents were verified by animal experts, which provide the appropriate information needed to ensure the safety of the firefighters and animals. Information such as the most common equipment, current techniques, procedures, or tricks they employ when attending to an animal call were included. Only equipment observed at the stations was included in the guide. Based on information from experts and administrators of organizations we included the proper techniques and procedures used to capture the animal.

The second deliverable was a manual designed for the Academy for training purposes. It includes resources for training, information on updating the visual aids created, detailed information on the animal from our own research and input from experts, and recommendations on how to improve the guide. Also, we explained how to update the interactive map to model where all of the legal animal organizations throughout the country are. This map allows the user to click on the icon representing an animal organization and view facts about that organization, such as the types of animals accepted and contact information.

Recommendations

We recommend that the BCBCR improve the resources provided to the firefighters in two ways: improving training and equipment, and adding information to the guide.

Improving Training and Equipment Provided to Firefighters

The BCBCR should formalize a training program that is coordinated with the organizations who indicated a willingness to work with the firefighters. Having minimal training on animal management has become a concern for the Academy. There are many organizations that have offered their time and resources to give classes or training to firefighters. Those that indicated a willingness to work with the firefighters include: Monkey Farm, Osa Wildlife Sanctuary, Kids Saving the Rainforest, Zoo Ave and Instituto Clodomiro Picado. Working with these organizations is a useful opportunity to gain more knowledge and training on animal management that should be taken full advantage of.

The National Fire Academy should invest in the correct equipment for each station to manage their most common animals. Our study indicated there is a lack of proper rescue equipment available at the fire stations. We determined that, although some fire stations have some animal response equipment, many stations do not have the proper equipment based on the most common animals they respond to. A higher priority should be placed on having the most effective equipment for handling the priority animals at each station, as proper equipment is imperative to ensure the safety of the animals and responder. To facilitate proper investments in equipment, each fire station should create a list of equipment needed based on the animals they encounter frequently.

Adding Information to the Field Guide

More resources should be dedicated to the research of safe and effective techniques of management and capture of bees. The management of bees is an important topic, as they accounted for over 80% of all animal calls the BCBCR responded to in 2015. More time and research dedicated to the research of bees will not only be useful for the firefighters who will be able to safely capture the bees, but it will also help the decreasing bee population.

More resources should be dedicated to the research of management and capture techniques of marine animals. Marine animals are a topic that had not been discussed in the process of determining the animals should be included in the guide. The guide was made with the focus on animals that are most common across the country. During our visit to the Quepos station, we learned that they often deal with marine animals such as dolphins, seals, and even small whales. These animals were not considered for the guide because the majority of the stations are not near coastal areas. However, if marine animals are included, the guide will encompass a wider range of animals that are common at many stations located on the ocean coasts.

The BCBCR should design and implement a system to systematically record animal calls and organize a periodic review to determine if additional animals should be added to the field guide and manual. While some animals are not common throughout the country, they might represent a majority of animal calls at certain stations. Currently, the BCBCR has a method for recording calls, but it is insufficient. It does not categorize the condition the animal is in when the firefighters respond, such as if it was attacked, injured or displaced. By improving the current system a thorough database will be available to help with future research and improve where the BCBCR should focus their training. To make use of the data, the BCBCR should organize a periodic review of the information to determine if any animals should be added to the guide.

The BCBCR should add photos of responders capturing and handling animals to create incentive for the firefighters to follow the guide. Although the guide included photos of animals, equipment and methods of capture, it does depict the firefighters. We wanted to include more photos of firefighters holding and capturing various animals. However, due to the limited number of animal calls we attended, we only got a few photographs of firefighters managing animals. Therefore, when a firefighter attends an animal call, an accompanying firefighter should take photos of the responder handling and capturing the animal if it is needed in the guide, while keeping in mind both of their safety.

The BCBCR should keep the interactive maps of animal organizations up-to-date with relevant information and new locations. The maps with the locations of animal organizations and fire stations are currently up-to-date; however, information can change and organizations that can help with further care may change, especially with the law that the MINAE is changing. The BCBCR should update the maps annually to make the post-care of rescued animals can be efficient. In order to keep these maps up-to-date, we provided the BCBCR with an explanation of how to update the Google map. This map also allows sorting by province, which we recommend stations use to find the closest available organizations that accept the animal in need.

Conclusion

The deliverables, the guide and manual, will provide an effective, safe, and secure process for the BCBCR to use for animal management. The guide will help firefighters identify animals, the best method and equipment for capture, and the nearest animal organization that accepts the animal. The manual provides supplementary information on wild animal management to improve the accessible resources the firefighters have. Providing this information to the firefighters who respond to animal calls will contribute to a higher degree of safety for both the firefighters and the animals. The BCBCR can use our guidance to improve their daily management of animals and carry out their mission statement of protecting the environment and the animals in it.

Authorship

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In addition, Seth acted as the overall main editor for our final project, which was then reviewed by each team member

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1.0 Introduction

Human and wild animal interactions are increasing with, usually, negative consequences to both people and the animals (Hosey and Melfi, 2014). Two reasons for the increase in encounters are that human populations are expanding in rural and urban areas and land modification such as deforestation, urbanization, and agricultural expansion are required in order to accommodate the increase in population (Bryant, 2001). An example of human expansion into wildlife habitat that creates more encounters is illustrated in India. Poor rural farmers have been forced to expand their fields into areas populated by elephants to meet the needs of the growing population. The expansion of farmland has contributed to a 54% decrease in the elephant population over the past 35 years and simultaneously to an increase in human-elephant encounters with negative consequences (Handwerk, 2005). Chile provides another example of increased human-animal interactions. In Chile, over 64% of rural wild dogs have recently been found in urban areas due to human population expansion (Villatoro, et al., 2016). Similarly, residents of Kenya and India have been experiencing an increase in conflicts with animals due to land use fragmentation, development of farmland, and land modification for fruit cultivation (Vijayan and Pati, 2002 and Distefano, n.d.).

Costa Rica is no exception to the trend of increasing negative interactions between humans and animals due to a loss of habitat and growing human populations. From 2005 to 2015 Costa Rica's human population increased by 560,000, and the increase in land use has caused the proportion of human-inhabited forestland to increase from 48% to 54% over the last ten years. The increase in population and land use has had a negative impact on many species in Costa Rica (WorldBank, 2016). From 1995 to 2007 Costa Rica lost over half of its monkey population due in large part to the growing human population taking over their habitats and forcing them into smaller communities (Sherwood, 2007). Many animals are now venturing out of their habitat because their homes are being intruded. The relocation of animals is one reason that the number of incidents of animals getting attacked by humans, electrocuted, and hit by cars is increasing (Monge Mora, 2016).

As a consequence, increased demands are being placed on those that have the responsibility of responding to negative human-animal interactions. Organizations have different procedures to ensure the safety of both the animal and the responders. For example, in Northwest Territories of Canada, due to increasing human interactions with caribou, the authorities established a standard operating procedure for the "capture, handling, and release of the caribou using acceptably humane methods while maintaining minimal risk to staff" (Cattet, 2011, p. 2). Similarly, New Zealand has implemented a set of communicational, consultational, and operational plan templates that are used for animals who are in the wrong environment (New Zealand Department of Conservation, n.d.).

The Benemérito de Cuerpo de Bomberos en Costa Rica, the BCBCR, is the main responder to animal calls in Costa Rica. Though their main priority is responding to fires, the mission statement of the BCBCR states that their purpose is to "provide Costa Rican society with protection when life...and the environment are threatened by...emergency situations" (BCBCR, n.d.). Part of achieving this mission requires them to manage calls about wild animals in human-inhabited zones. In the past six years, BCBCR has seen over a 600% increase in animal related calls (Coto, 2016). Yet, in a survey sent to all 74 fire stations in Costa Rica almost half of the respondents indicated that they have never had any formal training on animal management and almost 70% indicated that they do not know how to correctly respond to an animal call (Monge Mora, 2016). Though the firefighters have had some minimal training to capture animals, they

are lacking in guidance and an all-inclusive animal management system to use in the field as well as for further training. The new Animal Welfare Act, Law 18.298, which states that any human that causes tangible harm to an animal can be sentenced to up to two years in prison, makes it even more imperative that the firefighters have a method of procedures to avoid injuring themselves or the animals (Animal Welfare Act, 2016).

In order to help address the absence of formal animal management procedures and training for the Costa Rican firefighters, the goal for this project was to provide guidance in order to help improve the capacity¹ of firefighters when treating wild animals in emergency response calls. To achieve this goal we:

1. Developed an understanding of how the Costa Rican organizations can aid the BCBCR in their animal rescue process.
2. Investigated what firefighters believe are the best methods to use in an animal related response call.
3. Gathered content and received feedback on guidance from animal experts.

Through interviews, surveys, and research, we produced key findings and recommendations. We found animal organizations often give higher priority to certain animal groups and injured animals. In addition, creating a long-lasting relationship between the BCBCR and animal organizations is challenging. After investigating, we found that firefighters do not have the capacity to respond to animal calls safely and effectively. Furthermore, the perceptions among firefighters on the importance of wild animal management vary among stations but are generally positive.

This project resulted in a field guide that can be used by firefighters when responding to animal calls. In addition, we provided recommendations to give firefighters more training, equipment, and knowledge in the form of a manual so they will be better able to respond to animal calls safely and effectively. The BCBCR is planning to distribute the printed guide to all 74 stations throughout the country, ensuring uniform knowledge and eventual familiarity with capture and rescue techniques. With this guidance, the BCBCR will have the capacity to attend to wild animal emergencies in a more methodical fashion. Our guidance has the potential to prevent serious injury or death to the animals being captured and to the firefighters managing them.

¹ In the context of this paper, capacity refers to the amount of resources available to the firefighters for animal management. Examples of capacity include equipment, training, knowledge, and organizations to bring animals to.

2.0 Background

In this section we begin with the current problem faced by BCBCR regarding animal management. Next we describe three factors that are contributing to a need for an improved procedure on animal management. Then we discuss procedures of other animal organizations worldwide and compare them to how the BCBCR currently operates. We finish with a summary of the key information to take away from this chapter.

2.1 The BCBCR Lacks Sufficient Guidance on Animal Management

Currently, the BCBCR is the main agency responsible for responding when there is problem with a wild animal in Costa Rica. It has seen over a 600% increase in the number of animal-related calls during the last six years (Coto, 2016). However, the firefighters responding to these calls lack sufficient guidance on animal management, inhibiting their ability to properly respond, which puts the safety of both the firefighters and animals at risk (Monge Mora, 2016). Guidance, for the context of this paper, includes extensive training that allows firefighters to handle calls more efficiently and safely, advice on the appropriate equipment to use on calls, and a written protocol, in the form of a physical guide and manual, to follow when attending to wild animals. Factors that contribute to the firefighters' lack of knowledge include the low priority of animal calls in relation to fire emergencies and the infrequency of training programs.

An administrative assistant at the BCBCR Academy, Mariam Monge Mora, sent a survey to all 74 fire stations in Costa Rica to inquire on the management of wild animals. Of these stations, 36 responded with information that helped confirm the necessity of guidance for animal management. Over 52% of respondents stated that their station receives a wild animal call more than three times a week. With this level of frequency, it is important that the BCBCR has an effective response protocol. It is especially important because 69% of the respondents stated that they do not know how to properly manage a wild animal call. Furthermore, 100% of the respondents were in favor of a practical field guide that would lay out a step-by-step procedure to follow when rescuing an animal (Monge Mora, 2016).

2.2 Factors Indicating a Need for Further Guidance on Animal Management

In this section we discuss three additional factors that indicate a need for further guidance on the animal management process in Costa Rica. The rise in human-animal interactions, a new Costa Rican animal law, and a lack of organizational resources for further animal care provide added impetus for the BCBCR to have better guidance to follow when responding to wild animal calls.

2.2.1 Increase in Human-Animal Interactions

For the purpose of this paper, human-animal interactions refer to when wildlife's requirements overlap with those of human populations, creating impacts, usually negative, on humans and/or the wild animals. A 2010 study of species listed on the IUCN Red List of Threatened Species, the global authority on species' conservation statuses, "concluded that at least one-fifth of the world's mammals, birds, reptiles, amphibians and fish are threatened with extinction due to human activity" (Nature's Backbone at Risk, 2010). Simply put, as the human population continues growing and expanding its boundaries, it is having a detrimental effect on wildlife numbers. Human over-consumption and population growth are endangering wildlife by disrupting ecosystems and habitats (Animal Programs, 2017). As the environment continues to be disturbed, more reported incidents with wild animals are occurring. Examples of these animals coming into close contact with human populations include coyotes roaming in

downtown Washington D.C. and New York City (see Figure 1), monkeys in the streets of Cape Town, wild boars in Berlin, and boa constrictors in Miami (Dell'Amore, 2015). Recently, a goanna was found inside a busy winery in Australia, as shown in Figure 2 (Brown, 2017).

Figure 1. Coyote on a roof of a New York City bar (Dell'Amore, 2015).



Figure 2. A goanna being dragged out by a waiter at a busy winery in Australia (Brown, 2017).



2.2.2 New Costa Rican Animal Law

A new law in Costa Rica penalizes people who harm animals, providing further incentive for better animal management. Many firefighters attending to calls report that they are unsure of what to do with the animals upon response (La Touche, 2016). Firefighters would often take the easiest route: once they arrived on a call they would find the animal, kill it, and dispose of it in whatever manner was most convenient. Sometimes, if an animal was not killed, it would be relocated to the nearest location away from humans. While it was not helping the wildlife, it was the easiest process to use when no instructions for the process were given. However, the people of Costa Rica did not settle for inhumane treatment of animals. Animal rights groups and volunteers collected over 150,000 signatures to get a referendum on the national legislation ballot promoting animal welfare (L. Arias, 2016). In late July of 2016, the Animal Welfare Law of Costa Rica was passed as Law 18.298, which sanctions a six-month to two-year imprisonment of humans that cause harm to an animal's health (Anders, 2016). Awareness of this law is important for improving animal management practices. Yet, according to the aforementioned survey conducted by the BCBCR, 78% of the respondents stated that they were not familiar with the wildlife law (Monge Mora, 2016).

2.2.3 Limited Established Contacts with Animal Care Organizations

Currently, Costa Rica's 2003 Law for Wildlife Protection and Conservation states that if a wild animal is in a healthy condition then it must be relocated to its natural habitat near the capture location within 24 hours (MINAE, 2003). However, if the animal is a juvenile or has suffered injuries then it must be taken to a registered animal organization for further care. In Costa Rica, some of these organizations include Rescate Animal ZooAve, Instituto Clodomiro Picado, and Costa Rican Animal Rescue Center. Due to these centers' limitations, such as space, staff, and veterinary hours, sometimes firefighters must care for an animal at the fire station (even overnight) until it can be taken to a proper organization. However, the BCBCR has little to no guidance on how to care for a wild animal overnight. They need information regarding the animals' nutrition, sleeping habits, and special escape abilities (Monge Mora, 2016).

In order to successfully deliver rescued wild animals to authorized animal organizations that accept them, the BCBCR needs sufficient connections with them to have established drop-off points for all 74 stations throughout the country. While there are some centers that the firefighters habitually deliver animals to, the department sees over 3,000 animal calls annually. With the increase in number of calls, displacing so many animals requires the support of more available organizations (Jiménez, 2016). A lack of connections with sufficient animal organizations throughout the country creates great difficulty for stations to find proper relocation sites for animals in need (Monge Mora, 2016). The shortage of connections contributes to a lack of incentive for the firefighters to properly relocate an animal. Importantly, the BCBCR had previous relationships with some animal management organizations around Costa Rica. However, due to a lack of funds and difference in opinion on the priority of animal management, there is a disconnect between both parties (Matamoros, 2017 and Bonilla, 2017).

2.3 Procedures for Animal Rescue Organizations

In this section, we show how animal management guidance has been addressed in different parts of the world. We describe the steps that wildlife rescue organizations take in responding to an animal call. This includes the first step of preparing for the call, such as considering safety measures and necessary equipment, the second step of capturing the animal, and the final step of providing veterinary care and ultimate placement. We will illustrate these steps with different countries' Standard Operating Procedures (SOP) for animal capture (in the form of manuals and guides²). For example, in the United States, the University of Nebraska-Lincoln uses a written guide outlining procedures to take based on the wild animal type: birds, mammals, or reptiles (Schemnitz, et al., 2009).

2.3.1 Safety Measures and Equipment to Prepare for Animal Response Calls

In order to be prepared to go on an animal call, the responders must take certain steps and precautions to avoid injury to themselves, the animals, and the locals. The first step is for the responders to identify the proper safety measures and bring the rescue equipment needed to effectively and safely remove the animal. These safety measures and equipment are typically outlined in a written guide as a reference for responders going on a call.

Prior to departing for the call, the responders must ensure they have the education, training, and proper clothing for self-protection. If the animal in the call is identified prior to departure, then the responder with training for that animal should be contacted first. For

² Guides are typically used for field use and quick reference while manuals contain content that can be learned through more formal courses.

example, the Norwest Territories Wildlife Care Committee's (NTWCC) SOP for capture, handling, and release of caribou is that the responder must be trained on safety procedures and capture before responding, or must be monitored by an expert if the responder lacks prior experience (Cattet, 2011).³

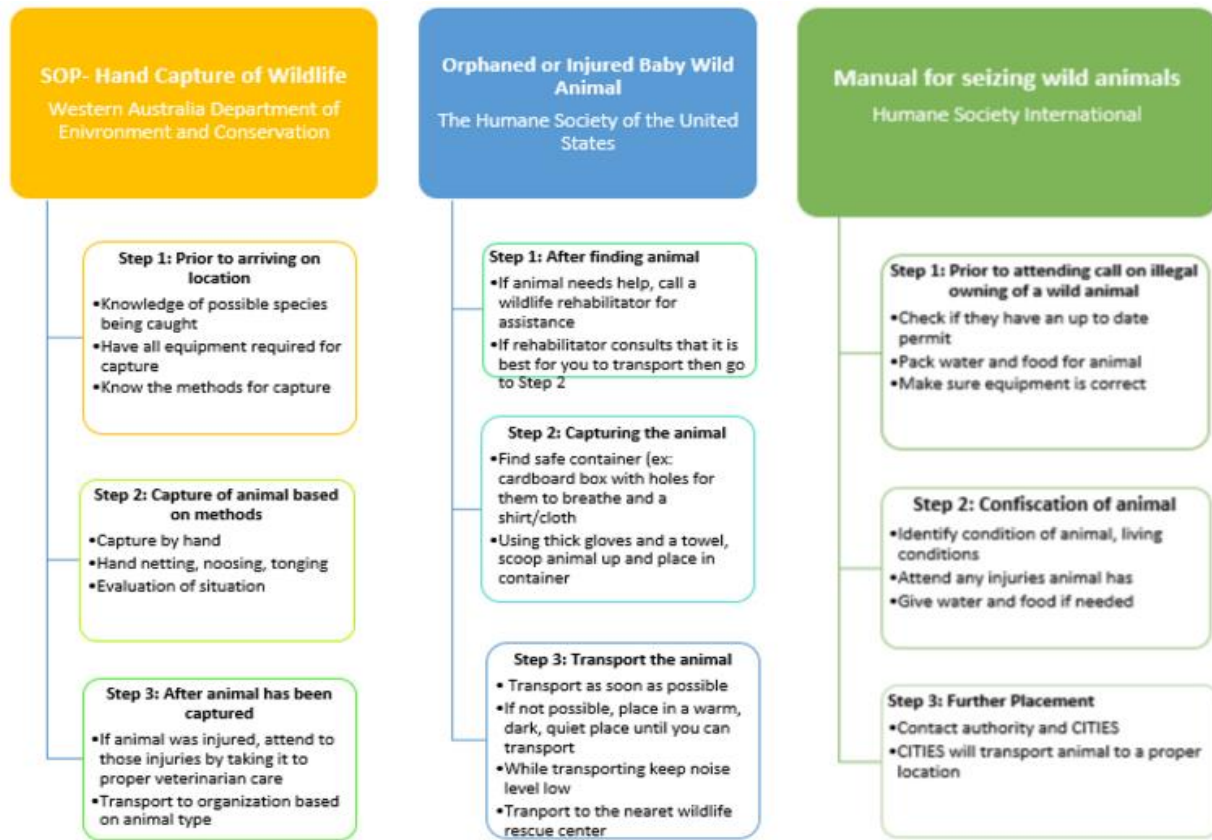
Once the responder has followed the necessary safety measures, he or she must pack equipment necessary to remove the animal from the situation. Necessary equipment includes personal protection for the responders and tools to capture and transport the animal. Proper clothing and protection are needed to prevent, for example, bites, stings, and scratches. In Western Australia, the Department of Environment and Conservation's SOP highlights the importance of proper equipment because of the risk of viruses, bacteria, parasites, and fungi spread between animals and people (Brown, 2016). The Humane Society Guide recommended equipment for animal capture, and the protective purpose of each article, is shown in Appendix A. Another example, originating from the United States, includes FEMA's (Federal Emergency Management Agency) list of equipment required for a small animal rescue strike team; it is provided in Appendix B. Currently, all the stations in the BCBCR use the equipment that its department head prescribed (Monge Mora, 2016). Once all the necessary equipment is packed, the responder then departs for the animal call to resolve the situation.

2.3.2 Physical Capture of Animals

In most situations, callers request an animal response team to remove or rescue an injured or abandoned animal and bring it to the nearest designated clinic or shelter, sometimes accompanied by volunteers (Poveda, 2016). When departing for an animal call, the responders must be prepared to capture the animal and carry out emergency care and veterinary needs that may follow. The majority of protocols for animal capture are structured in a similar manner for proper animal removal. Figure 3 illustrates the correlation between the system used in Australia, the United States, and the Humane Society's Latin American guide.

³ Similar to NTWCC, the BCBCR has provided classes for proper capture and handling of snakes, crocodiles, and bees. However, the training was minimal given its infrequency (a few classes per year) and furthermore those classes have not been offered since 2014 (Rodriguez, 2017).

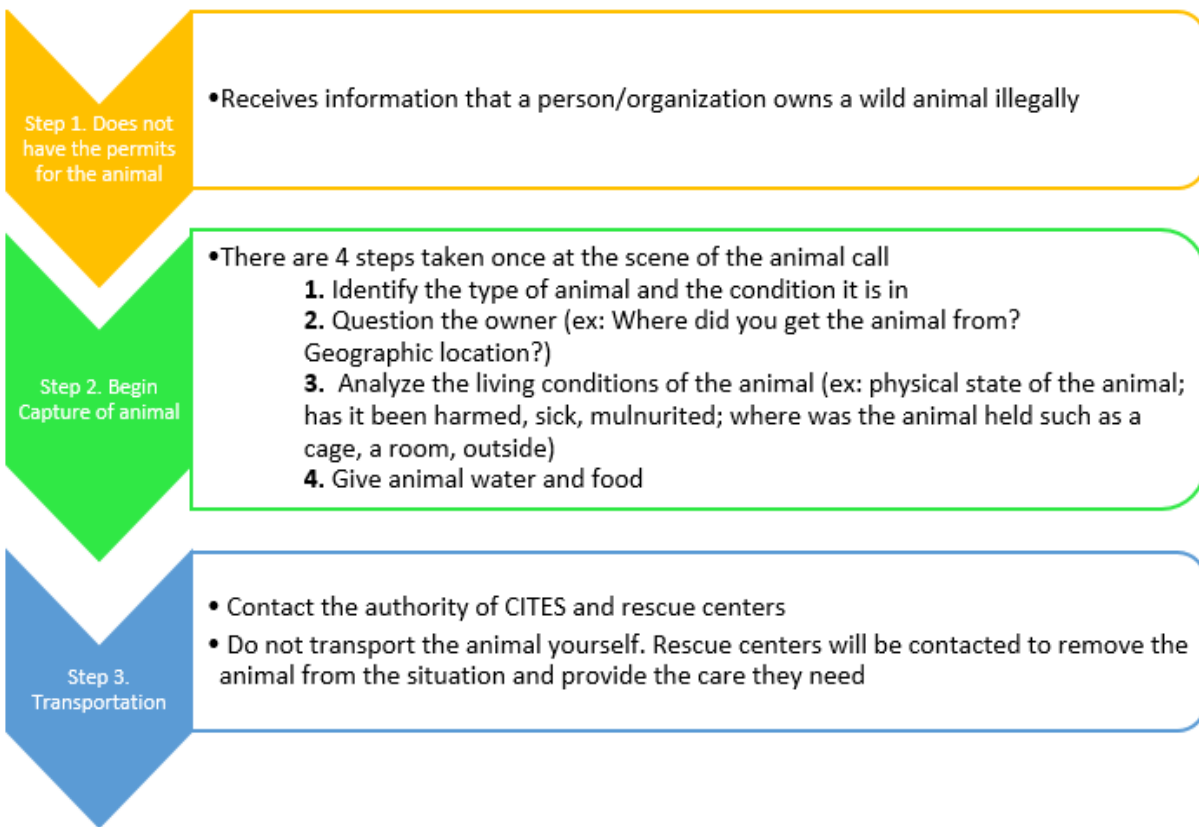
Figure 3. SOP's for Animal Removal from Australia, USA, and Humane Society International.



Although the overall procedures are similar, each organization differs in certain steps throughout the process. For example, every method involves assessing the situation first, capturing the animal next, and finally transporting it. However, each one uses specific procedures with different types of equipment to capture the animal.

Although different organizations utilize similar processes, the equipment they use can vary. In the UNL guide, they list the equipment according to animal type (Schemnitz, et al., 2009). For birds, they only use nets; for mammals, numerous sorts of traps with bait; and for reptiles, a combination of each based on the type (Schemnitz, et al., 2009). Comparatively, the Humane Society Guide recommends using both nets and bait to capture birds (Curriculo y Guia, 2010). It also has a general procedure for calls dealing with illegally owned animals, which is outlined in Figure 4. This outline clearly shows the step-by-step procedure, from the call regarding an illegally owned animal to contacting an animal organization for animal transportation. An illegal animal call is different from a typical one because responders are not allowed to transport the animal to an organization. Instead, they must contact an organization who will come to the responder's location to pick up the animal.

Figure 4. Steps Taken to Confiscate Illegally Owned Wild Animals (Curriculo y Guia, 2010).



2.3.3 Animal Care after Rescue or Capture

Responders need to know the procedure that should be carried out to rescue or capture an animal in its particular situation, especially if the animal is in immediate danger. They must examine the animal to determine if it is injured and take the necessary steps to get it emergency medical treatment if necessary. Some of the unfortunate situations include electrocution by electrical wires, traffic accidents, and other animal attacks. The responders must also identify fractures, spasms, illnesses, shock, dehydration, and general health state (Curriculo y Guia, 2010). However, most cases require the responder to quickly find the nearest organization that can provide further care for the animal. For example, the Human Society's Guide recommends that a rescue is immediately called after rescuing an animal. The rescue center will then notify the responders to either bring the animal to the rescue center or wait for a staff member to pick up the animal (Curriculo y Guia, 2010).

2.4 Summary

The increase in human-animal interactions, a new Costa Rican animal law, and limited established contacts with animal care organizations have increased the need for the BCBCR to have proper guidance on how to treat wild animals in emergency response calls. Other countries have developed detailed guidance, in the form of manuals and guides, which is intended to increase the safety of responders and animals. However, in Costa Rica, properly rescuing and treating wild animals is a difficult task for the different fire stations around the country. This task is rendered even more challenging in the absence of procedures on how to correctly handle an animal call.

3.0 Methodology

The goal of this project was to provide guidance in order to help improve the capacity of firefighters when treating wild animals in emergency response calls. The capacity of firefighters included knowledge on the wild animals of focus, the procedures for each animal, and the perception of the importance of proper wild animal management. In order to provide guidance, we:

1. Developed an understanding of how the Costa Rican organizations can aid the BCBCR in their animal rescue process.
2. Investigated what firefighters believe are the best methods to use in an animal related response call.
3. Gathered content and received feedback on guidance from animal experts.

These three objectives led us to several findings, which enabled us to develop two final deliverables. The first deliverable was a manual encompassing all relevant information found on wild animal management for the director of education in the Fire Academy to use as an outline for animal management classes. The second deliverable was a field guide to be distributed to each station in Costa Rica to be used in emergency animal calls. In this chapter we describe the methods that were used in order to accomplish these objectives.

3.1 Objective 1: Develop an understanding of how the Costa Rican organizations can aid the BCBCR in their animal rescue process.

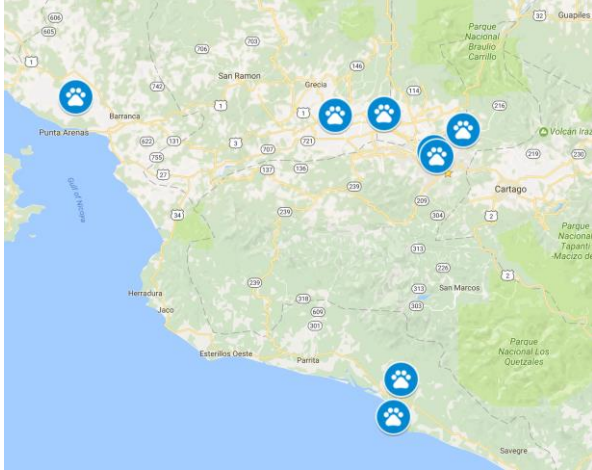
We researched Costa Rican animal organizations and created a list of all the ones we could find that stated they are willing to work with the BCBCR (see Appendix C). There are three ways we gathered this information.

First, we found all animal organizations that could aid the BCBCR and organized them into the seven provinces of Costa Rica. We did this through Google searches, directories such as El Directorio Páginas Verdes de Costa Rica and El Ministerio de Ambiente y Energía (the MINAE), and information provided to us by our sponsor.

Then, we contacted each of the organizations through telephone and email. In the email (see Appendix D) we sent each organization, we asked if they would be willing to aid the BCBCR. For those who responded positively, we wrote back to them with a series of questions regarding animals they deal with, staff and space capabilities, and how responders contact them. The full list of questions is provided in Appendix E. Certain organizations indicated they wanted to have a phone interview. Over-the-phone interviews enabled us to develop conversations and respond to answers that we could not have been done over email. The general outline of this interview is included in Appendix F. Emails and phone calls were simple ways to connect with organizations that were too far from our traveling capabilities. To address the fact that not everyone would respond to our email, we also used phone calls to reach out after a week of sending our initial email.

Finally, we selected a small set of organizations to visit. The following organizations were within our travel limitations or near us during our travels and had the potential to provide us with pertinent information: the MINAE, FundaZoo, ZooAve, Kids Saving the Rainforest, Macaw Sanctuary NATUWA, Finca Natural-Refuge, Instituto Clodomiro Picado, and Universidad Técnica Nacional. These organizations are mapped in Figure 5.

Figure 5. Locations of the animal management organizations (in blue) that we visited.



During each visit we interviewed veterinarians, nutritionists, biologists, and department heads. We observed first-hand how organizations such as sanctuaries, rescue centers, zoos, and universities differed. We were also able to see animals we focused on with our project, the equipment that should be used for the calls, and their staffing capabilities.

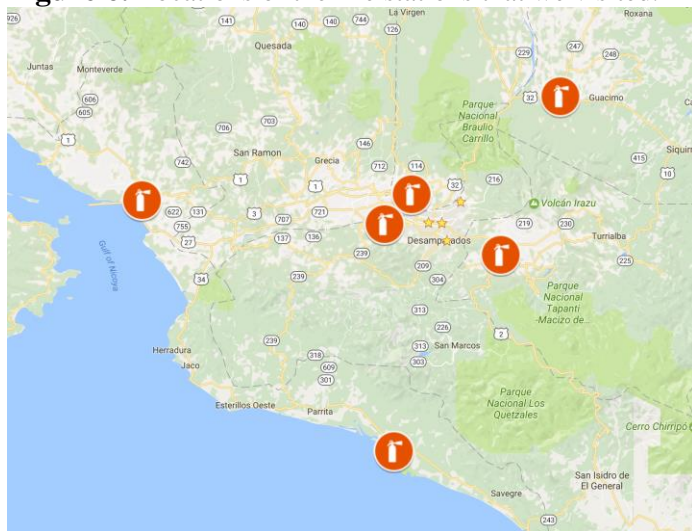
In addition to the in-person interviews, we also had a phone interview with the Sloth Sanctuary and email interviews with the Monkey Farm and Alturas Wildlife Sanctuary. Once we received confirmation, either by phone, by email, or in person, we compiled a list of organizations that would help the BCBCR. Then, we created a map that encompassed all of the organizations in Costa Rica, and separated it into each of the seven provinces.

Although the goal was to visit all organizations in person, this was not feasible due to time and travel restrictions. Additionally, not all organizations we reached out to responded to us. Without a response, we did not include those organizations in the guide section on Costa Rican organizations. The lack of response was a limitation because there are organizations in Costa Rica that can potentially help the BCBCR but are not included.

3.2 Objective 2: Investigate what firefighters believe are the best methods to use in an animal related response call.

We sent a survey (outlined in Appendix G) to all the fire stations to get opinions directly from firefighters on their perspective on animal management. Due to administrative reasons, the Academy staff did not send out the survey in time to receive the results. To understand the capacity of the BCBCR fire stations, we analyzed and traveled to six predetermined stations (of the 74 total). Our travel schedule is included in Appendix H. To determine which stations to travel to, first we identified the 20 fire stations that had the most animal related emergency calls between 2007 and 2016. Then we chose the stations representative of the main geographic regions, as this would provide information on how animals, equipment, knowledge and perceptions differ through the country. The six stations we chose to represent Costa Rican climates and terrains include: mountainous, valley, city, dryland, wetlands, and coastal. The selected stations are Cartago, Heredia, Santa Ana, Guápiles, El Roble, and Quepos. These are indicated in Figure 6. Our method was based on the geographical locations of the stations and was not representative of characteristics outside of climate and geography, such as available budget, education level, and surrounding rescue centers.

Figure 6. Locations of the fire stations that we visited.



At each station, we accompanied firefighters responding to calls to observe and record the step-by-step processes used, note the equipment that was available and used, and determine the awareness regarding the animals and their management process. We interviewed firefighters in person to learn their perspective on the importance of animal management. We started our conversations with the list of questions outlined in Appendix G. Throughout, we gaged the attitudes based on the firefighter's body language. For conversations that included crossed arms, lacked seriousness, and/or had poor discussion on the importance of proper animal care we noted the stations as having a small priority on animal management. Conversations that expressed enthusiasm demonstrated the importance firefighters place on animal management.

3.3 Objective 3: Gather content and receive feedback on guidance from animal experts.

To develop proper guidance for the Fire Academy and create guidance on wild animal management, we used several resources. In addition to extensive research from academic journals, animal books, and scholarly sources, we asked each group of firefighters about the procedures they have encountered that work and do not work. We also asked veterinarians, biologists, and animal experts to give their input so that the guidance could be as complete for the firefighters and the animals as possible.⁴ To gather and verify the necessary content we used three steps. First, we determined the animals to be included in the guide. Second, we gathered reliable information on the selected animals. Third, we had our example guide reviewed by experts to ensure the information and formatting was correct and easy to understand.

3.3.1 Determined the Animals to be Included in the Guide

In 2015 the BCBCR received 16,848 emergency animals calls (La Touche, 2016). Although over half of these calls were pertaining to bees, they were not included in the guide due to the complexity and time needed to fully address the topic. Of the remaining calls, the primary animal groups were reptiles and mammals with a minor presence of birds (La Touche, 2016). A

⁴ We also created a survey (see Appendix I) to send to various Central American stations to learn about any processes or equipment that worked well, or did not work, for them; however, due to administrative restrictions the Academy staff did not send this survey.

survey conducted by the Academy of the BCBCR in 2016 shows the animals that firefighters have encountered on animal calls. We used the information found in this survey, in conjunction with our sponsor, to determine the animals that should be included in the guide. In addition, at each fire station we interviewed the responders to find the most dangerous and common animals they encounter. From these two sources, we organized a list of seven types of mammals, three main groups of reptiles, and four sets of birds in regards to what the BCBCR deals with the most. This list includes raccoons, coatis, sloths, porcupines, opossums, felines, and monkeys; crocodiles and caimans, iguanas, and snakes; and owls, parrots, toucans, and birds of prey (such as falcons, eagles, and hawks).

3.3.2 Gathering Reliable Information

We interviewed organizations to determine any procedures they use for capturing their animals. We also asked them about equipment they use and any food they administer to the animals. We noted any information on endangerment status and animal laws for each animal. We did background research on the animals to fill in any gaps in information, and as a source of additional techniques and methods.

3.3.3 Verification Process

The creation of the guide followed a process of making an example guide, having it checked by experts, and finally adapting the guide based on experts' feedback. We also used the feedback they provided to adjust the information in the manual.

First, we developed an outline for the layout of the guide. We then researched, using reliable animal books and guides recommended by our sponsor, one animal from each category (mammals, reptiles, and birds) and organized the information into the guide. The information included for each animal included its family name, its scientific name, its ranking in the IUCN Red List, if it is dangerous, how to identify the animal, its behaviors, its habitat, the equipment and techniques for capture, the food it eats, and any organizations that can be contacted to help with further care for the animal. We sent these samples to the head of the education department, Allan Rodriguez, and the head of the animal management project in the Fire Academy, Mariam Monge Mora. They made edits on the layout, organization, and information included to inform us of what to change for the second draft and remaining animals.

Then, after incorporating the edits into the first round of guide pages, we created the second iteration of the guide, which included information on each of the 14 animals of focus. We sent the second round of information to be reviewed by experts to ensure its accuracy and effectiveness. We made connections with as many experts as possible in interviews with rescue centers, universities, sanctuaries, and zoos. We contacted biologists, animal experts, and veterinarians to gather any input possible. These experts included Fabian Bonilla, a biologist at the Instituto Clodomiro Picado, Adriana Gonzalez, a head biologist at Universidad Técnica Nacional, and Randall Arguedas, the head veterinarian at FundaZoo. We also sent the guide draft to Mr. Rodriguez and Ms. Monge Mora again to ensure it would be well-received and easily understood by firefighters.

Finally, once all three experts reviewed what we sent them, they replied with comments on how we could improve this guide or if there was missing or incorrect information. We incorporated their edits in the new draft. Once we fixed all the information and formatting, we resent the guide to the three experts for a final revision. With the feedback they gave us, we made final changes.

3.3.4 Challenges and Limitations

To create the guide we encountered four challenges. First, the biggest challenge had to do with experts giving differing opinions on information and techniques used. We had to recognize that there is not always a single right way to handle an animal in a certain situation. In addition to this, the experts did not always get back to us in a timely matter so it was difficult to continue the process of putting together the guide without their input. When we sent the guide to experts for revisions, we indicated a time when we needed to have their comments back to ensure we addressed them before our final guide was completed. However, the animal experts often responded past the time we indicated we needed the revisions. Therefore, we needed to make the revisions quickly and efficiently so the guide could be finished in time.

Second, our sample size of stations that we had direct contact with was limited. Although we chose six stations based on geography to best represent all 74 stations, there were other factors that we did not consider as heavily, such as available budget, education level of the firefighters, and number of surrounding rescue centers.

Third, during interviews, we relied on our own opinions to gauge body language and tone of firefighters. Although we noted certain actions as negative or dismissive, these may have been unintentional by the firefighters. Our opinions could have led to incorrect interpretations on attitudes and perceptions of firefighters on animal management.

4.0 Findings

In this chapter we discuss our four main findings from our interviews, observations, and visits that facilitated our final deliverables for the fire department. We conclude this section by showing how we used the information from our findings, our own research, and input from experts to construct the field guide.

4.1 Finding 1: Firefighters lack the capacity to respond effectively to animal calls

By interviewing firefighters from six stations, we developed an understanding of the current methods the firefighters use to capture animals, as well as the animals they most commonly respond to and the equipment they use. Table 1 outlines the types of equipment a station should have based on the animals they deal with most. We then compared the types of calls they receive to the equipment they have available. Table 2 outlines the equipment available at the stations, and will be referenced throughout this section. Given the variations in need for specific tools, we determined that each station lacked certain equipment depending on the animals they typically interact with. Without proper equipment for the animals they most commonly respond to, they lack the capacity to effectively respond to animal calls. Also, the lack of proper equipment can result in an unsafe environment for the animals and firefighters.⁵

Table 1. Types of equipment that can be used for different types of animals

Type of equipment	Type of Animal it can be used for
Catchpole	Mammals & Reptiles
Hook	Reptiles
Snake tongs	Reptiles
Mesh Sack	Snakes, Small mammals, birds
Net & Blanket	Birds, covering eyes of animals such as crocodiles and sloths
Small Cage	Small mammals, reptiles, birds
Large Cage	Mammals, reptiles, birds
Crate	Mammals, birds
Wooden Box	Mammals, reptiles, birds
Bee Crate & bee Suit	Bees
Rope	Reptiles, mammals

⁵ Despite our efforts to select stations from different geographical areas with a large amount of calls, our observations might not be representative of those with a smaller amount of calls.

Table 2. Equipment each station has for animal calls (equipment they should have is underlined)

Y Yes, the station has this equipment

N No, the station does not have this equipment

	Cartago	Santa Ana	Heredia	Guapiles	El Roble	Quepos	Total
Catchpole	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	6
Hook	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	6
Snake Tong	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	6
Gloves	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	6
Bee Suits	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	6
Mesh Sack	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>N</u>	<u>Y</u>	5
Small Cage	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>N</u>	<u>Y</u>	<u>Y</u>	5
Large Cage	<u>Y</u>	<u>N</u>	<u>Y</u>	<u>N</u>	<u>Y</u>	<u>Y</u>	4
Leather Bag	<u>Y</u>	<u>N</u>	<u>Y</u>	<u>Y</u>	<u>N</u>	<u>Y</u>	4
Crate	<u>Y</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>Y</u>	2
Netting	<u>N</u>	<u>Y</u>	<u>N</u>	<u>N</u>	<u>Y</u>	<u>N</u>	2
Rope	<u>N</u>	<u>Y</u>	<u>N</u>	<u>N</u>	<u>Y</u>	<u>N</u>	2
Wooden Box	<u>N</u>	<u>N</u>	<u>N</u>	<u>Y</u>	<u>N</u>	<u>N</u>	1
Blanket	<u>N</u>	<u>N</u>	<u>Y</u>	<u>N</u>	<u>N</u>	<u>N</u>	1
Bee Crate	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>Y</u>	1
Total	10	9	10	8	9	11	

During our interviews, we found that the only pieces of equipment the BCBCR could afford to supply each station with is a catchpole, a hook, and snake tongs. Table 2 shows that stations are short on equipment needed for the most common animals they encounter. We discovered that any equipment not provided by the BCBCR has been bought out-of-pocket by the responders. Some stations lack appropriate funding to purchase the proper equipment for particular animals.

The Cartago station was representative of a valley region. Responders from Cartago indicated that the most common wild animals they come into contact with are raccoons and snakes, followed closely by falcons (a bird of prey), owls, monkeys, iguanas, two and three-toed sloths, macaws, parakeets, and sometimes jaguarondi (a wild feline). Despite the large interaction this station has with birds, they do not have netting, blankets, or a wooden box; all useful tools for attending to bird calls (as shown in Table 1). Because they do not have the funds to buy this equipment, they stated that they typically use a jacket or a simple cover to throw over the bird. The lack of proper equipment is extremely unsafe for the birds, as it poses greater risk of mishandling and suffocating the bird while restraining it.

The Heredia station was representative of a city region. The responders from Heredia stated they mainly encounter raccoons, snakes, sloths, iguanas, porcupines, owls, and felines. For small mammals, experts typically suggest a small cage or a crate for transportation. While Heredia is not equipped with a crate for these mammals, they have a small cage that they can use. Heredia is well-equipped to deal with most of the common animals they respond to. Similarly, experts suggest netting and blankets for capturing of birds, such as those Heredia encounters. While they do not have netting for the capture, they do have a blanket to use.

The Santa Ana station is in a mountainous region. Firefighters at Santa Ana said they see a lot of boas, sloths, opossums, raccoons, iguanas, and a few birds. “We see six to eight boas a week,” said Andrés Lopes, one of the firefighters from the station. Despite this, they are not equipped with a wooden box or a leather bag for their capture and transportation, which is the most reliable equipment to use. One station indicated that flimsy bags have often resulted in the escape of snakes, thus having the proper equipment for these calls is ideal.

The Guapiles station was representative of a Caribbean coastal region. The firefighters reported the frequent occurrence of monkey calls. Surprisingly, they have no cages to transport them in. Lack of cages can cause an unsafe trip for the monkey, and, if it is aggressive, could result in injuries for the responders if it is not in a controlled space. Other than many calls with monkeys, the interviewees said that they also often encounter opossums, porcupines, iguanas, owls, and snakes.

The El Roble station was representative of a dryland region. El Roble commonly encounters snakes, raccoons, opossums, seabirds, and anteaters. In addition, the weather attracts significantly more crocodile calls than at other stations. Because they encounter many crocodiles and do not have the proper equipment to capture it, they created a larger, makeshift catchpole out of PVC pipe and rope. While this improvisation can be useful on their crocodile calls, El Roble's head firefighter, José Angel Castillo, stated, "having homemade equipment can also be dangerous and unreliable" (Castillo, 2017).

The Quepos station was representative of a wetland region. Quepos encounters an extremely large number of sloths, which is perhaps because of its close neighbor, the Manuel Antonio National Park. In addition, their highest frequency calls are for crocodiles, raccoons, snakes, owls, and porcupines.

4.2 Finding 2: Perceptions on the importance of wild animal management across stations vary, but they are generally positive

In our interviews with the firefighters at each station, we asked a few questions to the responders on their perception of animal management to ensure the guidance we provide to the BCBCR will be well-taken. When asked if they would be willing to take courses offered by the academy on wild animal management, half of the firefighters mentioned that they had taken a course about snakes or bees in the past, but nothing beyond that. They further indicated that they are all interested in more comprehensive courses created from an all-encompassing manual.

Firefighters at five of the six stations had overwhelmingly positive responses for extensive training and a field guide. Almost every responder was nodding their head enthusiastically or smiling while offering favorable support for this guidance. The head of the Quepos department said, "The guide would help not only with the safety of the firefighters and the animal, but it would also help the firefighters comply with the law." In El Roble, they explained how a poorly handled crocodile call showed a need for guidance. Once, a crocodile was captured and secured to the top of a fire truck. As a result of not having a protocol, the firefighters were not ready with a location safe to take the crocodile to. Meanwhile, they received multiple fire calls that they needed to respond to. After the consecutive calls, they finally found a place to deliver the crocodile. Unfortunately, they found it dead on top of the truck, due to dehydration, heat, and restraint. Because of this case, the firefighters who responded to the crocodile call expressed great gratitude for the fact that we will outline all organizations that can be used for further placement of animals.

However, one station in a city expressed less interest in our guidance. In our interview with its members, they stated that when an animal is captured, they do whatever they can to quickly relocate it to a sufficient area nearby. They do not allow any animals to be kept at the station overnight, which is unlike most stations. Because of the fast capture and release system they employ, a field guide was not considered as much of a priority as at other stations.

Although five of the six stations we visited responded positively to our guidance on wild animal management, we took note that this project or subject may not be a priority for every

station. The law of priority could affect the amount of effort put into understanding wild animal management, and may result in less attendance in classes and participation than the academy would like. Still, attending to animal management is important due not only to the BCBCR mission statement, but also because of the laws that the MINAE is creating.

4.3 Finding 3: Creating a long-lasting and legal relationship between the BCBCR and animal organizations is challenging

The Ministry of Environment and Energy is the governing power in Costa Rica that protects animals. They regulate the organizations that are authorized to take in animals for further care. Every organization must comply with the regulations the MINAE creates to be included on the registered list of legal organizations. Vice Minister Madrigal explained a situation in which a station was taking reptiles to an organization that ended up being part of an illegal trade group. For this reason, we investigated the legality of each organization we encountered, as only legal ones can be recommended for use to the BCBCR. We contacted over 50 organizations throughout all seven Costa Rican provinces; this included zoos, rescue centers, sanctuaries, and universities. After further investigation, we found that only 60% are officially recognized by the government.

Finding organizations that were willing to partner with the BCBCR was complicated due to politics and history. For example, we learned of a misunderstanding between the BCBCR and the Instituto Clodomiro Picado. The institute put a lot of time, money, and staffing into providing multiple workshops, equipment, and informational material for the public on animal management. However, the BCBCR gave no recognition for these efforts and has since ceased communication with the institute. We found similar situations with FundaZoo Simon Bolivar and University of Costa Rica. Although there have been misunderstandings between the BCBCR and several animal organizations, they agreed to be included as an organization that will accept animals from the BCBCR.

Currently, the MINAE is working to modify Wildlife Conservation Law 7317, which is changing the way animal organizations are categorized (Important Laws of Costa Rica, 2016). The Vice Minister of the MINAE indicated the proposed law would lead to stricter classifications of different animal organizations (MINAE, 2017). Rodolfo Orozco reiterated this information during our interview with the Macaw Sanctuary NATUWA in which he explained that this law would force rescue centers, zoos, and sanctuaries to develop new protocols and infrastructures in order to be considered legal. They would also need to have a biologist or veterinarian working at all times (Orozco, 2017). Due to the new Wildlife Conservation Law, organizations with low income or lack of resources may be shut down. Organizational shutdown might pose a problem for establishing connections with the BCBCR, since this could decrease the amount of organizations that they can bring animals to for further care.

With the new Wildlife Conservation Law by the MINAE, organizations are going need to have certain titles (sanctuary, zoo, and/or rescue center) in order to continue to have funds from different sources. The law separates sanctuaries, zoos, and/or rescue centers by regulating the infrastructure they must have. However, a zoo is ideal for receiving the most funds, as Orozco from NATUWA indicated, “a rescue center does not the capital to build the structures needed” (Orozco, 2017). Therefore, based on the type of organization, their funds may vary. For example, zoos can generate income from donations, investment, tours of facilities, and public visits. Chip Braman, a co-owner of Kids Saving the Rainforest (KSTR), stated that at times it is hard to reach income quota for the year as “about 90% of our income annually comes from our volunteer and

tour programs” (Braman, 2017). Fortunately, KSTR has the facilities and staff to be classified as a rescue center, zoo, and sanctuary. Because of this, they are allowed to receive their funds from a variety of sources. However, with stricter laws coming, other organizations may not be so fortunate to have multiple classifications and therefore may struggle to make ends meet.

4.4 Finding 4: Most organizations do not accept all types of animals; they typically specialize in caring for certain animal groups

We contacted multiple organizations to get a better grasp on how each organization could aid the BCBCR in the animal rescue process. Table 3 shows the types of animals they accept (mammals, reptiles and/or birds) and those that they prefer (their primary purpose). As a result of overpopulation of certain animals at organizational facilities, some organizations reported that they cannot accept some animals.

Table 3. List of types of animals the organizations we interviewed accept. **X** indicates animals they prefer, **O** marks the ones they accept, and blank ones are not accepted.

Type of organization	Name	Mammals	Reptiles	Birds
Rescue Center	The Monkey Farm	X	O	X
	Kids Saving the Rainforest	X		X
	MINAE	X	X	X
Zoo	FundaZoo – Simon Bolivar	X	O	O
Sanctuary	Sloth Sanctuary	X (sloths only)		
	Alturas Wildlife Sanctuary	O	O	O
	Macaw Sanctuary	O		X
	Finca Natural-Refuge		O	
University	UTN (Universidad Técnica Nacional)		O	
	Instituto Clodomiro Picado		X	

As shown in Table 3, most organizations do not accept all animal types, which can create a problem for the firefighters who have a rescued animal and bring it to an organization that does not accept it.

An issue we learned about while interviewing both firefighters and animal organizations was that sometimes a firefighter has an injured animal that needs medical attention but there are not organizations within a realistic distance that accept that type of animal. Waiting days or even hours could put the life of the animal at risk. Although most organizations prioritize certain

animal groups, we found, through our interviews, that almost all organizations put a high priority on injured animals even if they are not in the typical animal group they accept. The Macaw Sanctuary, for example, did not accept large mammals until one day when a jaguar needed a place to recover from a car crash. In addition, the director of FundaZoo Simon Bolivar, Yolanda Matamoros, stated, "Although there are certain animals that we do not accept due to overpopulation, such as raccoons, if they are injured then we have to accept them. Our main goal is to provide the proper medical care for animals in need" (Matamoros, 2017). A high priority on injured animals over misplaced ones was very common among the organizations we visited.

4.5 Wild Animal Management Guide

Using the five findings we drew from our interviews and surveys, in addition to our own research and the input of animal experts, we constructed a guide that encompassed all the relevant information we found. This section presents the design and content of this guide for the BCBCR about wild animal management. We explain how the content of the guide is informed by the findings, the literature review, and the survey sent by the BCBCR. The final guide is also based on feedback from two preliminary drafts from four animal experts, biologists, and veterinarians.

4.5.1 Content/Format of Final Guide

We used the findings mentioned in this chapter to gather information and insight on the content that should be included in the guide. The general outline is shown below in Table 5. Although the content was important, the format and the way in which we presented the information were equally important.

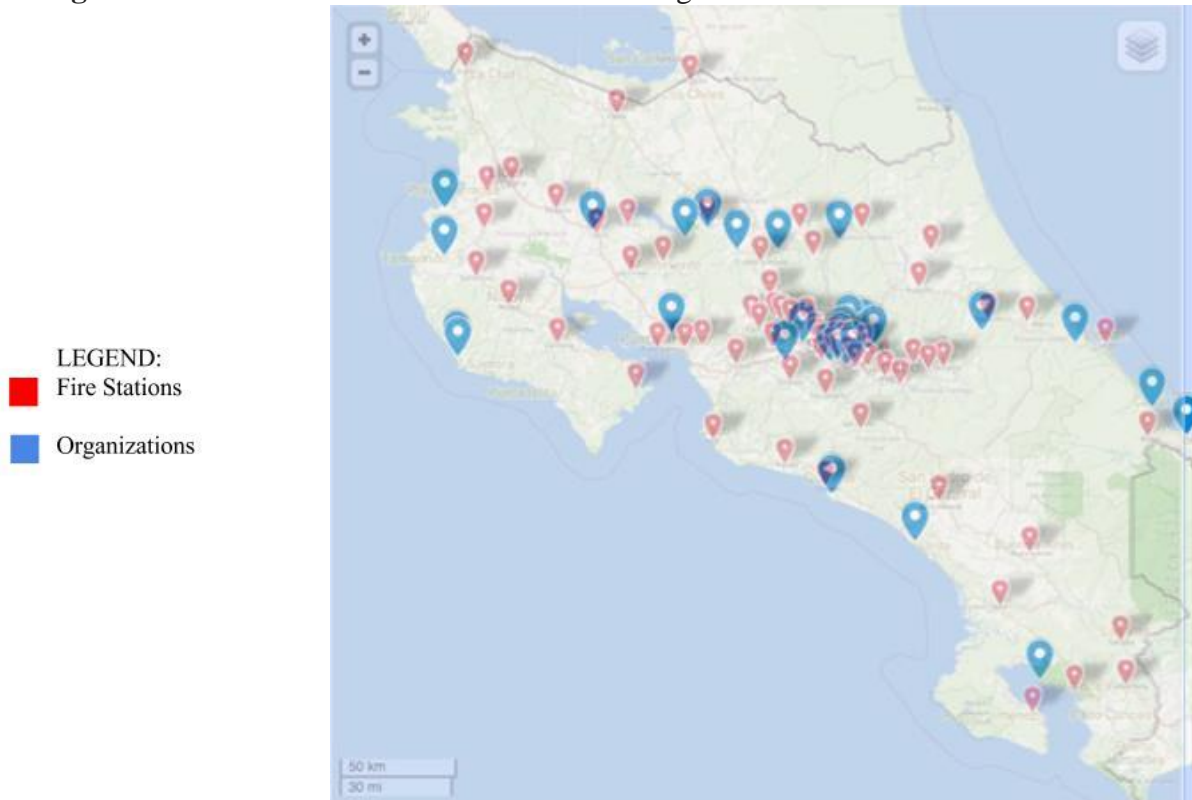
Table 4. Section names, content, and justification of information in the guide

Name of Section in Guide	Content	Support for Inclusion
Emotional Statement	This is in the very beginning of the guide. It states that it is their duty to protect wildlife and that animals should be treated with almost as much value as human life.	Finding 2: Although most firefighters respond positively to animal calls, a positive attitude is not consistent throughout all stations. We would like to motivate a positive attitude throughout the BCBCR.
Animal Name	Each animal is sorted by either blue (for mammals), green (for reptiles), or orange (for birds). The animal name is included at the top of each page for easy finding and identification of the animal.	BCBCR Survey: The animals included are the most common animals indicated by fire stations.
Scientific Name	The scientific name offers more in-depth information on the animal. It is often important for identification when bringing the animal to an organization, especially for veterinarians. For example, there are many types of monkeys, so knowing the scientific name for it can help further identify it.	Finding 4: Some organizations only accept certain animals, so identifying the animal correctly is important for determining if it accepts it.
Endangerment Status	The IUCN Red List indicates if an animal is in danger of becoming extinct, is of least concern, etc. The status on the IUCN Red List of each animal is important because it gives them an extra incentive for them to be extremely careful with the animal. It also acts as a liability to ensure that they take good care of each animal.	Finding 1: Firefighters have not been trained on many wild animals, so they do not know the endangerment status.
Protecting Law	The Law of Animal Conservation is included to show the firefighters the laws that are protecting each animal.	Data: About 78% of respondents surveyed were not aware of the laws protecting animal life.
Physical Characteristics	Each animal’s identification is outlined through pictures and written descriptions. If there is a difference between a baby’s identification from an adult, it is explained here.	Finding 3: We want the firefighters to be as helpful as possible with organizations so they can maintain a good relationship. Finding 4: Some organizations only accept certain animals, so identifying the animal correctly is important for determining if it will be accepted.

Name of Section in Guide	Content	Support for Inclusion
Behaviors	The animal's sleeping habits, socialness, and predators are included here. Special abilities are also included here to indicate if an animal could escape easily.	Data: Firefighters indicated they would like to understand the behaviors of animals to better understand their condition.
Habitat	If a firefighter responds to an animal and it is not injured and does not need further care, they should place it back in its natural habitat.	Data: Often times firefighters do not have to bring the animal to an animal organization. An example of when this would not be done is if an animal was misplaced (perhaps in a home) with no injuries. The firefighters do not know what the habitats are for each animal and in the past would place it wherever possible.
Equipment for Capture and Transportation	All equipment that will be needed for capture are outlined here so the firefighters can take everything out that they will need before beginning the capture.	Finding 1: The equipment that was found to be most common through the stations were used as much as possible (as long as considered safe and useful) in the guide, to ensure as many stations could use this guide as possible.
Techniques for Capture	Safe techniques are included here for the animal and the firefighters.	Finding 1: 69% of firefighters reported not knowing how to manage wild animals. Techniques for capture are a large part of this.
Diet	If an animal is to be kept overnight, the firefighters need a basic understanding of what the animal should eat.	Finding 3: In the nature of maintaining good relationships with organizations, the firefighters must respect that they may not be open 24/7. In this case, the animal would stay overnight at a station.
Animal Organizations of Acceptance	Following each animal, there is a list of organizations that accept the animal. This includes location, contact process, and their contact information.	Finding 4: Different organizations specialize in certain animals. Finding 3: The status of some organizations are changing, so keeping this up to date will ensure that there is never confusion with which organizations can help the BCBCR.

In order to have a visual aid to show the firefighters where all of the legal animal organizations throughout the country are, we created an interactive map that indicates the location of all the rescue organizations. This map allows the user to click on the icon representing an animal organization near them and view facts on that organization including types of animals accepted and contact information. The information can also be updated by the firefighters. A screenshot of this map is shown in Figure 7.

Figure 7. Locations of fire stations and animal organizations in Costa Rica



One limitation of this map is that we were only able to include information about the 35 organizations that we could find online. We included contact information that organizations gave us directly. However, 16 of the organizations we originally contacted did not respond to us. For these organizations, information on the interactive map is only that which we could gather from viewing their websites or talking to firefighters who use those organizations.

The field guide is a professional document with information by multiple experts including biologists, veterinarians, and university professors. In order to see how the guide is laid out in its entirety, see Appendix J.

5.0 Recommendations

In this chapter we discuss our recommendations to the BCBCR regarding two main topics: improving training and equipment, and adding information to the guide. Both sets of recommendations are intended to further the understanding and knowledge of firefighters on animal management.

5.1 Improving Training and Equipment for Firefighters

Recommendation #1: *We recommend that the BCBCR formalize a training program, both using the information provided in the manual, and programs that are coordinated with the organizations which indicated a willingness to work with the firefighters.*

One of the areas that we addressed was the minimal training firefighters have received on animal management, which we stated in Finding 1. The manual provided in Appendix K outlines necessary information that can be used to create courses on wild animal management.

In addition, many organizations have offered their time and resources to give classes or training to firefighters. From the organizations we were in contact with, those that indicated a willingness to work with the firefighters include: Monkey Farm, Osa Wildlife Sanctuary, Kids Saving the Rainforest, ZooAve, and Instituto Clodomiro Picado. Working with these organizations is a useful opportunity to gain more knowledge and training on animal management that should be taken full advantage of.

Recommendation #2: *We recommend that each fire station create a list of equipment needed based on the animals they encounter daily. Then, the National Fire Academy should purchase the correct equipment for each station to manage their most common animals.*

Another area that we addressed was the lack of proper rescue equipment at fire stations. In Finding 1 we determined that, although some fire stations have many individual pieces of capture and transportation equipment, some stations do not have the proper equipment based on the most common animals they respond to. The BCBCR should place a higher priority on having the most effective equipment for handling the priority animals at each station. The equipment that each station should have is outlined in section 4.1, Finding 1, in Table 2.

In order to have the most proper equipment possible at each fire station, each one should determine their most common animals and decide if they have the correct equipment for capture and transport of those animals. We realize that, other than a catchpole, a hook, and snake tongs, all rescue equipment is purchased out-of-pocket from each station's individual funds; therefore there may not be enough money to buy certain pieces of equipment. However, proper equipment is imperative to ensure the safety of the animals and responder.

5.2 Extensions to the Guide

The guide that we developed for the BCBCR provides a basic understanding on how to identify, capture, and give further care for the most commonly attended animals from across the country. The guide does not encompass all types of animal calls that firefighters attend to. Specifically, two subjects that we did not include in the guide were bees and marine animals.

Recommendation #3: *We recommend that more resources be dedicated to the research of management and capture techniques of bees.*

While bees accounted for over 80% of all animal calls the BCBCR responded to in 2015, we did not include them in the guide because we could not thoroughly complete this topic during our limited time in Costa Rica. However, bee management is an important topic. More time and

research dedicated to the research of bees will not only be useful for the firefighters who will be able to safely capture the bees, but it will also help the bee population, as currently the most common method for managing a bee call is to simply kill all them all (La Touche, 2016).

Recommendation #4: *We recommend that more resources be dedicated to the research of management and capture techniques of marine animals.*

Marine animals are a topic that we did not discuss in the process of determining the animals that should be included in the guide. We made this guide focusing on animals that are most common across the country. In our visit to the Quepos station we had time to briefly visit a marine-based fire station. At this station we learned that they often deal with marine animals such as dolphins, seals, and even small whales. We did not consider these animals for the guide because the majority of the stations are not near coastal areas and therefore do not regularly encounter marine animals. However, if marine animals are included, the guide will encompass a wider range of animals that are common at certain stations across the country. Even though marine animals are responsible for a miniscule part of the total calls the BCBCR responds to, at stations located on the ocean they account for a large percentage of the animal calls.

Recommendation #5: *We recommend that the BCBCR design and implement a system to systematically record animal calls and organize a periodic review of the information to determine if any animals should be added to the guide.*

As exemplified by bees and marine animals, there are potentially other groups of animals that should be included in the guide. While some are not common throughout the country, they might represent a majority of animal calls at certain stations. Currently, the BCBCR has a method for recording calls, but it is insufficient as the codes used to summarize each call give little description as to the specific animal attended to or the nature of the capture. With the guide, animal identification will be easier. By implementing a better system they can establish a thorough database of all of the types of animals that all fire stations deal with. To make use of the data, the BCBCR should organize a periodic review of the information to determine if any animals should be added to the guide.

Recommendation #6: *We recommend that a firefighter take photos of responders capturing and handling animals.*

There were certain parts of the guide that we were unable to complete due to lack of time and resources. One area that needs further attention is the use of animal photographs for identification and capture description. In order to make the guide as relatable as possible for the firefighters, we intended to take pictures of the firefighters holding and capturing various animals and then including those pictures into the guide. However, due to a lack of resources and limited number of animal calls we could attend, the guide only has a few photographs of firefighters managing animals. For the rest, we inserted relevant, place-holding pictures from the Internet to demonstrate what they should be replaced with. In order to make the guide more relatable, when a firefighter attends to an animal call regarding an animal that needs a better photo, an accompanying firefighter should take photos of the responder handling and capturing the animal. These pictures should then be emailed to Ms. Monge Mora at the Academy so she can edit the guide accordingly.

Recommendation #7: *We recommend that the BCBCR keeps the interactive maps up-to-date with all relevant information and new locations.*

An important part of our guidance was the maps with the locations of animal organizations and fire stations. These maps are currently up-to-date; however, we realize that information can change and more organizations may become available for further care. The BCBCR should maintain the maps as often as possible so that the post-care of rescued animals can be done in an efficient manner. In order to keep these maps up-to-date, we provided the BCBCR with an explanation of how to update the shared Google map. An outline demonstrating this process is shown in Appendix L. These maps also allow the user to sort by province, which we recommend stations use to find the closest available organizations that accept the animal in need.

6.0 Conclusions

Through our interviews with firefighters, the necessity of our project became more apparent as the majority of firefighters indicated they lacked the capacity to correctly respond to animal calls. This information is consistent with the survey that the Academy sent to all the fire stations in which 100% of responders indicated that animal management is an important part of the BCBCR and that guidance on successful animal management is needed (Monge Mora, 2016). Through interviews and surveys, we drew several conclusions regarding firefighter knowledge and attitude towards animal management, laws dictating animal organizations, and animal organizations' ability to aid the BCBCR. Our findings were:

Finding 1: Firefighters lack the capacity to respond effectively to animal calls, which can result in an unsafe environment for the animals and the firefighters.

Finding 2: Perceptions on the importance of wild animal management throughout stations may vary, but they are generally positive.

Finding 3: Creating a long-lasting and legal relationship between the BCBCR and animal organizations is challenging.

Finding 4: Most organizations do not accept all types of animals; they typically specialize in caring for certain animal groups.

These four findings provided insight on the information that should be included in our final guide. In order to address the current lack of guidance in the BCBCR, we constructed the guide using information from our findings, along with our own research. The sections of the guide are meant to help firefighters identify the animal at hand, the proper equipment to use, the best method for capture, and the nearest animal organization that accepts the captured animal. We implemented these sections to address areas that we found firefighters were lacking in their procedures of animal management. The guide is a comprehensive document, verified by animal experts, which can be used to handle wild animal calls. Including this guide in the everyday lives of firefighters who attend to animal calls will provide a higher degree of safety for both the firefighters and the animals. In addition, the BCBCR can use this guidance to ensure they comply with national animal regulations and their mission statement to “provide Costa Rican society with protection when life...and the environment are threatened by...emergency situations” (BCBCR, n.d.).

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