Creating Learning Resources for the Hong Kong Youth about the Illegal Pet Trade

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Sponsored by

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ABSTRACT

The illegal pet trade puts animals, humans, and the environment at risk. Our project goal was to create learning resources to increase public awareness about the trade and the risks associated with owning an illegally traded pet in Hong Kong. We reviewed literature, interviewed experts, and observed pet store sales in order to create learning resources to increase public awareness in Hong Kong for World Wildlife Fund Hong Kong (WWF-HK). We observed that children were present during a significant amount of pet store sales so they became the focus of our learning resources. The team created an informative handbook to educate children about the trade. We recommend that WWF-HK creates and distributes learning materials about the illegal pet trade to children in Hong Kong.

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The Illegal Animal Trade

Every day, animals are bought, sold, and shipped across the world by legal and illegal means. The legal trade of animals occurs when the sale of animals is permitted by both national and international law. Conversely, illegal trading occurs when the trade of animals is prohibited by national or international law.[1] The illegal animal trade is a prominent issue because of its vast economic impact globally. In a report published by the United Nations, it is estimated "that the illegal wildlife trade is worth as much as 23 billion USD every year."[2] Because the trade provides sellers with high profits and buyers with their desired animals, it is difficult to dissuade poachers and other people involved in the sale of illegally traded animals to give it up.

Root Causes of the Illegal Animal Trade

The illegal animal trade is driven by a worldwide demand for animal parts and live animals. Animal parts are used in a variety of commonly used products, however, while the versatility of animal parts contributes heavily to the success of the illegal animal trade, this project did not focus on this aspect of the trade. People purchase live animals through the illegal animal trade to keep them as exotic pets or slaughter them for food. This project focused on illegally traded animals that are to be sold as exotic pets. The illegal trade of animals with the intent to be sold as pets can be referred to as the **illegal pet trade.** As seen in *Figure 1*, these animals are often harmed or killed in the process of being trafficked.

Figure 1. Tortoises were packaged with duct tape, found abandoned in an airport.

However, in many cases, the consequences of the illegal pet trade extend beyond the animals involved. The trade also affects biodiversity and public health.

Hong Kong's Role

The illegal pet trade is a global industry that has various hubs, including Hong Kong. Hong Kong, Laos, Cambodia, Thailand, and Indonesia are so prominent in animal trafficking that they "account for under 3% of the world's landmass and 8% of the global population, but the region is estimated to account for 25% of the global illegal wildlife trade."[3] Hong Kong plays a central role in animal trafficking due to its geographic location, cultural practices, lack of clear regulations on the animal trade, accessibility of the internet, and free trade economy as seen in *Figure 2*.

Hong Kong's geographic location contributes significantly to its success as a hub for the illegal pet trade due to its proximity to China and its function as an international port city.[4] Over the last decade, the number of endangered species

imported into Hong Kong has increased by 57% while the estimated value of the trade has increased by 1,600%.[5] Hong Kong also has few effective regulations that detail clear punishments for those contributing to the illegal pet trade which allows the trade to flourish.[6] However, the crux of the problem is that policing of the animal smuggling industry is under-resourced, allowing animal trafficking to flourish in Hong Kong.[6]

Hong Kong's cultural practices contribute to Hong Kong being a hub for the illegal pet trade as various practices call for the use of a range of animals.[7] Some animals are trafficked for their medicinal uses, some to make ornate meals, and others to be kept as pets due to their endangered status. The type of animal also varies widely between each case, "animals most commonly targeted include birds, reptiles, insects, fish and large game animals. Rare or endangered species are particularly targeted by collectors, or for the pet trade."[7] There are an immense range of species of animals being trafficked from the United States to Hong Kong. The variety makes it difficult to prevent traffickers from bringing the animals into Hong Kong.

Another factor to Hong Kong's success as a hub for the illegal pet trade is the rise of the internet. The internet has helped facilitate the accessibility of the illegal pet trade. According to a 2021 study conducted in Hong Kong, the illegal pet trade "occurs at a significant scale in plain view on internet platforms, highlighting ineffective enforcement"[8] of the regulations on the trade. These internet platforms increase the ease of communication between pet traffickers and consumers. Some of the common methods of communication between traffickers and consumers are specialized facebook groups and encrypted direct-messaging apps.[8] The 2021 study focused on a Facebook group in Hong Kong that

Figure 2. The main factors contributing to animal trafficking in Hong Kong.

Geographic Location — Cultural Practices — Lack of Regulations — Accessibility of the Internet — Free Trade Economy

ANIMAL TRAFFICKING

Effects of the Illegal Pet Trade on Biodiversity and Public Health

Biodiversity is affected by the illegal pet trade as it can deplete animal populations which may lead to the extinction of species. Over the last 30 years, both legal and illegal "wildlife trade caused a 61.6% decline in species abundance."[9] Biodiversity is also affected by the illegal pet trade due to the release of live animals that were purchased through the trade. Traffickers sell animals to owners that may not have the proper ability to care for them. When pet owners are not able to care for the animals they often release them into Hong Kong ecosystems. For example, conservationists have found freshwater carp released into the ocean, baby birds dropped in the middle of parking lots, and ponds full of invasive species such as red-eared sliders (*Figure 3*) and American bullfrogs.[10] Released illegally traded animals can be ill-fitted to survive in foreign ecosystems, however, these animals may also thrive in their new environments and become **invasive species**. Invasive species thrive in environments they are not native to because these environments may not contain natural predators or other factors that would limit the species' expansion. As the invasive species population expands, the invasive species has the ability to over hunt prey and may carry foreign diseases that affect other animals and therefore harm biodiversity in the ecosystem. Illegally traded pets run the risk of
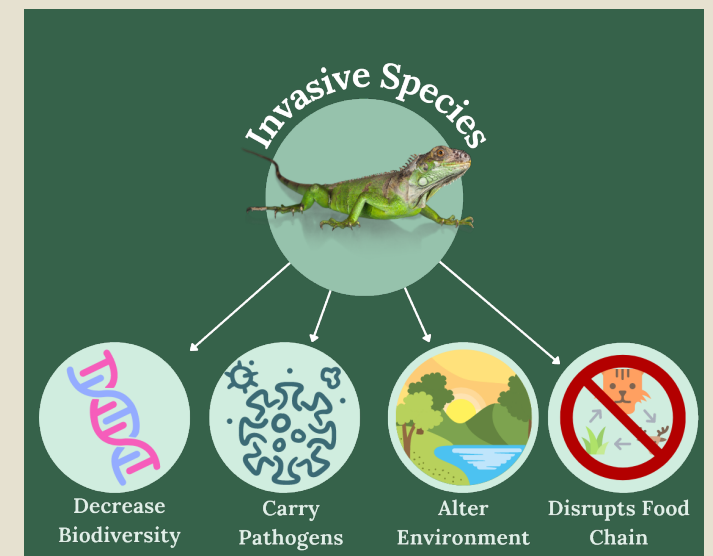

Figure 3. Red-eared sliders are often sold in Hong Kong for the pet trade. When released, these turtles can become invasive.

specialized in turtle trade because direct-messaging apps are accessed by fewer buyers.[8] Facebook groups are therefore more accessible to a larger audience. While Facebook does not allow the trade of live animals on its platform, the researchers in this study expect that it will be very difficult to crack down on traders due to their ability to quickly transfer to other apps. Because online pet trafficking is so adaptable, the illegal pet trade in Hong Kong can continue to succeed.[8]

Figure 4. Ways an invasive species can impact an environment.

transmitting a variety of diseases to humans, posing a risk to public health.[11] These illegally traded pets also could physically harm their owners and other pets through biting and scratching. These threats to biodiversity and public health create a need for public awareness about the damaging effects of the illegal pet trade. These effects can be seen in *Figure 4*.

Creation of Learning Resources

Our goal was to assist the World Wildlife Fund Hong Kong branch (WWF-HK) with their public educational campaign about the illegal animal trade by creating learning resources about the risks associated with illegally traded pets from the United States to Hong Kong. These learning resources come in the form of a hand book and story book for children. WWF-HK is interested in raising public awareness of the illegal animal trade, in order to deter the Hong Kong public from purchasing these animals. This project intends to help WWF-HK spread awareness

of the illegal pet trade and thus discourage the public from buying illegally traded pets. To make effective learning resources, it was necessary for us to understand the illegal pet trade and the pets involved in the trade. It was additionally necessary to understand the pertinent problems caused by the illegal pet trade and the proposed solutions to mitigate it.

Significant Issues Posed by the Illegal Pet Trade

The illegal pet trade in Hong Kong introduces a variety of significant issues, including threatening environmental sustainability[11] and jeopardizing animal welfare.[12] Pets are often abandoned by owners after they realize the animal has specialized needs. Because it is hard to reintroduce these species back into their appropriate habitats, they are often euthanized.[12] According to ADM Capital Foundation's (ADMCF) report, 6,952 non-native small mammals, rep-

tiles, and birds were caught in Hong Kong by the Agriculture, Fisheries and Conservation Department (AFCD) between 2015 and 2019.[11] Additionally, the trade of exotic pets puts animal welfare into jeopardy at every stage of the trade, from capture, breeding, and transport to the point of sale."[12] As seen in *Figure 5*, abandoned exotic pets are often found sick, injured, or dead.
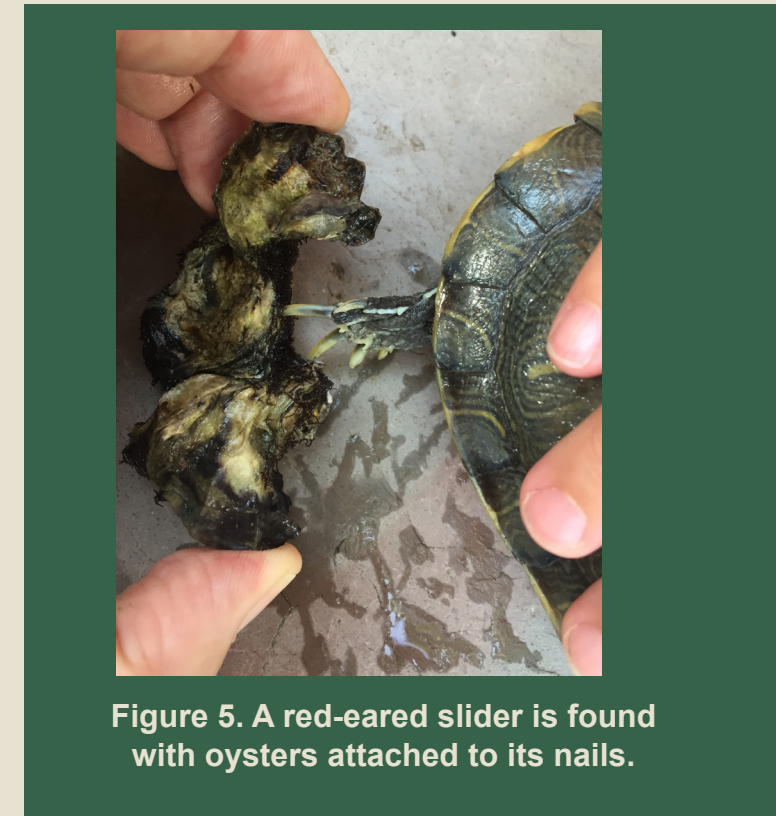

Figure 5. A red-eared slider is found with oysters attached to its nails.

Environmental Sustainability

Because so many species of animals make up the illegal pet trade in Hong Kong, the trade is a significant threat to environmental sustainability.[11] A majority of the Convention of International Trade of Endangered Species (CITES) regulated animals imported into Hong Kong to be sold as pets are classified as 'Vulnerable,' which indicates the species is facing a high risk of extinction in the wild. Many non-CITES animals that are imported are threatened species or species that have declining wild populations. However, the threat by imported pets and their species is not the only negative environmental impact of the illegal pet trade. As reported by ADMCF, released pets that have the potential to become invasive species could outcompete local wildlife, and could pose significant health risks to the animals and people of Hong Kong due to the possibility the illegally imported animals carry dangerous pathogens.[11] Captive animals have historically been released in Hong Kong due to cultural and religious practices, exacerbating environmental issues. According to ADMCF's report, some institutions ordered large amounts of animals for these "mercy releases" which highlights the issue that these animals are being captured, and are harmed in the process, just to be released[11] as seen in *Figure 6 a-b*.

Animal Welfare

The illegal trade of pets also jeopardizes animal welfare. Multiple factors contributing to animal welfare include the animal's ability to function well, feel well, and lead a reasonably natural life[13]. Functioning well requires the animal to be healthy and have a nutritious diet. Feeling well regards the animal's comfort in confinement. Finally, leading a reasonably natural life includes the animal's activity and environment. Illegally traded animals are put in a position during and after trading where these basic needs cannot be met.[11] It is often misinterpreted by owners of exotic pets that the illegally traded animals they buy
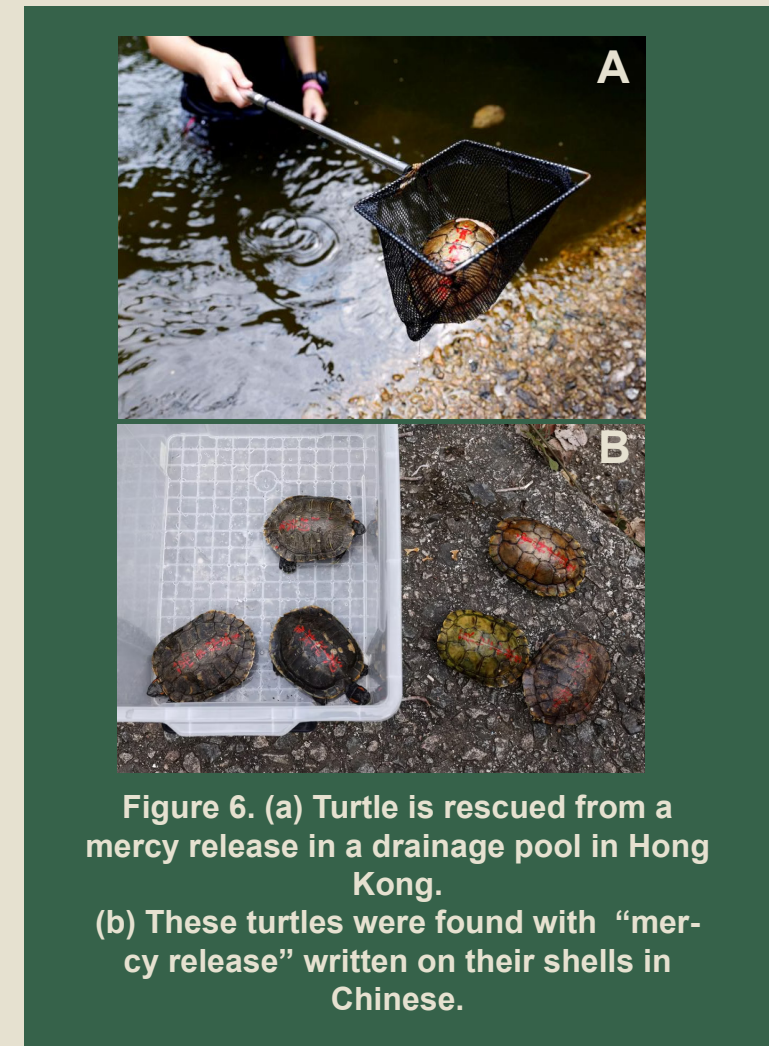
Figure 6. (a) Turtle is rescued from a mercy release in a drainage pool in Hong Kong.
(b) These turtles were found with "mercy release" written on their shells in Chinese.

will be manageable pets, similar to the difficulty of owning a cat or dog. However, cats and dogs have evolved over thousands of years to develop traits that allow them to thrive in captivity with humans. On the contrary, exotic animals still have traits suited for a life in the

wild which makes it near impossible to maintain them in a captive environment as shown in *Figure 7*. It is difficult to meet basic needs regarding the housing of exotic pets as Hong Kong's legislation in this subject is ambiguous, which makes regulations hard to follow and enforce.[11]

Captive Breeding is not a Solution

The CITES Secretariat states "captive breeding, and other captive production systems, can have a number of benefits compared with direct harvests from the wild."[14] One of these benefits is that "captive breeding would appear to address some of the sustainability concerns around the exotic pet trade by alleviating the pressures on wild populations."[11] However, this solution could be considered part of the problem itself, as many breeders buy wild-caught animals to breed more genetically diverse captive populations. This means that the illegal pet trade is still being supported despite captive breeding of these

Figure 7. Severe shell damage caused by a heat lamp. These reptiles require
specific lighting and heat.

animals. Additionally, in many species it is difficult to tell the difference between captive-bred and wild-caught animals. This allows poachers to claim their animals are captive-bred even when they are wild-caught, making it more difficult to crack down on the illegal pet trade.

The current idea of solutions addressing the illegal pet trade are not implemented properly and thus continuing to enable the damaging effects of the illegal pet trade. Education on the illegal pet trade allows us to understand and become more aware of the risks and impacts the trade has.

The creation of learning resources was necessary to help raise awareness about the illegal pet trade in Hong Kong.

Project Approaches and Outcomes

To accomplish our goal of increasing public awareness about the most trafficked animals from the United States to Hong Kong, we created learning resources to educate people about the risks associated with owning them. We developed four objectives to achieve this goal. They were to identify the top ten illegally imported animals to Hong Kong from the United States and to compile information about each pet pertaining to their characteristics and potential environmental impacts. The team also set out to determine demographic data about purchasers of these illegally imported pets through observation of pet stores. This allowed us to discourage a target demographic from buying illegally imported pets through the use of our learning resources. The learning resources created included a story book and

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PROJECT GOAL:

INCREASE AWARENESS ABOUT THE MOST TRAFFICKED PETS BROUGHT INTO HONG KONG FROM THE UNITED STATES AND INFORM THE PUBLIC OF THE RISKS ASSOCIATED WITH OWNING THEM

OBJECTIVE 1

Identify the most common pets that are illegally imported to Hong Kong from the United States

TASKS
- Conducted Review of the trade databases
- Compiled descending list of the numbers of imported animals

OBJECTIVE 2

Compile information about the top ten illegally imported pets

- Conducted research about each animal
- Interviewed animal trade experts and conservationists

OBJECTIVE 3

Identify the target demographic for learning resources through observations of pet stores

- Conducted pet store observations
- Recorded demographic information about customers
- Identified target demographic

OBJECTIVE 4

Develop a strategy to discourage the public from buying illegally imported pets by creating learning resources

- Determined sub-demographics within target demographic
- Developed age-specific learning resources for each sub-demographic

Figure 8. Methodology Summary

handbook. *Figure 8* shows our objectives and research methods.

Identify the most common pets that are illegally imported to Hong Kong from the United States

In order to identify animals imported to Hong Kong from the United States, we conducted a re-view of published reports from databases such as the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and the CITES Trade database. To assess this data, a Python Data Analysis Library (pandas) data-

frame was made and then sorted from highest to lowest by 'importer reported quantity.'[15] The species with the highest numerical quantities were compared to the CITES Appendices. If the species was included in the Appendices they were made part of the top ten list.

Compile information about the top ten illegally imported pets

To learn more about the animals imported for the pet trade, resources such as National Geo-

DR. YIK HEI SUNG   DR. GARY ADES   DR. GAIL COCHRANE

Figure 9. Experts interviewed.

graphic, U.S. Fish & Wildlife, and specific state government websites were used. We documented data about the animal's native habitat, physical appearance, safety risks, and environmental risks that released pets may pose to Hong Kong

ecosystems. We have conducted interviews with animal trade experts and conservationists such Dr. Yik Hei Sung[16-Supp] and Dr. Gary Ades[17-Supp] (*Figure 9*) to determine animal behavior and environmental risks of the illegal pet trade. An interview with Dr. Gail Cochrane[18-Supp], a veterinarian, was conducted in order to determine potential risks these pets might pose to their owners and the care that the pets require. The interview questions are listed in the supplemental materials.

Identify the target demographic for learning resources through observations of pet stores

To create effective learning resources for a specific audience, the demographic distribution of the members of the Hong Kong public that purchase live turtles was determined. Turtle sales were observed due to the fact they make up nine out of ten of the top ten illegally traded pets from the United States to Hong Kong. The other pet, the green iguana, was not sold in any of the pet stores. This was ac-

complished through an observation of pet stores on Tung Choi Street. The observations were conducted thrice a week over two weeks. Members of the team were assigned specific spots on the street observing the sale of turtles at eight pre-determined pet stores. The street has over twenty pet stores, however, the exact number is hard to determine as there are both stores on the ground level and above. Demographic information of the people purchasing turtles as well as people accompanying the purchaser was collected. Knowing demographic information, it became possible to target specific audiences when creating the learning resources to effectively discourage people from wanting to own illegally imported pets.

Discourage the public from buying illegally imported pets by creating learning resources

Based on the demographic data collected, the team determined the targeted demographic was children living in Hong Kong.

A handbook was created to be used to discourage these children from wanting to own illegally imported pets. The handbook has images of the pets, information about diseases carried by these pets and other physical risks they can pose to humans, and the potential environmental impacts that these pets can have if released. A handbook was chosen due to our sponsor's advice and handbooks' success in other WWF campaigns. Past children's educational campaigns and media in Hong Kong were reviewed to ensure our handbook was appealing to children ages 9-12. A draft of a story book for younger children was also provided to WWF. The handbook will be distributed by our sponsor, WWF-HK.

Findings

Top ten Illegally Traded Pets

The top ten animals trafficked from the United States to Hong Kong were identified using the Python PANDAS dataframe, compiled from the CITES trade database.[15]

Some of the most prevalent species traded from 2010 to 2020 are the alligator snapping turtle, common snapping turtle, and African spurred tortoise as seen in *Figure 9*. Additionally, we compiled information provided by the IUCN Red List regarding the illegally traded species. Four of the ten animals have been declared endangered such as the African spurred tortoise.[19]

Pets and Their Environmental Impacts

Through our interviews and literature review we identified the impacts of the illegal pet trade on animal welfare and the environment.

Finding 1: The illegal pet trade puts animal welfare in jeopardy.

According to the Royal Society for the Prevention of Cruelty to Animals (RSPCA), "at every stage of the wildlife trade, animals are exposed to serious risks to their health and welfare"[20] including during capture, shipping, and after sale. During capture and restraint, animals may experience "fear, distress, pain, and injury."[20] During shipping ille-
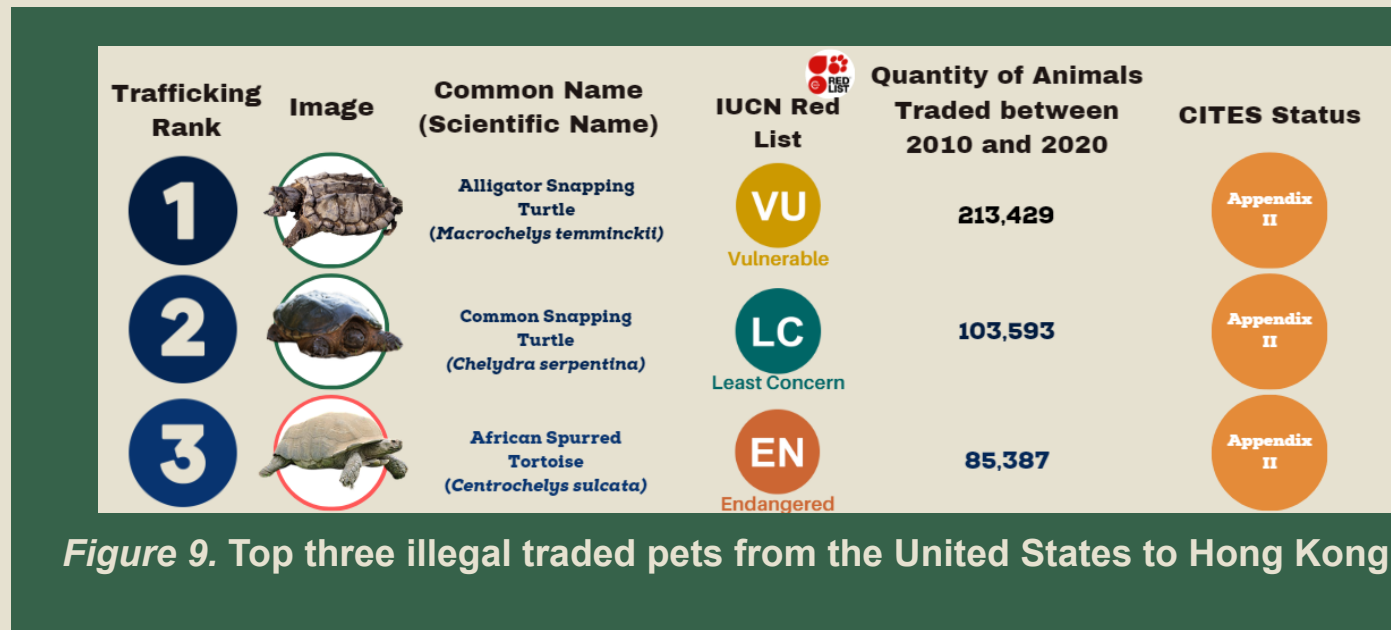

Trafficking Rank	Image	Common Name (Scientific Name)	IUCN Red List	Quantity of Animals Traded between 2010 and 2020	CITES Status
1		Alligator Snapping Turtle (*Macrochelys temminckii*)	VU Vulnerable	213,429	Appendix II
2		Common Snapping Turtle (*Chelydra serpentina*)	LC Least Concern	103,593	Appendix II
3		African Spurred Tortoise (*Centrochelys sulcata*)	EN Endangered	85,387	Appendix II

Figure 9. **Top three illegal traded pets from the United States to Hong Kong.**

gally traded pets are often denied the food and water they need to survive and some animals do not survive the journey. For example, during a seizure of thirteen iguanas at Heathrow airport, one of the thirteen had died during the flight and the "surviving animals were dehydrated"[21] and placed under the supervision of a specialist vet. Thus the welfare of illegally traded pets is not taken into account when they are being traded.

After sale, owners of illegally traded pets often do not have the resources necessary to take care of them. According to veterinarian Dr. Gail Cochrane, a major issue owners of these pets have is replicating their native environments. Cochrane explained that "most people do not have the space to keep (these pets), even the small species of tortoises that people have in their apartments in Hong Kong." For example at age ten, the alligator snapping turtle needs 2,400 liters of water in its tank to live a healthy life.[22] However, the lack of space for these animals is not the only issue in regard to the owner's ability to provide a safe environment

for these pets. Cochrane explained another problem due to "inadequate environment is what we call follicular stasis. Female turtles and tortoises tend to die younger than the males because they have ovarian problems, because they do not have the right environment to lay eggs. They often get follicles building up in the ovaries and then the follicles might go into the oviduct to become calcified." Because the turtles cannot dig up ground to lay their eggs, they build up like "space-occupying lesions" in their bodies. This results in causing gastrointestinal issues and the female turtles do not eat enough. Finally, Cochrane stated another issue is that some turtles fall off balconies of Hong Kong apartments resulting in cracked shells or death. Inadequate care extends beyond the issues owners have with providing the right environment. According to Dr. Gail Cochrane, diet is also another significant factor contributing to the inadequate care of illegally traded pets. She stated some owners feed the turtles and iguanas "cat food" and other foods that do not meet the animal's nu-

tritional needs, which results in the pets developing liver failure and/or calcium deficiencies. Due to owners' inability to replicate these turtles' and iguanas' natural diet and environment, animal welfare is also neglected at this point of the trade of illegally imported pets.

Finding 2: Suspected negative impact of released illegally traded pets on Hong Kong's environment can not be proven.

The team initially set out to include information about the negative environmental impacts of released illegally traded pets in our learning resources, such as the pet's potential to become an invasive species. Dr. Yik Hei Sung, an expert on the turtle trade in Hong Kong, explained that scientists lack the evidence needed to prove that the presence of invasive species are damaging to native populations. He stated, "we cannot really show the impact (of invasive species) because (Hong Kong's) native turtles are pretty much gone. We cannot really show that invasive species

are a problem because we cannot find native species anymore, mainly because of hunting."

Thus, we cannot show the impact the released illegally traded pets have on the environment if they become invasive species because the native turtle species' population has already been diminished. Dr. Sung also explained that we need more study in the field to show the degree of the negative impact. While it can not be proven that the invasive species are causing harm to Hong Kong's native ecosystem, Dr. Sung did state, "we cannot rule out the possibility that invasive species also play a role" in diminishing native species' population.

In our interview with veterinarian, Dr. Gail Cochrane, she explained that studies have not been conducted about the presence and impacts of invasive species. She stated, "nobody was doing the studies (30-40 years ago) to count the native species, to then watch the impact of the invasive species" on the native environment. Because studies were not conducted in the past, it is impossible to measure the changes in the population of native or invasive species.

Determination of Target Demographic for Educational Campaign
Finding 3: We found that children are our target demographic for our learning resources.

Ecologist and expert on the turtle trade in Hong Kong, Dr. Yik Hei Sung, stated in our interview that the group that he thought we should target for this campaign is children, saying "I think in the future, if we can change them, the next generation will be very important" to reducing the prevalence of the illegal pet trade. The results of our observations supported Dr. Sung's insight. We found that the largest group of purchasers were in the 30-59 age range. In *Figure 5* in the supplemental materials, there were a total of 26 sales and 77% of customers leaving pet stores were found to be in the 30-59 age group.[23] In *Figure 4* in the supplemental materials, the total number of people we observed accompanying the purchasers was 35 people.[24] Children were found to be the most common age group of people accompanying the purchasers. Among the number of people accompanying the purchaser, children were found to be accompanying the purchaser 63% of the time a purchase was made. With further analysis of the purchases made by the 30-59 age group, it was found that 70% of those purchases had at least one child present.[25] Through analyzing the data collected, we determined that children, or people under 18, would be our target demographic for the creation of our learning resources.

Analysis of How Children Learn
As children were determined to be our target demographic for our learning resources, we conducted research to see how best to present our materials to children. Through thorough literature review of past children's educational campaigns in Hong Kong, such as EatSmart and StartSmart, and academic journals and articles, data about children's learning was found. Our

findings are as follows:

Finding 4: Age group is an important factor of learning

Learning resources have to be designed with a specific age group in mind, as the age group of children is an extremely significant factor in whether or not a child responds well to a learning resource. Many educational programs and curricula already implement different learning techniques based on age (with elementary school ranging from 3-6 years old, and primary school from 6 to 12 years old): "In the early elementary years, children's cognitive processes develop further, which accordingly influences the strategies for educators in early elementary classrooms. Primary grade children are using more complex vocabulary and grammar."[26] A study based on how to best create online children's media found that "young users reacted negatively to content designed for children that were even one school grade below or above their own level."[26] Because of this, different resources should be considered for different age groups as well as the difficulty of material. Children are acutely aware of age differences, thus it is vital to target specific age ranges. It is important to take these differences in age groups into account. For example, children aged 9-12 "develop critical thinking, self-monitoring, and self-reflective abilities" which makes complicated reading material more suitable for their age group.[27]

Finding 5: Story books are effective learning tools for 4-5 year olds

Children can connect concepts they read about in storybooks to real life. Story books also "engage children in lengthy adult–child conversations"[28] which allows difficult concepts to be discussed in more detail. Based on information sourced from the article, "Children's UX: Usability issues in designing for young people" published by the Nielson Norman Group, we also found "once the children are motivated by the story, they can express their ideas and what they have discovered through investigation and experiment during the field trip and science activities."[28] Because children become motivated from reading storybooks, they are a good resource to introduce concepts like the illegal pet trade. Storybooks are also found to be an effective learning tool in order to enlist the child's pre-existing knowledge and skills into new learning situations. At this age a child's language and literacy skills are fostered by "the adult's use of varied vocabulary in interaction with the child, as well as by extending conversation on a single topic (rather than frequently switching topics), asking open-ended questions of the child, and initiating conversation related to the child's experiences and interests."[26] Dialogue conversations about the text helps the child not only understand the information introduced to them better, but also to learn about the subject more deeply by combining past and current experiences. After being introduced to the concept, children will be more interested in discussing it further with family and friends.

Finding 6: Technology can be used to enhance learning

Technology such as digital books and television advertisements/shows can be a useful medium for 6-7 year old children's learning. Based on information collected from the article, "Children's UX: Usability issues in designing for young people" published by the Nielson Norman Group, "children are more motivated by interaction with digital picture books, such as answering questions about the story; such interaction enhances their engagement, memory, understanding, and vocabulary."[28] Digital books engage 6-7 year old children with the subject more than other picture books. Additionally, it was found through the literature review, television also educates 7-8 year olds children if the television program or commercial is designed correctly. "Using simple dialogue, concrete examples and animated figures, the children demonstrated a fairly good understanding of pro-social messages" on television.[29] This means that a television adver-tisement or children's show would be an effective way to teach children about the illegal pet trade.

Finding 7: Children in Hong Kong are taught morals at a very young age

Children in China and other Asian countries are taught morals at a very young age. They learn the difference between right and wrong, as well as the social norms associated with respect, "children are taught to respect their parents, other siblings, and other adults in positions of authority (e.g. teachers); and individual family members are to be aware of their place in the hierarchy of family membership."[30] Based on the article "Hong Kong children's understanding of television advertising", we learned that Hong Kong children aged 7-8 years old use moral reasoning to assess appropriate behavior on television. "Hong Kong children frequently mentioned 'product' and 'incorrect behaviors' as reasons" they did not like certain commercials.[29] This suggests that 7-8 year olds are ca-pable of moral reasoning and may be able to learn about and morally assess the animal welfare and environmental issues caused by the illegal pet trade.

Finding 8: Graphics and visuals play a key role in children's learning

Throughout our literature review, we found that the proper utilization of graphics and visuals played a key role in educating children. For example, "another way teachers help students build background knowledge is to create visual or graphic organizers that help students to see not only new concepts but also how previously known concepts are related and connected to the new ones."[31] We created materials, *Figure 10* and *Figure 3*, based on the principle that "visual representations of abstract concepts and ideas that are the focus of writing,"[32] assists instruction of students. This included unrelated comparisons in order to allow children to quantify the scales of the graphs. This is an important strat-
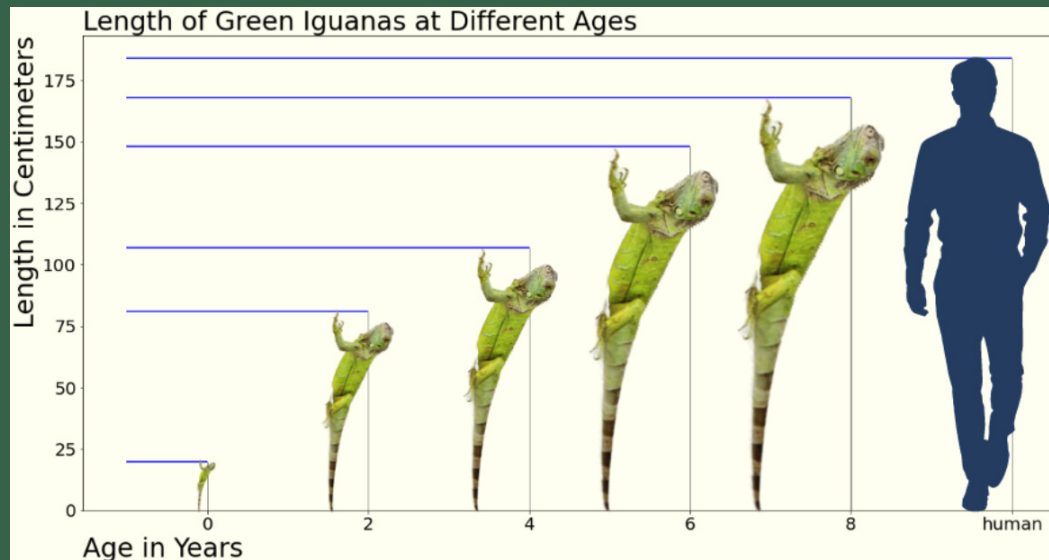
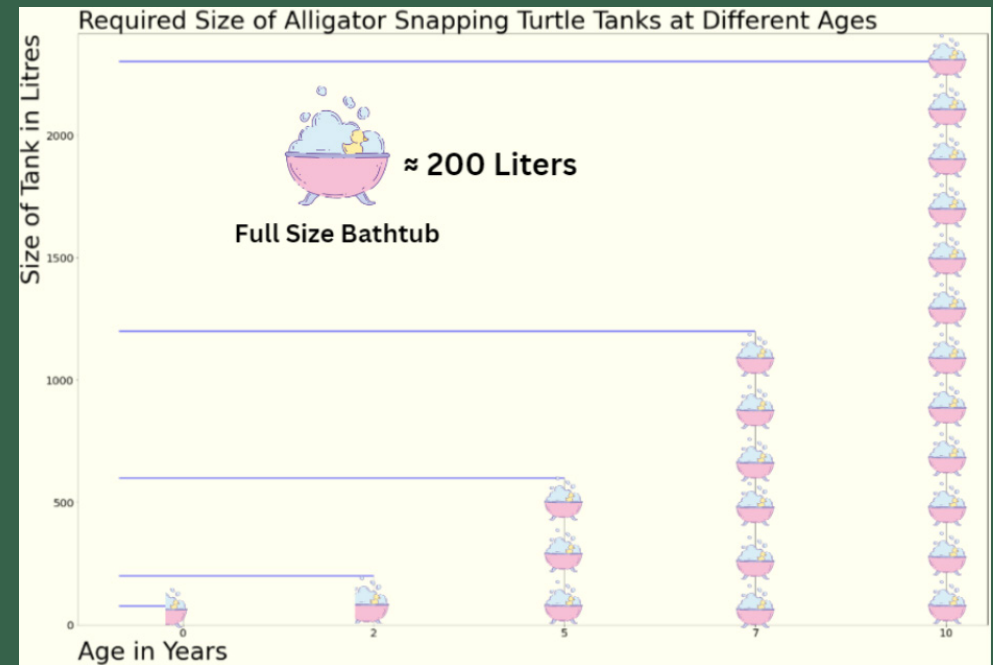Figure 10. Green iguana growth (in centimeters) over time (in years) compared to an adult male[34].

Figure 11. Alligator snapping turtle required tank size (in liters) at different ages compared to full sized bathtub volumes[22].

egy, especially for the education of children, because "using graphical representations are critical to being scientifically literate."[33]

Figure 10 shows the length of green iguanas (in centimeters) at different ages. The graph portrays a silhouette of a 180 cm tall adult male. The silhouette comparison is used to show children how big the green iguanas can grow in a way that they are able to easily visualize. The graph shows how large a green iguana is, at different stages of its life, up until full maturity/growth.

Figure 11 shows the minimum size required of the tanks that house alligator snapping turtles at different ages. We used full size bathtubs to visualize the amount of water (in liters) that are required for alligator snapping turtle tanks. The smallest tank being 75 liters, which is 3/8 of a full size bathtub.[35] The largest tank being approximately 2400 liters, or twelve full size bathtubs worth of water. This visualization makes it easier to comprehend the size of the tank required than simply stating that a ten year old alligator snapping turtle requires a 2400 cubic liter tank.

Finding 9: It is useful to incorporate aspects of Hong Kong science curriculum into our learning resources.

We identified important features to include in our learning resources through the analysis of the science based learning objectives for students in Primary 4-6 (ages 9-12) created by the Hong Kong school system. The science curriculum for students in Primary 4-6 (9-12) covers a variety of science based learning aspects. These aspects include "The Earth and Beyond," which focuses on the ways that the local environment influences the daily lives of the students.[36] Another aspect is "Life and Living", which focuses on the appreciation of the existence of living things, the respect of nature, and the recognition of the interdependence of living things and their environments.[36] By informing students about the risks, both to them and the animals, associated with keeping the animals discussed in our learwning resource,[37] which was a handbook, as pets we believe that the students will be able to make real-world connections to the lessons they learned in class. In our handbook, we emphasize how the animals that students or their friends may own can impact and offset the "interdependence of living things and their environment",[36] by altering the food chain in local ecosystems. Our handbook also addresses how certain pets are harmed in the process of trafficking them into Hong Kong. The denial of the basic needs of these pets, such as food, water, and the space to move freely, leads to serious risks to the health of the pets at every stage of trafficking.[20] Students who have learned about the importance of the appreciation of living things in their classrooms will be able to easily identify the blatant problems present during the trafficking of these pets, as seen in our handbook.

The handbook also discusses the lack of consideration for animal welfare of the animals listed, specifically the enclosure, environment, temperature, and care requirements of keeping these wild animals as pets. If children are able to identify the harms that affect the pets during trafficking, they will also be able to understand the difficulties of caring for the pets at their homes in Hong Kong. We can infer that children will be able to understand that by owning these pets, they are opening the pets up to the possibility of contracting diseases, sustaining injuries, and leading less fulfilled and natural lives.

Conclusions

The illegal pet trade is a major concern for Hong Kong. Raising public awareness about the illegal pet trade will deter the Hong Kong public from purchasing the traded animals, which would protect humans and the environment from the risks associated with them. The education of the Hong Kong youth about the illegal pet trade in particular should be a major priority. This is because educating the youth about the harm caused by the illegal pet trade will make them less likely to choose illegally traded animals as pets in the future, and more likely to extend the education they received to future generations.

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Learning materials for children that focus on the risks associated with owning illegally traded pets can help raise awareness about the illegal pet trade. We concluded multiple learning resources should be created to properly inform multiple age groups about the illegal pet trade. We found that more complex reading material with images and graphics is a suitable learning resource for older primary school children (ages 9-12).

Because of these conclusions, an informative handbook about the illegal pet trade for 9-12 year olds was created. Graphics and visuals play a key role in children's learning, this handbook includes many pictures and graphs. Additionally, we connected our handbook to Hong Kong's primary school science curriculum. Topics included in the handbook were compared to the science based learning objectives such as "The Earth and Beyond" and "Life and Living". Example pages of the handbook can be seen in *Figure 12*. The rest of the handbook can be found in the supplemental materials.

From our finding that children in Hong Kong are taught morals at a young age, we concluded that we can leverage these teachings to explain to children the moral wrongdoings of purchasing illegally traded pets. We also concluded we can inform them about how the pets' lives are negatively affected in almost every aspect. This conclusion is also supported from our findings in the *Pets and their Environmental Impacts* section.

Recommendations

The conclusions drawn from our research findings led the team to make recommendations to WWF

Figure 10. Example pages of our handbook.

about continuing their campaign against the illegal pet trade. We recommend that:

WWF should continue focusing their campaign efforts on children

Because children are so involved in the sale of turtles and are more susceptible to new ideas, they are a good demographic to focus on for this campaign. Focusing on children will allow WWF to start making a campaign that initiates a change in Hong Kong on people's outlook on the illegal pet trade. Teaching children to purchase pets responsibly is important, because it will result in fewer purchases of illegally traded pets.

WWF should continue to create learning resources about the illegal pet trade

WWF could distribute informative materials such as our handbook to primary school students in international schools in Hong Kong and/or have it available on their website. There are 46 international schools in Hong Kong, however, in some of these schools English is not the (primary) language of instruction. To reach more children, these learning resources should be translated to traditional Chinese. Although it is difficult to determine the number of students who could potentially benefit from these learning resources, distributing our handbook will help children understand what the illegal pet trade is and the risks associated with the animals that are being traded.

WWF should consider other types of learning resources

As found in our research, storybooks are very effective learning resources for 4-5 year olds that help children connect difficult concepts to real life. Because of this finding, we recommend that WWF create storybooks about the illegal pet trade like the draft included in the supplemental materials.[38] We found digital books are even more effective than regular picture books. Additionally, we found that television is a good medium to use for children's learning. The team concluded WWF should consider creating more digital books and, if financially feasible, a television advertisement campaign, airing during the commercial breaks of children's shows, that informs children about the illegal pet trade. WWF should conduct research to develop advertisements and campaigns on social media platforms for children. Using television and digital books would be beneficial to WWF's campaign as it would allow even more children to be informed about the illegal pet trade as these media are especially effective on 5-6 year olds (digital books) and 7-8 year olds (television).

Thank you!

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