

Don't Feed the Fish:
How to Better Educate the Public on the Negative Effects of Feeding
Aquatic Wildlife
In
Virgin Islands National Park

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Table of Contents

Introduction.....	1
Research Methods.....	2
The Effects of Feeding to the Ecology of the Trunk Bay Food Web.....	3
Visitor Statistics and Lifeguard Observations	9
Suggestions for Visitor Outreach	12
Works Cited.....	17
Appendix I: Yearly Visitor and Feeding Statistical Charts.....	i

Table of Figures**

Figure 1 Virgin Islands National Park sign informing visitors of beach rules.....	1
Figure 2 Staghorn coral, Sea Fan and Soft Octocoral, Trunk Bay 2014.....	2
Figure 3 Hard Corals sign on the Snorkel Trail.....	3
Figure 4 A flamingo tongue feeds on a Purple Sea Fan, Trunk Bay 2014	3
Figure 5 Parrotfish among corals and sponges, Trunk Bay 2014	4
Figure 6 Long spined Urchin (below). West Indian Sea Egg (above) Trunk Bay 2013.....	5
Figure 7 A Caribbean lobster hides on the reef, Trunk Bay 2014	5
Figure 8 Hawksbill Turtle Trunk Bay, 2014.....	5
Figure 9 Southern Stingray, Trunk Bay Lifeguard Camera 2013	6
Figure 10 An octopus peers out from his home, Trunk Bay 2014	6
Figure 11 An invasive Lionfish caught at Trunk Bay, 2014	7
Figure 12 Yellow Crowned Night Heron, Trunk Bay 2014.....	7
Figure 13 Laughing gulls flock to a school of fish, Trunk Bay 2014	8
Figure 14 Yellow Tail Snapper Trunk Bay 2013. These fish seem to be the most easily habituated due to food conditioning.....	10
Figure 15 A school of Sergeant Majors, Trunk Bay 2014.....	11
Figure 16 Common Predators sign on the Snorkel Trail, adding more about the role each fish plays in the food chain would help visitors understand and respect the food chain.....	12
Figure 17 Underwater Trail Marker, 2014	13
Figure 18 Next to smoking areas would also be a great place for informational signage.....	14
Figure 19 The entrance to Trunk Bay, the sign about not standing on the coral is on the right hand side of the walk way. The brown signs describe other rules such as no feeding the fish or wildlife, 2014	14
Figure 20 Trunk Bay Blue Flag sign, this whole open area would be a great place to put more informational signage.....	15
Figure 21 Next to the picnic pavilion would also be a great place for educational signage.....	15
Figure 22 Trunk Bay Coral Reef, 2014.....	17

** All photographs were taken at Trunk Bay by me in 2014, with the exception of Figure numbers 6, 9, and 14 which were taken by another Trunk Bay lifeguard (Pete Hassen) with the lifeguard camera in 2013.



Figure 1 Virgin Islands National Park sign informing visitors of beach rules

Introduction

“It is often with the best intentions, be it gratitude, curiosity, or just plain friendship that park visitors wish to offer wildlife something in return, rationalizing that feeding wild animals doesn't really do any harm (Bryce Canyon National Park, 2014).” However, feeding wildlife has extremely harmful negative consequences for the wildlife, as well as the visitors who feed them. At Virgin Islands National Park (VIIS) fish feeding is particularly detrimental and has been a relatively unexamined phenomenon. Not only does feeding fish, like with other wildlife, cause acclimation to human presence and changed behavior but it also is bad for fish health. “... It is rarely a good idea to habituate wild animals to humans by feeding them... (Frink, 2013).” In addition to being detrimental to the fish it is also harmful to the delicate coral reef ecosystem in which they live. “A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise (Leopold, 1949).” The coral reef is one of the most important and most threatened resources within park boundaries; anything that contributes to its damage should be eliminated.

Not only is feeding the fish harming them and the reef, fish feeding for those who are swimming or snorkeling with the fish are also in danger of being injured or swarmed by the fish and consequently panicking which could lead to drowning. Although this information is known by park staff, those visiting the park are only told not to feed the fish, but not why they shouldn't and also not explicitly so. The only signs which are posted to inform visitors not to feed the fish are posted at entrance ramps as part of a list of several other rules that they should abide by for their own safety. The rule just states “Do not feed fish or wildlife (Figure 1).” This paper aims to show the importance of informing the public of the harm done by feeding as well as the information necessary to educate the public in concepts such as the food web within Trunk Bay and park regions. This paper also aims to show some strategies for getting this information to the public in an effective and educational manner.

Research Methods

The main method for data collection was direct observation of visitor habits, as well as research of related resources. The site for observation was Trunk Bay; this site is home to the heavily patroned snorkel trail, drawing thousands long and short-term visitors annually. This beach is the only one within VIIS where visitors pay to get onto the beach; it has showers, flush toilets along with a snack bar, gift shop and lifeguards. As a lifeguard I spend much of my week on the beach observing visitors and their habits of fish feeding. Since it is part of my job to stop visitors from feeding the fish and to record the number of offenders, it was quite easy for me to gather data on how many people were caught feeding the fish and other wildlife. Even on my days off, lifeguards still record the numbers of fish and bird feeders. Lifeguards are present every day of the year from 9am to 4pm. I have also gone through the records of the last three years to collect fish and bird feeding data to give a broader picture of trends, and to illustrate the amount of visitors over time and their an impact on the reef. The numbers of those feeding, although only a small percent of the total amount of visitors, when added up shows that there is still a need to educate visitors about the harmful effects of feeding wildlife. The total numbers for the years show that over time even such a small thing like feeding can become a serious threat to reef health. I also looked at reports of fish and bird feeding at Trunk Bay from 2011-2013. Charts illustrating this data can be seen in the section on visitor statistics. The use of bird feeding data is important to show that not just fish are being fed, but the larger issue at hand is all wildlife habituation within the VIIS as a whole. Also, I have found many sources discussing habituation of larger species such as bears, elk and deer, but I have only found a few articles and other sources speaking about fish feeding, exemplifying the need for the research presented here. My goal in this project is to teach visitors about the importance of not feeding wildlife.

Additional research about wildlife habituation and effective visitor outreach was also conducted through professional periodicals and journals, National Park websites, and other assorted written media. Also, interviews were conducted with former and present lifeguards at Trunk Bay to show the timespan of the issue, and that it is not only a question of wildlife safety and health, but also an issue of visitor safety. Originally I had also planned on interviewing visitors about their knowledge of fish feeding. However, due to time constraints, this was not an option. NPS policy is to obtain a specific permit when conducting such interviews and the time table for receiving permit approval is six months. Therefore, it was not possible to conduct this type of research during the four month research period. I did, however, obtain a different research permit from the park service to conduct all of the other aforementioned research within the allotted time. The culmination of that research is this paper, the displays and distributable media that accompany it, as well as future projects that can be designed using this information. This paper will be submitted to the NPS Research and Permitting Database so that the compiled data may help others in similar future studies.



Figure 2 Staghorn coral, Sea Fan and Soft Octocoral, Trunk Bay 2014

The Effects of Feeding to the Ecology of the Trunk Bay Food Web

In order to understand the harmful effect that fish feeding has, and in order to effectively educate the public on this harm, it is first necessary to understand the ecosystem at Trunk Bay. Many of the species that exist at Trunk are located at other beaches in Virgin Islands National Park (VIIS); however, there are hundreds of species of fish, coral, birds and other aquatic life throughout the park. This report focuses mainly on Trunk Bay but the information would be useful in educating guests about the food web that exists in all of the bays as well as on land in VIIS as well as other locations. There are dozens of different species of coral, algae, fish, crustaceans, echinoderms and other creatures which call Trunk Bay home. Each of these animals and plants plays an important part in keeping the reef healthy and alive. When one link in this chain is affected the whole ecosystem is at risk. A prominent example of this affect is humans feeding different species of this ecosystem. As humans tend to feed the larger species, the effects of feeding on these species will be discussed in tandem with their descriptions, later in this section.

The coral reef at Trunk Bay consists mainly of Staghorn (*Acropora cervicornis*), Elkhorn (*Acropora Palmata*) and several species of brain corals also known as hard or reef building corals; this reef also contains sea fans and sea whips, known also as soft corals or gorgonians. There are also species of hydrocorals which include several species of fire coral. Other creatures such as anemones, sponges and tunicates also grow on and around these corals (Virgin Islands National Park, n.d). Understanding the ecology of the reef

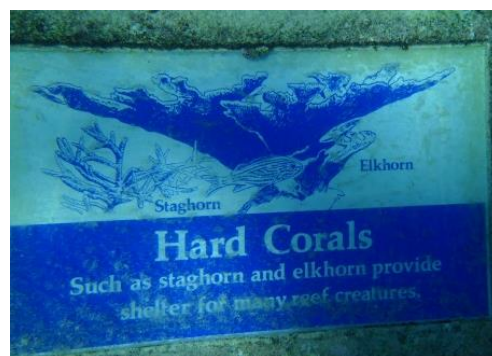


Figure 3 Hard Corals sign on the Snorkel Trail

means understanding the coral and its importance to the ecosystem at Trunk Bay. Coral polyps are animals which live symbiotically with zooxanthellae, which are a single cell plant life. These plants give the corals their bright colors and help the coral build their skeletons. These skeletons are calcium carbonate and the coral grown on them in colonies of hundreds or thousands. These creatures are extremely delicate and can take hundreds of years to build what we think of as reefs. New corals grow on the rocky bottom of the ocean floor, as well as the dead skeletons of those that came before. Each of these colonies of creatures gives shelter to the fish and other mobile sea life.

The clarity of the water is very important to the growth of coral; particles of silt and sand in the water can choke the polyps and stop them from feeding (Deloach & Human, 2002). The polyps feed on both zooplanktons and the sugars produced by the zooxanthellae (National Ocean Service, 2011). Of course there are some animals which feed on the coral, called corallivores (Deloach & Human, 2002). Several species of corallivores, such as Flamingo Tongues snails (*Cyphoma gibbosum*) and various species of fireworms, are present at Trunk Bay.

Additional harm to corals from other animals can come from tunicates and sponges, which bore into the coral skeleton and eventually cause extensive damage to a colony. Extensive damage of this type can occur when an overabundance of



Figure 4 A flamingo tongue feeds on a Purple Sea Fan, Trunk Bay 2014



Figure 5 Parrotfish among corals and sponges, Trunk Bay 2014

nutrients or bacteria, which the tunicates and sponges feed on, exists in the water (Deloach & Human, 2002). There are also some species of damsel fish which will intentionally bite the coral; when the coral dies algae grows on the skeleton which the damsel fish eat (Friedlander, 2013).

Most coral colonies can rebound from these small amounts of damage, but there are also several diseases which affect coral to where they cannot rebound from. Black band and white band diseases are two of the most common bacterial infections which result in the sickness and eventual death of corals both hard and soft (Deloach & Human, 2002). Also, coral will have trouble rebounding if they have been previously damaged by other forces such as: hurricanes, breakage from anchoring, or damage from swimmers and snorkelers.

Bleaching, another threat to coral, is caused for the most part by environmental factors including drastic changes in water temperature, changes in water salinity, pollution, and increased sedimentation. These things can all cause the zooxanthellae to be expelled from the coral, resulting in the loss of the coral's ability to build new skeletons as well as deprives them of nutrients. Since the zooxanthellae give the corals their colors the term bleaching refers to the corals lack of color (Deloach & Human, 2002). It is important to understand how delicate the corals are and that the rest of the ecosystem relies on the coral to live. Since coral are already so susceptible to these many other threats, minimizing any further harmful action such as feeding should be a priority.

Without the structure provided by the reef none of the fish would have a place to hide from predators or find shelter during storms. And it is not only the reef that is harmed; birds which eat the fish are also affected, feeding even effects the sand which makes up the beach and the majority of the bottom of Trunk Bay. This fine white sand, which makes Trunk such an appealing beach, is the result of fish droppings (Virgin Islands National Park, n.d): Parrotfish droppings to be exact. When parrotfish scrape the algae off coral with their hard teeth they also take along some coral polyps and parts of their skeletons. This coral passes through their digestive tract and becomes the fine sand found at Trunk Bay and other beaches. There are several species of parrotfish, at Trunk Bay the most abundant seem to be the Stoplight Parrotfish (*Sparisoma viride*) and the Princess Parrotfish (*Scarus taeniopterus*).

Other fish at Trunk Bay which eat algae are the damselfish such as the Sergeant Major (*Abudefduf saxatilis*), Three spot Damsel Fish (*Stegastes planifrons*), and various butterfly damselfish. Other species present are Surgeonfish (*Acanthurus bahianus*) and Blue Tangs (*Acanthurus coeruleus*), as well as Smooth Trunkfish (*Lactophrys triqueter*). The algae that these fish feed on are green algae, phylum *Chlorophyta*; many of these tiny plants grow on the coral and help stabilize the reef (Deloach & Human, 2002). However, there are some that would also smother the coral, if unchecked. Many of these algae look similar to many terrestrial plants; others take on odd shapes and textures. These algae are the bottom of the food chain on the reef, and fish are not the only ones feeding on the plant life in and around the reef. Long-spined Urchins (*Diadema antillarum*) are an important part of the reef ecosystem. These



Figure 6 Long spined Urchin (below). West Indian Sea Egg (above) Trunk Bay 2013

these creatures have been drastically overfished (NOAA Fisheries, 2013), and so their protection in park waters is critical. These bottom feeders are affected by feeding when the left overs of whatever human food sinks to the bottom. The exact effects on these creatures is not known, however, since the chemicals in many man made foods are not the natural food source for conch it is possible that the same negative



Figure 7 A Caribbean lobster hides on the reef, Trunk Bay 2014



Figure 8 Hawksbill Turtle Trunk Bay, 2014

urchins eat the macro algae that would otherwise smother the reef, and prevent coral larvae from establishing new colonies by competing with their settlement space (Deloach & Human, 2002). These urchins are quite abundant at Trunk Bay and another delicate player in the balance of the reef.

Queen Conch (*Strombus gigas*), a mollusk, is another non-fish algae eater that plays a major role in keeping the algae in check. Queen Conchs are also a food source for the octopus which also occupies the reef. Conchs are also detritivores and eat any leftover dead matter which falls to the sea floor. Conchs are a food source for octopus and for humans. Unfortunately effects seen in fish and other animals are present in those that eat enough human food. Also anything that eats the conch or other bottom feeders that has eaten this non-natural food also may potentially be affected.

Another important member of the reef ecosystem is the Caribbean Spiny Lobster (*Panulirus argus*). These creatures feed on gastropods, crustaceans, and occasionally vegetation and carrion from the sea floor (MarineBio, 2014). Lobsters are eaten by sharks as well as eels. These arthropods are just one more crucial part of the reef ecosystem at Trunk Bay and in the Caribbean.

Green Turtles (*Chelonia mydas*) are also present at Trunk Bay. These turtles feed on Turtle Grass (*Thalassia testudinum*) and Manatee Grass (*Syringodium filiforme*) which stretch in a long bed next to the coral and sand bottom that make up Trunk Bay. Green Turtles are also a threatened species.

Hawksbill Turtles (*Eretmochelys imbricata*) are also present at Trunk Bay, as well. These turtles feed on algae, sponges and other invertebrates (NOAA Fisheries, 2013). The Hawksbill is a critically listed endangered species. Both Green and Hawksbill turtles nest on St. John and at Trunk Bay. Feeding the turtles can cause great harm. Unfortunately there are some resources which state it is ok to feed turtles ground beef, this can result in the turtles becoming constipated and causing other digestive problems. The

SeaWorld website says that feeding turtles a carnivorous diet is “ok in a zoological setting” (Seaworld Parks, 2014). One website states that it is ok to feed a turtle that is a pet ground meat (Rhudy, 2014), yet other state to never feed them meat (Buzzle, 2014). Green turtles have special bacterial symbionts in their intestines that help them break down plant cellulose; feeding them things like ground meat can be harmful to their digestion (Oceanic Research Foundation, 2005). Educating the public about not feeding wild animals because of the harm it can cause is extremely important, because they may be getting information that is contradictory. Teaching the science behind the rules must be at the forefront of the way the park explains rules such as not feeding wildlife.



Figure 9 Southern Stingray, Trunk Bay Lifeguard Camera 2013

(*Dasyatis americana*) also eat many of these same animals and are also present at Trunk Bay (Friedlander, 2013) eating non-natural food sources can also harm these bottom dwellers as well.

On the opposite end of the spectrum of feeding herbivores meat is feeding piscivores (animals that feed mainly on fish) or invertivores (animals that fed mainly on invertebrates) non-meat products (Alevizon, 2013). Feeding fish such as the Queen Trigger Fish (*Balistes vetula*), which eat sea urchins a diet of bread or even fruit can cause harm to the fish. Similarly feeding Lane Snapper (*Lutjanus sunagris*) and French Grunts (*Haemulon flavolineatum*) which eat other small fish as well as various other species, crustaceans, worms and cephalopods (Friedlander A. M., 2013) is also a detriment to their health . Southern Stingrays

“Most animals have very specific natural diets and therefore specific kinds of digestive bacteria. Being fed human food causes the wrong type of bacteria to become dominant in their stomachs. Soon these animals are no longer able to digest their natural foods. They end up starving to death with stomachs full of what they should have been eating all along (Bryce Canyon National Park, 2014).

The larger piscivores at Trunk Bay consist mainly of Great Barracuda (*Sphyraena barracuda*), Bar jack (*Caranx ruber*), Yellow Tail Snapper (*Ocyurus chrysurus*), Trumpetfish (*Aulostomus maculatus*), Flat Needlefish (*Ablennes hians*, and Houndfish (*Tylosurus crocodilus*). The occasional Nurse Shark (*Ginglymostoma cirratum*), or Lemon Shark (*Negaprion brevirostris*) also make an appearance, but are small and harmless to humans as long as they refrain from spearfishing (which is not allowed in park waters). Red Hind (*Epinephelus guttatus*) and several species of wrasse and needle fish also feed on smaller fish



Figure 10 An octopus peers out from his home, Trunk Bay 2014

such as damsel fishes and the fry of various fishes. As predators, these fish are the ones that can be viewed as being more aggressive and are more likely to swarm people who offer them food. Interestingly, many people are concerned about sharks harming them, when really as long as they refrain from feeding the fish they do not become aggressive. According to Deloach and Human 2002, many shark species attack only when frenzied due to food in the water, and divers are advised to use caution when spearfishing. The same is advised with barracuda. Although spearfishing is not allowed in the National Park it is a popular activity elsewhere in the Virgin Islands.

There is one more important piscivore at Trunk Bay as well as other locations throughout VIIS and the rest of the Caribbean. However, this piscivore is not native and is quickly becoming a threat to all other reef fish. The Indo-Pacific Lionfish (*Pterois volitans*) have no natural predators in the Caribbean. The population of these fish has become quite large, quite quickly. The lionfish eats any fry and adult fish that it can swallow. Although a whole project could be conducted just on the lionfish, alone, here it is just mentioned as another threat to the ecology of the reef at Trunk and at VIIS. Educating the public on the importance of getting rid of these fish because of their unbalanced position in the food chain fits nicely into this topic. Showing that the balance of the food web can be thrown off by the presence of just one type of fish is an important message that must be understood in order to protect the fragile aquatic ecosystem. Taking of invasive lionfish by spearfishing is done by park employees.



Figure 11 An invasive Lionfish caught at Trunk Bay, 2014

It is not only the fish and other aquatic life that is threatened by feeding, there are several species of birds such as Brown Pelican (*Pelecanus occidentalis*), Brown Booby (*Sula leucogaster*), Brown Noddy (*Anous stolidus*), Magnificent Frigate Bird (*Fregata magnificens*), Great Blue Heron (*Ardea herodias*), Laughing Gull (*Leucophaeus atricilla*), Green Heron (*Butorides virescens*), Snowy Egret (*Egretta thula*), Pearly Eyed Thrasher (*Margarops fuscatus*), Green Throated Carib Hummingbird (*Eulampis holosericeus*), Belted Kingfisher (*Megaceryle alcyon*), Yellow Crowned Night Heron (*Nyctanassa violacea*), White Wing Dove (*Zenaida asiatica*) and Zenaida Dove (*Zenaida aurita*), Bananaquit (*Coereba flaveola*), and Smooth Billed Ani (*Crotophaga ani*) (Stengel). The thrashers, doves, hummingbirds, Bananaquit (*Coereba flaveola*) and Ani's are all land birds and feed on a variety of foods such as seeds, nectar and fruit but the others are all sea birds and feed on the fish that inhabit the reef. All of these birds, except the hummingbirds, will take handouts from humans. In the case of the gulls, thrashers and doves, people feed them and the birds become so accustomed to the feeding that they will forage in people's bags when they are not around. It has become such an issue that the beach's



Figure 12 Yellow Crowned Night Heron, Trunk Bay 2014

snack shop has put up lines of wire over the dining area to prevent the birds from descending on patrons and stealing their food.

Not only have the birds become accustomed to people giving them food but they have become aggressive about taking the food. As for the sea birds such as herons, egrets, and frigate birds which feed on crabs and assorted fish, they spend the majority of their time over the water habitation, handouts are not so much a factor as them eating fish which have been fed man made processed food. The gulls and pelicans are the most prevalent birds, and the ones which come into the most contact with humans in the water and on the beach. Both species will fly over and feed on schools of fish, such as the bar jacks, tuneys and the small fry of several species of silvery fishes. Large schools of fish can be seen from the beach as the larger fish chase the smaller fish and try to evade the birds. This instance is a great opportunity to teach guests about the food chain at Trunk. Signage describing what the guests are seeing would help educate visitors of what the natural eating habits of the fish and the birds and help deter feeding. By learning about the balance that exists in the ecosystem at Trunk visitors are learning about the balance in all of nature. By learning about the food web and the importance of diet visitors will have a better idea of how aspects of nature can be effected by humans.

Also present at Trunk Bay are land animals such as Caribbean hermit crabs (*Coenobita clypeatus*) and Ghost Crab (*Ocypode quadrata*). There are also other animals such as donkeys, mongoose, and feral pigs (all non-native). In the case of the hermit crabs they are scavengers which will eat whatever is lying around. I have even witnessed several hermit crabs eating from packets of mayonnaise which did not make it into the garbage cans. Although this is not a direct or conscious feeding of the crabs, they are being exposed to an artificial food source. The other animals which are also opportunistic feeders have been mostly thwarted by the covered trash cans, but they will not hesitate to go after an open can or garbage lying on the ground. All of these instances, just as with bears in other parks (Denali National Park, 2014), cause a health issue for the animals and a safety issue for both animals and humans.



Figure 13 Laughing gulls flock to a school of fish, Trunk Bay 2014

Introducing man made food products, which is what most people feed the fish is harmful to the fish. More often people are feeding factory produced foods with preservatives and other chemicals which are unhealthy for humans, let alone fish (such as aerosol cheese). People do also try to feed the fish fruit; I had to stop visitors on three separate occasions from feeding the fish bananas. But again it is far more often that I and other lifeguards have witnessed people feeding aerosol cheese, bread, cheerios, dog biscuits and granola bars. I even had one guest ask if they could feed the fish rice crispy treats (of course I told him no). The unnatural components of these foods as with the sunscreen that the park instructs guests to avoid; end up on the reef and effect reef health. Feeding aerosol cheese to fish is not isolated to Trunk Bay. An account in the article *Unintended Consequences* tells of fish in American Samoa also being fed this substance and it causing constipation in the fish (Frink, 2013). And of course everything that goes in must come out, and all of these chemicalized droppings end up on the already fragile coral. It has been found that fishes' natural excretions are beneficial to the reef and are high in nitrogen and phosphorus; "coral heads with fish had higher growth rates than those without fish (Meyer, Schultz, & Helfman, 1983)." If healthy fish feces are a benefit to the reef, than surely unhealthy droppings could be detrimental.

“Many animals have specialized diets and the wrong foods can negatively affect their health. Artificial food sources can cause increased wildlife populations that are damaging to the environment and that natural available food supplies can’t support. Unnatural foods can also make them sick (Denali National Park, 2014).”

This information is stated in a full page dedicated to informing guests of the dangers of feeding wildlife. The Virgin Islands Website would benefit from a similar message. Currently there is only a small message stating that guests should not feed the fish or wildlife. I believe that if guests are more informed they too will recognize the harm and refrain from feeding the fish as well as the birds and other wildlife at the beach and the rest of the park. The coral reef at Trunk Bay is an intricate and delicate ecosystem. By changing the feeding patterns of the wildlife humans are altering their behavior and their health. It is only through reaching out to the visitors and providing them with this knowledge that we can hope to alter their behavior.

Visitor Statistics and Lifeguard Observations

The data collected on VIIS visitors came from several sources. Information about general park visitation and more specifically beach visitors came from IRMA the National Park Service Integrated Resources Management Application. This tool is open to the public, and visitor statistics on yearly and monthly basis are readily available. The data on bird and fish feeding came from lifeguard logs recorded on a daily bases by the lifeguards at Trunk Bay. This data is consolidated monthly, printed out, and is currently stored as hard copies at the VIIS visitor center along with the original handwritten daily logs. Lastly I have gathered observational data from other lifeguards both past and present and kept a personal record of what I have seen during the course of my internship. I have used this information to show the number of people who have been caught feeding at Trunk Bay since 2011; these were the earliest reports present which contained complete data for the entire year.

This park visitors’ numbers posted below serves two purposes. Although the percentage of those caught feeding appears relatively small, it does show that it is happening and has happened in the past continually. It is also important to show that the number of those feeding don’t necessarily mirror the number of visitors. It shows that the rate of feeding is relatively consistent; the numbers don’t vary too radically year to year. It is also important to note that these numbers are only of those who have been seen feeding by the lifeguards. As monitoring the safety of swimmers is the priority of lifeguards, it is reasonable that fish are being fed without the lifeguard’s knowledge, especially during busier days. In addition, there are several beaches at VIIS, Trunk Bay is the only one with lifeguards who enforce the park rules such as not feeding the fish, and it is reasonable to assume that there are people feeding at other beaches. Also the lifeguards are only at Trunk Bay from 9am to 4pm but visitors still come to the beach once they have left. I have been to Trunk Bay after work hours and seen someone feeding the fish, confirming that unrecorded fish feeding does occur.

Because fish feeding continues to happen without much change, the fish are continually exposed to artificial feeding. The effects of this feeding, such as increased aggression towards feeders and (most importantly the health of the fish, are a continuous and compounding threat to the ecosystem. The overall yearly visitor table shows the overall size of the audience the park hosts. This number reflects the people that can be reached by education of environmental issues. For 2014, the numbers only reflect the visitors from January thru March. For the more specific issue of fish and wildlife feeding the number of visitors to the beaches is presented, where signage and educational media can be placed to meet this audience. Visitors may encounter terrestrial and aerial wildlife elsewhere in the park, and I would recommend that species-specific educational media specific should be placed in appropriate locations. For this project the focus has been on Trunk Bay and covers the aquatic, terrestrial and aquatic life present at the location. And though the major part of this is focused on the fish and other aquatic life and the coral reef, the lessons taught to visitors about feeding wildlife can be used universally in all ecosystems.

Interviewing current and past lifeguards at Trunk Bay gave first-hand accounts of swimmers and snorkelers who have been feeding fish, often threatening the safety of park visitors in addition to impacting the ecosystem. My personal observations have been similar to those of the others. The fact that fish feeding has been happening at Trunk with the same results for over thirty years, as indicated by the interviews, is both interesting and alarming. It is my hope that with the information that has been collected the VIIS can make some progress towards educating the public and protecting the reef from fish and wildlife feeding.

My interviewees were Paul (current VIIS interpretation chief and former Trunk Bay lifeguard), Laurel (current VIIS educational specialist and former Trunk Bay lifeguard), Alberto (former Trunk Bay lifeguard), Cynthia (former Trunk Bay lifeguard), and Pete (current Trunk Bay lifeguard). The general consensus among all of the interviewees was that the Yellow Tail Snapper are the most likely to be drawn to snorkelers after becoming habituated to feeding. Pete had encountered one visitor who, while feeding a snapper, was bitten and the fish's tooth was left in the visitor's finger. I have encountered several visitors who while feeding fish have been bitten, but never to this extent. Paul, who was a lifeguard over twenty years ago, was encountering the same fish behavior when he was a lifeguard. He remembers people trying to feed the fish and, of course, being overwhelmed by fish. Alberto also stated that he has had to save, or at least assist, snorkelers who started to panic as the fish swarmed them. He also stated that as they panicked the visitors also damaged the reef as they tried to get onto Trunk Cay, out of the water and away from the fish. Pete said that he remembers only a few years ago (he has been at Trunk for 5 years) visitors coming to the beach with boxes of dog biscuits to feed the fish. This was, as the visitors told the lifeguards, because other locations (such as Coki Beach on St. Thomas and various charter boats) give or sell visitors dog biscuits to feed fish while snorkeling. Cynthia also stated that cruise ships use to give passengers fish food to take on snorkeling excursions.



Figure 14 Yellow Tail Snapper Trunk Bay 2013. These fish seem to be the most easily habituated due to food.

In addition to the information provided by other lifeguards and visitors informing me that Coki allows fish feeding, there is also a book on local fish species and snorkel spots which also talks about “feeding friendly fish (Birkhold, 2010).” In this same book the author talks about his experience in the Cayman Islands where he started feeding fish and was subsequently attacked by them. Birkhold was left with two large bites on his stomach as a result of this feeding. This is something that could easily happen at Trunk Bay or any VIIS beach. Although there is nothing VIIS can do to stop other places from allowing fish feeding, it can stop it within its own boundaries and educate those who visit so that they might take that knowledge elsewhere. And again, as big of a threat as it might be to humans to feed them, it is also a detriment to the fish and the reef.

Another instance similar to Birkhold’s was that of Cynthia who also lifeguarded at Trunk Bay, in the 1980s. Cynthia reported that while diving, she had brought a turkey leg with her to entice the fish. She stated that as soon as she pulled the bag containing the turkey out of her wetsuit while submerged she was suddenly swarmed by fish. “Nothing was left; the bag, the bones from the leg were all gone within a matter of seconds.” She also stated that she was covered in bites all over her hands and face; she had knocked her own snorkel mask off of her face as she was swarmed.



Figure 15 A school of Sergeant Majors, Trunk Bay 2014

I have observed several guests get swarmed by fish, although not to this extent. However, as a lifeguard, my job is to practice preventative lifesaving, as well as protect the reef from the swimmers and snorkelers. The other aspect of this reef protection is, of course, why people are feeding. Interviews have shown that this feeding occurs because visitors do not know about the damage that it causes, due to not understanding the ecology of the reef or general wildlife. My original intent of this project was to interview visitors about their

knowledge about ecology and if they were aware of the rules against feeding. Unfortunately, due to time constraints on permit approval for such research methods, a survey was not conducive to the length of my internship. The only information that I can give to this effect is the reactions of visitors once I or other guards told them that they were not allowed to feed the fish or birds. The most common response was that they did not know about the rule and they did not realize it was bad for the fish. In three separate instances I did have visitors say they saw the sign but they had done it elsewhere and so figured it was ok to do at Trunk. Other locations such as Coki Beach as well as charter boat cruises were the places that they were allowed to feed.

Children already tend to be a good voice of reason and speak for the wildlife; reaching them is important for the future wellbeing of the natural environment. An example of this is when I observed a family from one of the cruise ships. The father put bread into his swim trunks and handed food to the rest of the family to take with them, as they went into the water. As I went to tell them that what they were about to do was not allowed, the youngest boy (around 6 or 7) came running down the ramp to the beach yelling at his dad. “The sign says you can’t feed the fish!” The dad did not believe him and so walked up the ramp and, after reading the sign, the bread was put in the trash can. I was so happy when this happened: both to have this child as the one to police his own family ensuring that they did not do something that was wrong, and that the sign was actually read. And this was just one of the brown signs with a long list of rules, not a sign placed explicitly related to fish feeding. Of course I would have

stopped these people, but they stopped themselves; imagine if we had more vivid signs posted that would reach more visitors.

The observation of visitors and interviewing of lifeguards, to me, gives the best idea of the extent and ramifications of feeding. The data shown in the charts shown in Appendix I give an idea of the numbers of people that could potentially be reached by educational outreach, and shows along with the interviews from past lifeguards that this issue is not just a recent occurrence.

Suggestions for Visitor Outreach

Based on research of other sites where human impact on wildlife was an issue, *“Reduction of human disturbance through park-implemented signage, increased law enforcement near colonies, a docent program and greater public awareness has likely contributed to the successful establishment of these peripheral sites (Adams, 2008).”*



Figure 16 Common Predators sign on the Snorkel Trail, adding more about the role each fish plays in the food chain would help visitors understand and respect the food chain

however, many resources about educating the public on the habituation and food conditioning of larger animals such as birds, deer, elk and bears. But the principles behind not feeding wildlife are the same, regardless of size or if they are in the sea, on the land or in the air. Based on the research I have done and the observations I have made, I feel that there is enough information available to educate the public and more effective ways to do so than is currently available at VIIS.

“Work up some schtick for the cameras... and you will give me all the garbage I want...I’ve been around you people so much that I’ve grown used to your presence, I’ve grown accustomed to your face. I’m comfortable with you... (Hendry, 2010)” This bit from a 2005 “nature” performance by Jonathan Gray is given as a bear that has habituated to humans. Gray speaks to the idea that when bears are habituated to humans, they become a danger, and humans then are forced to kill the animals and do not blame themselves for causing the bears to become dangerous. This shows that we as humans are responsible for our interactions with wildlife. It is irresponsible of us to continue to feed the wildlife and enable them and then to destroy them when they become a threat. The responsible thing is to become educated and not feed them, keeping them wild is important, because as they become accustomed to

This statement was taken from a report about human influence on elephant seals, the report concluded that the more people were made aware of the issues the less likely they were to continue to harass and harm the animals. Like Trunk Bay the site for these seals were not remote and was where people came into regular contact with the animals.

Again my goal with this project is to better educate the public about the dangers and harm of feeding all wildlife, with a special focus on fish feeding. I did not find many examples of sites or even reports specifically on the negative effects of fish feeding. There were,

humans they are putting themselves in danger and also risking their own health. This is a message that can be carried over to all other wildlife including the fish in Trunk Bay as well as the rest of VIIS.

There are any numbers of ways to inform the public on the dangers of animal feeding, publishing media such as booklets, website pages, brochures or signage. In the course of my research, I have found several different methods from different National Parks, as well as state parks and museums on how to present information to the public. Publications such as National Geographic and the Wildlife Management Institute have also done articles or even whole books on presenting ecological issues to the public. Many locations in the Park Service have published reports based on visitor surveys about what they would like to see in parks. Educational signage was mentioned in several reports as being one of the most underused forms of educating the public.

“Many participants were not aware of the interpretive signage posted... Some families with children said they used the interpretive signs to complete their Junior Ranger booklets. A few participants did notice the signs and commented it was interesting to learn about the former occupants of each house (Yen Le, 2013).”

This particular section of a report on the experience of visitors to Martin Luther King Jr. National Historic Site shows that even though there was signage, it was not obvious to everyone, and those who did notice it enjoyed and learned from the signs. Participants in the surveys given by the park about what they thought would improve the visitor experience included improving and adding more interpretive signage. Although the nature of MLK and VIIS are somewhat different, the mentality of National Park or Historic Site visitors seems to be similar. Of course, if individuals looking for signage are unable to find it, individuals *not* looking for it will definitely not find it; if signage is more obvious and is eye catching people, will be more likely to stop and take the time to read. In addition to signage being requested, visitors also requested a roving docent or someone who could give more information about what it was that they were seeing. Currently at Trunk Bay, the lifeguards are asked many questions about the reef, the fish and other aspects of the park. However, as we are short staffed, it is difficult to really have a conversation with a visitor without compromising the focus on the water and those who are snorkeling and swimming. As the park becomes better staffed I would recommend letting the lifeguards not on stand take the role of interpreter for visitors, it also would give the lifeguards a larger role in protecting the reef. Perhaps they could even lead snorkel tours.

A study conducted at Craters of the Moon National Monument and Preserve stated, “One of the best ways to help people make a connection with these awesome resources is by providing interpretive opportunities (Slaton & Novey, 2007; Lacome, 2003).” This includes interpreters knowing the resources well and being able to relate to the audience so that they are invested in what they are learning. Understanding the audience, and who you are talking to, is quite important to interpreters. In the case of VIIS our visitors, especially at Trunk Bay are mostly cruise ship passengers. A survey of this demographic would be very helpful in understanding exactly what it is they want to see and learn while they are in the park would be extremely helpful. For the purpose of this study, as stated above, I was unable to survey the visitors; however, I can say that the



Figure 17 Underwater Trail Marker, 2014

majority of those who I personally had to tell not to feed the fish were cruise ship passengers. Current lifeguard Pete and former lifeguards Cynthia, Paul, and Alberto also agreed that cruise ship passengers made up the majority of those that they had to tell not to feed as well. Knowing that these visitors are here for only a short time and that most of them head straight out to the snorkel trail without looking at much else is a good indicator that this audience needs something quick. Although the snorkel trail itself is made up of informative signs, the order in which they are in, to me is not the most beneficial, and having one that says “do not feed the fish” would be a good start. The plaques do talk about predators as well as surgeon fish and parrotfish and their role on the reef, but a tie into their diets and the health of the reef may be helpful in relaying the message of fish health equaling reef health.

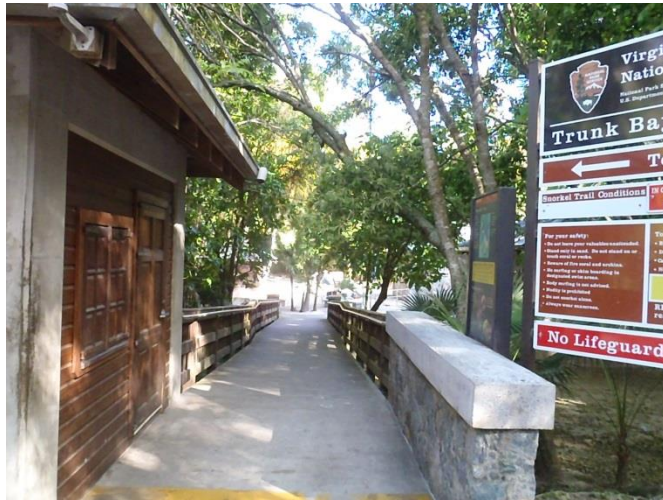


Figure 19 The entrance to Trunk Bay, the sign about not standing on the coral is on the right hand side of the walk way. The brown signs describe other rules such as no feeding the fish or wildlife, 2014

As an aside, there is a plaque that states that coral are fragile and that standing on them or touching them is harmful. Bu this plaque is the third plaque on the trail. There is also another plaque that says humans along with some other natural conditions, such as hurricanes, damage the reef. If these plaques were placed at the beginning there may be fewer snorkelers who stand on the coral, a problem which is something that happens every day and is what the other lifeguards and I spend the most time speaking to visitors about. Again for this issue there is only one informative sign and it is placed on the side of a walk way as the visitors enter the beach. The sign is not slanted and is literally over the heads of visitors. If it were placed in a more obvious place and at a height which would be more eye catching, I

believe more people would see the sign. I, for one, did not notice the sign until my third month of employment and I go by it every day. For visitors who are in a hurry to get onto the beach, placing the signs in places where they will notice them such as: near the changing room, the pathway to the beach, near the picnic pavilion or snack shop, or at the tops of the ramps would be good places to place them. Also, next to the designated smoking areas would help ensure the smokers stay in those areas as they smoke and read the signs. These signs would also be placed in locations away from the smoking areas so that non-smoking visitors do not have to stand in the smoking areas to read them.

I have had many people approach me asking about the types of fish that they are seeing. To me, this means tha we should be providing more information to this effect. Also, although the snorkel trail is what many people come to see at Trunk, there are those who don't or can't swim out to the trail. These visitors might be more likely to spend time reading informative signage placed on the



Figure 18 Next to smoking areas would also be a great place for informational signage.

walkways. In the cases of all visitors, the goal is to get them to learn and care about the resource and to take the knowledge they have learned to other locations.

“... An interpretive opportunity creates a meaningful experience for visitors, which encourages them to learn more or care more about a resource. As interpreters, it is important to foster and allow for those intellectual and emotional opportunities to take place. These interpretive opportunities can lead to curiosity, curiosity to reflection, reflection to understanding, understanding to appreciation and appreciation to preservation. One key way to facilitate these visitor connections is to relate the resources to concepts they are already familiar with (Lacome, 2003; Slaton & Novey, 2007).”

By using this model for creating an understanding and caring for a resource to foster preservation seems to be the best recourse for the coral reefs and the fish at VIIS. So far I have talked about visitors to the park, however, if we are going to foster real protection we must also think about the local



Figure 20 Trunk Bay Blue Flag sign, this whole open area would be a great place to put more informational signage.

population. Educating those who live on the island about the importance of maintaining ecological balance is a must. Specifically targeting the children who will someday be those in charge of the health of the island and the VIIS should also be a focus. Educating fishermen and those who rely on the reef and the fish to make a living must also be made to understand that if fish populations are overfished or fed a diet that is detrimental to them, that they are harming their own well being. Trunk Bay does not see much local traffic, although local children are brought on field trips and snorkel trips. I would recommend that during these trips, to

specifically mention the diets of the fish and the food web as a key factor in reef health. During the course of my research, I have developed a sign which could be used at Trunk as well as other beaches where more local people frequent. In addition to the children's education program that VIIS already has, I would recommend adding in a special section on fish feeding and its effect on the reef. Handing out brochures or flyers that include the information from this project would be a great way to distribute this knowledge to the public.

At Denali National Park they have started a Keep Wildlife Wild Campaign "...bookmarks, color brochures, buttons and plastic placards and decals (to be placed on picnic tables, trash cans, dumpsters, and inside toilet doors). All the materials contain a universal 'don't feed the wildlife' symbol and the 'Keep Wildlife Wild' message (Denali National Park, 2014)." They also have a much more detailed informational page about the impacts of wildlife feeding on their park website. Currently VIIS only has a short message about not feeding the wildlife. A more detailed page, informing visitors about the food web and the harm feeding can have, would be an



Figure 21 Next to the picnic pavilion would also be a great place for educational signage.

inexpensive means to informing visitors. Several parks place this page in the “Things to know before you come” section. Giving this information to visitors, especially cruise ship passengers, ahead of time could potentially limit the number of people bringing food to the beach specifically to feed to the fish. As for the media such as brochures and other items that cost money to produce, I would suggest asking the “Friends of the Park” (a non-profit organization) to perhaps start a fund for similar media handouts, as the park itself is limited in its funding. I also think that posting information in bathroom stalls, as mentioned above, might not be a bad idea as guests are forced to look at the back of a stall door while they are using the restroom. VIIS does already have some signs posted in the Visitor Center bathrooms on stall doors, and I feel like putting flyers or some sort of “Don’t feed the fish or wildlife” message would not be out of the realm of feasibility. Also it would be an appropriate venue to discuss fish feces and its effect on the reef.

As is seen throughout this report, fish and wildlife feeding is something that is detrimental to the wildlife and the visitors to Trunk Bay and VIIS. Clearly the best way to prevent this, and to protect the wildlife and the visitors, is to educate those who come to the park. Different methods are surely apt to work with the different audiences that come to VIIS. Thankfully there are several different things that could be done, such as: signage and other printed media, adding information about feeding to existing programming, or to develop an educational program specifically dedicated to topic of wildlife food webs. As people who are responsible for the preservation and conservation of the reef, we should do everything in our power to help protect our natural resources. Preserving the aquatic and terrestrial ecosystems within VIIS, by preventing the feeding of any and all wildlife, is just one small part of this stewardship but it is an important one. This message can be carried by our visitors to other places that they travel, and hopefully they will gain a new understanding, appreciation, and the urge for preservation.

“One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise (Leopold, 1949).”



Figure 22 Trunk Bay Coral Reef, 2014

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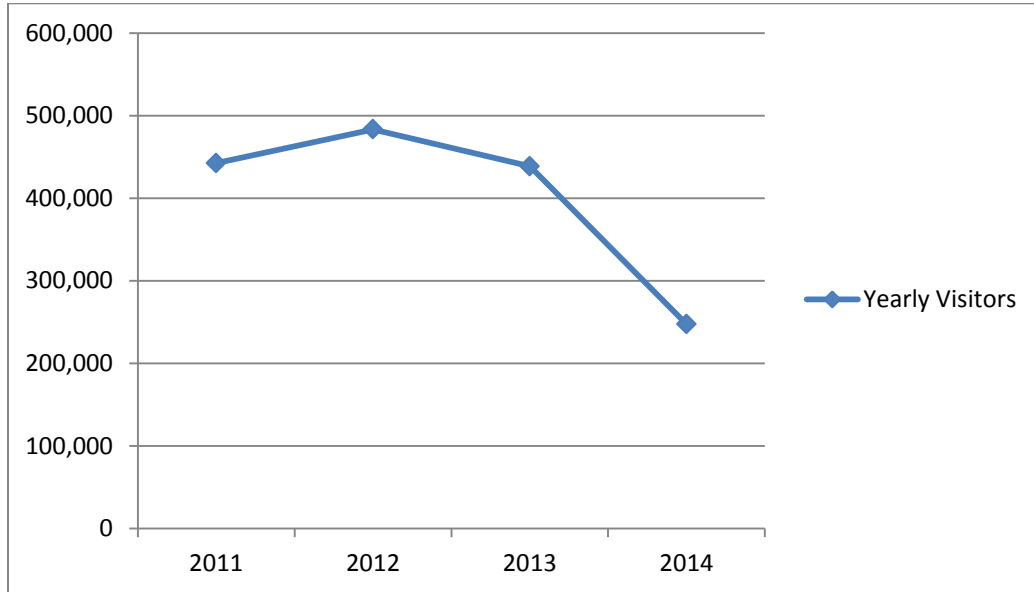
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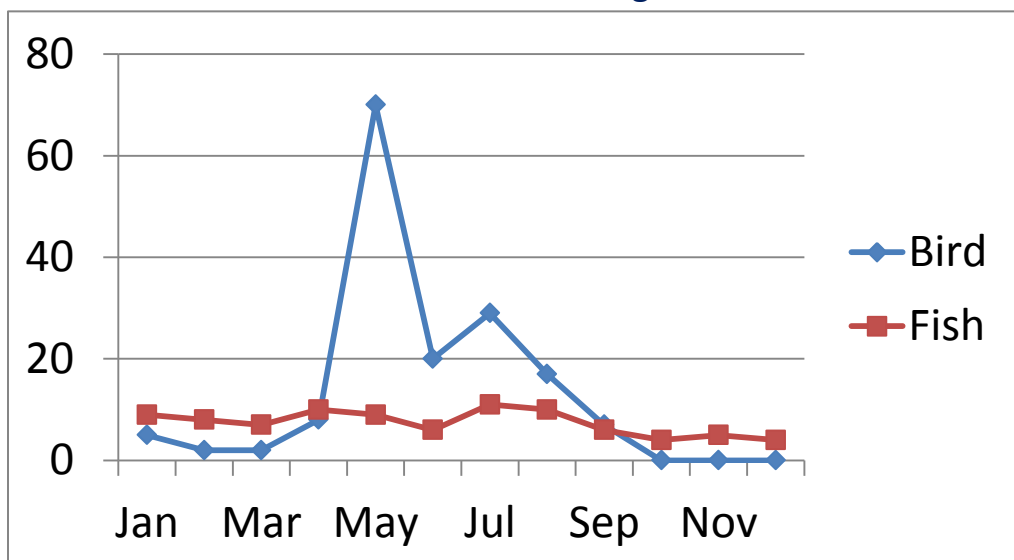
Appendix I: Yearly Visitor and Feeding Statistical Charts

Yearly VIIS Visitors 2011-2014



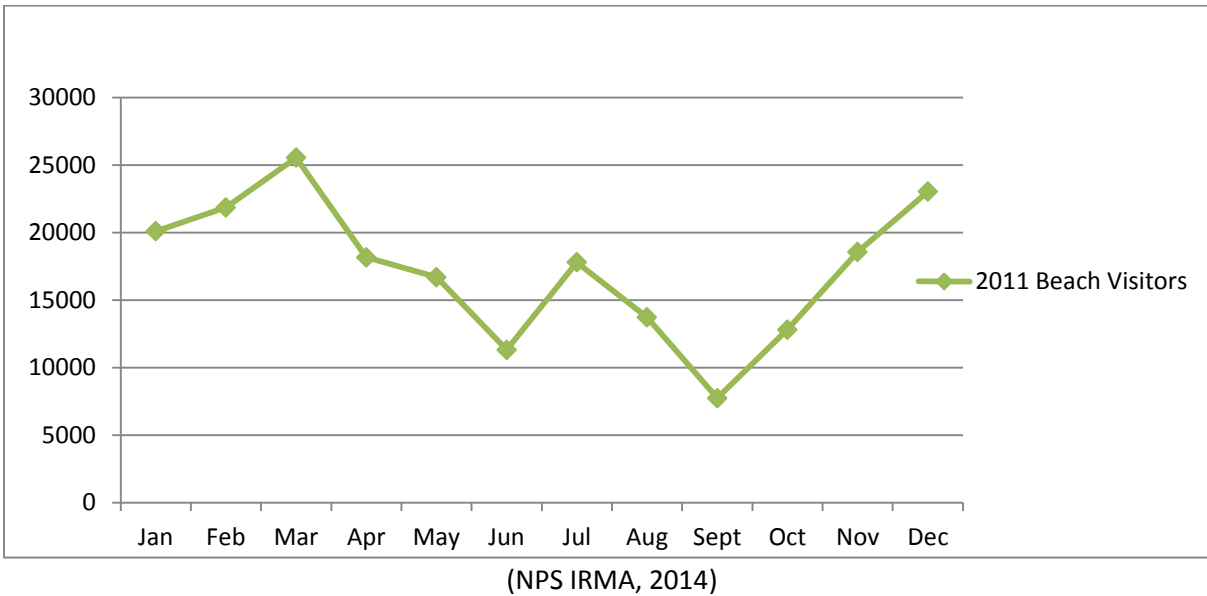
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2011 Bird and Fish Feeding Numbers

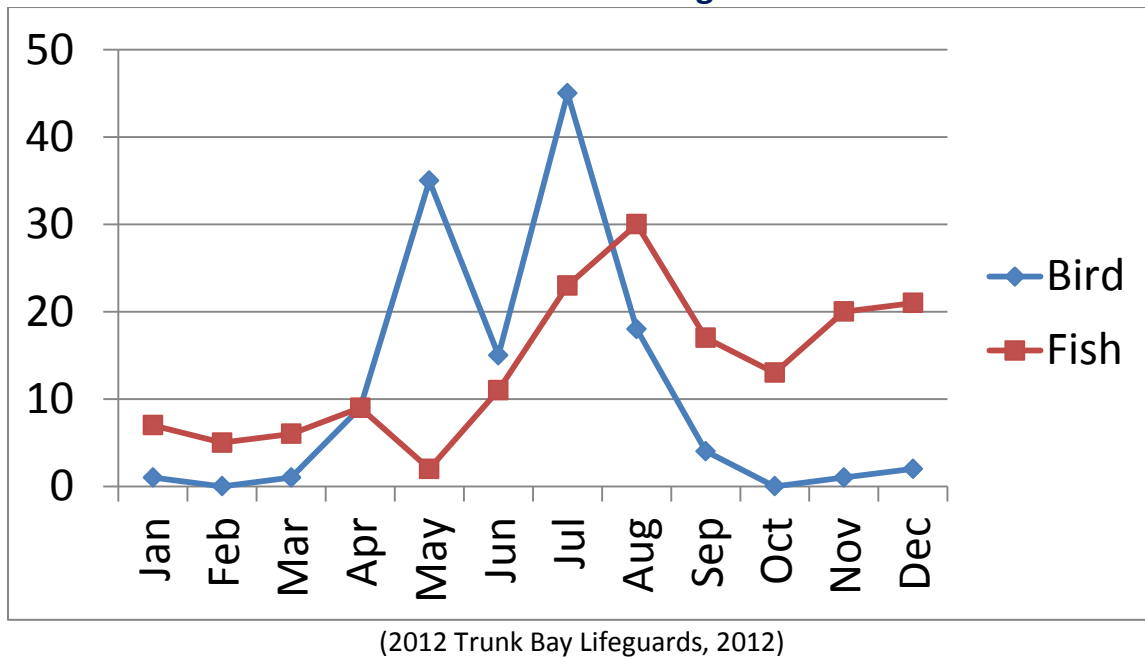


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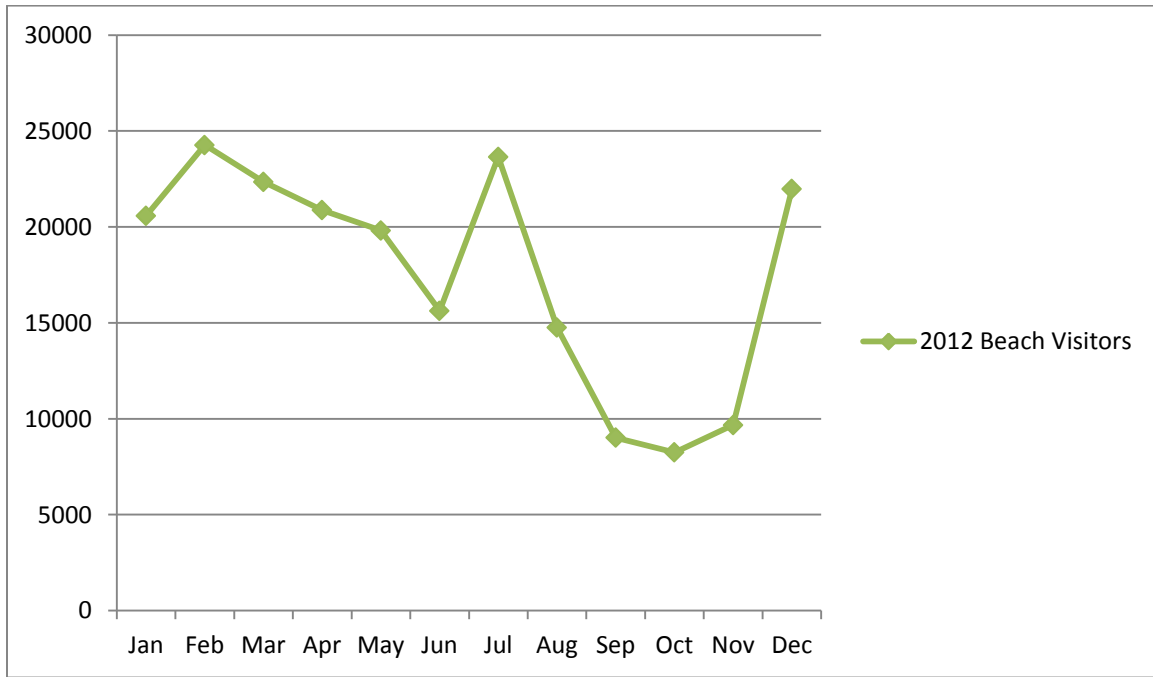
2011 Beach Visitors



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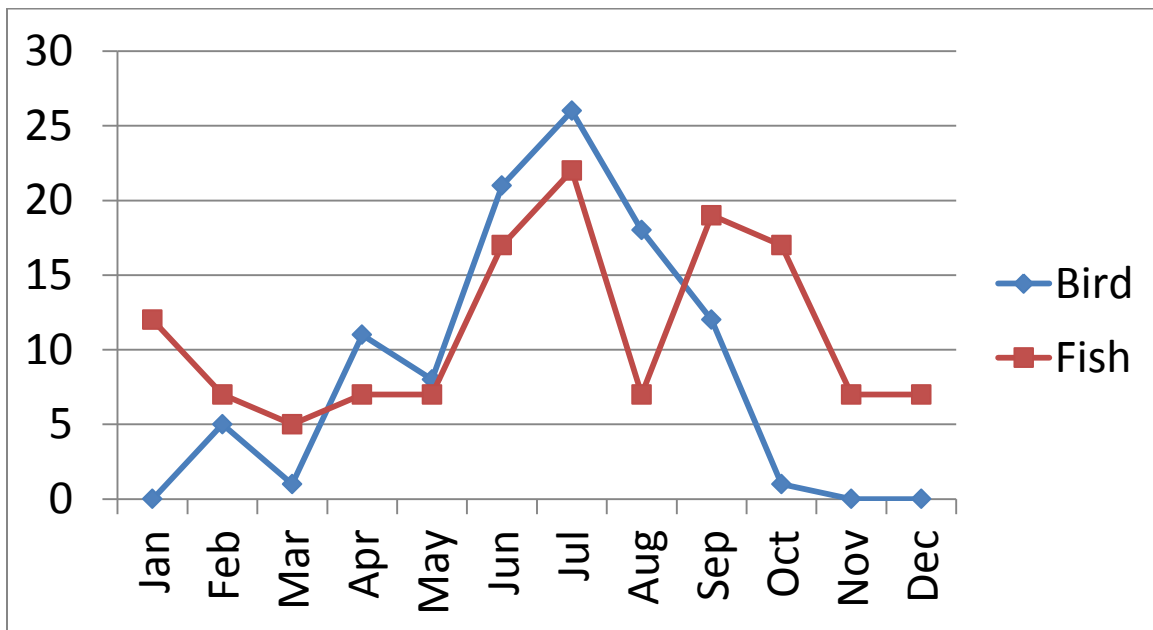


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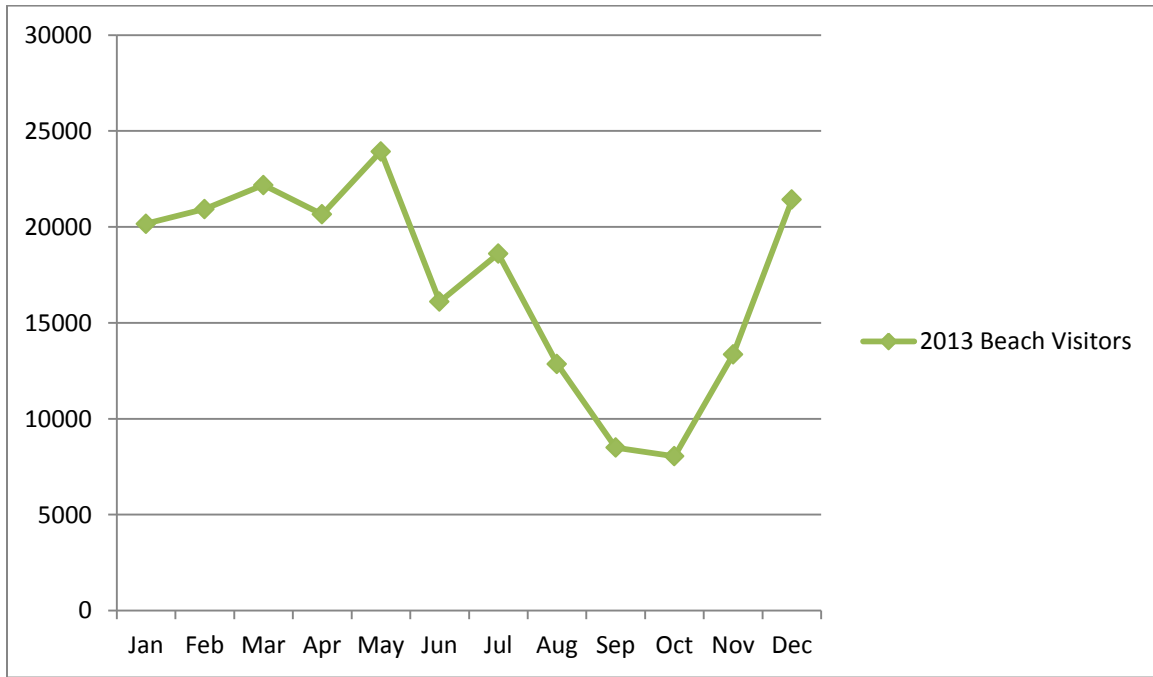
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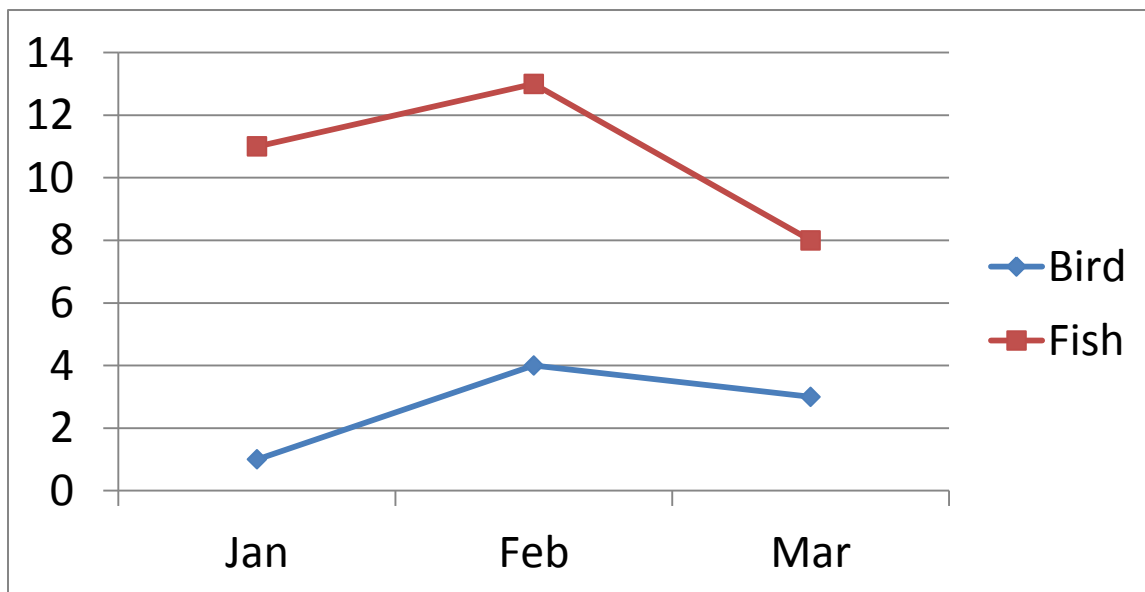


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2013 Beach Visitors

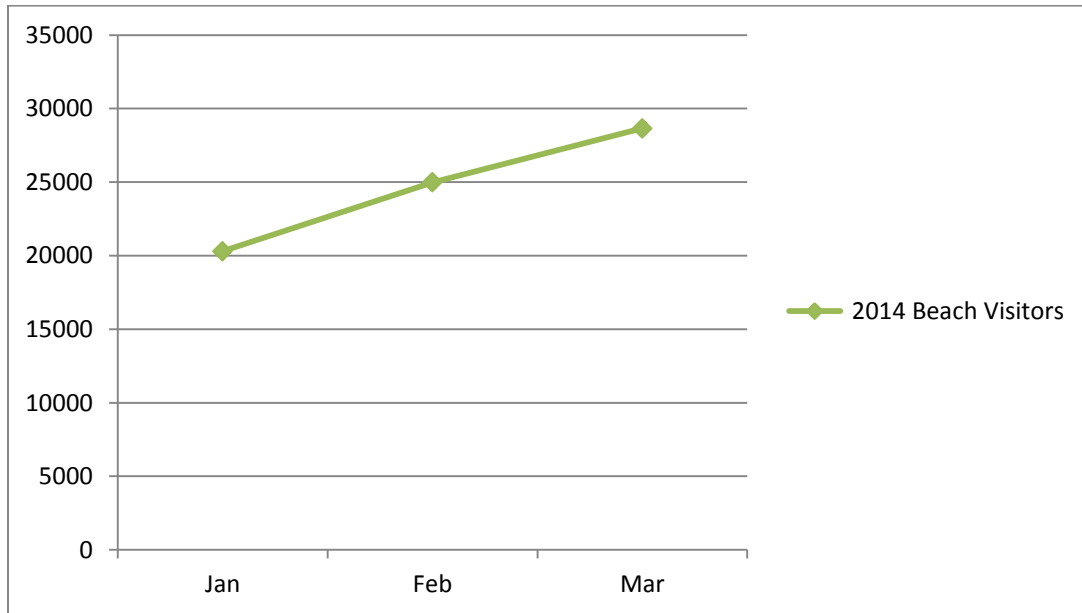


2014 Bird and Fish Feeding Numbers



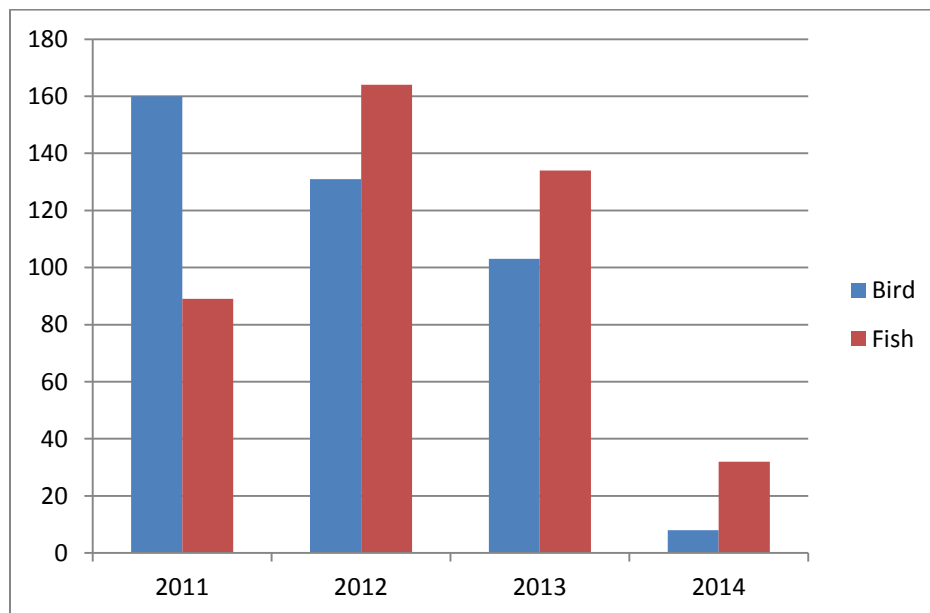
(2014 Trunk Bay Lifeguards, 2014)

2014 Beach Visitors



(NPS IRMA, 2014)

Bird and Fish Feeding Totals 2011-14



(Trunk Bay Lifeguard Logs 2011-2014)