Anthrozoology and Public Perception: Humans and Great White Sharks (*Carchardon carcharias*) on Cape Cod, Massachusetts, USA

Jessica O'Toole

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Marine Affairs

University of Washington
2020

Committee:
Marc L. Miller, Chair
Vincent F. Gallucci

Program Authorized to Offer Degree
School of Marine and Environmental Affairs

University of Washington

Abstract

Anthrozoology and Public Perception: Humans and Great White Sharks (*Carchardon carcharias*) on Cape Cod, Massachusetts, USA

Jessica O'Toole

Chair of the Supervisory Committee:
Dr. Marc L. Miller
School of Marine and Environmental Affairs

Anthrozoology is a relatively new field of study in the world of academia. This discipline, which includes researchers ranging from social studies to natural sciences, examines human-animal interactions. Understanding what affect these interactions have on a person's perception of a species could be used to create better conservation strategies and policies. This thesis uses a mixed qualitative methodology to examine the public perception of great white sharks on Cape Cod, Massachusetts. While the area has a history of shark interactions, a shark related death in 2018 forced many people to re-evaluate how they view sharks. Not only did people express both positive and negative perceptions of the animals but they also discussed how the attack caused them to change their behavior in and around the ocean. Residents also acknowledged that the sharks were not the only problem living in the ocean. They often blame seals for the shark attacks, while also claiming they are a threat to the fishing industry. The results of this study can be used to determine future strategies and policies as Cape Cod continues to navigate the increasing shark population.

Acknowledgments

I would like to thank Professor Marc L. Miller, Professor Vincent F. Gallucci, and Manjari Misra for all their guidance and assistance on this thesis. I really appreciate your help and insight as I navigated this new field of anthrozoology. Also, thank you to all my family, friends, and SMEA cohort and community who have supported me the last two years. You are all amazing! I especially want to thank my parents, Donna and Patrick, and my brother Bryan for constantly pushing me achieve my goals and supporting me every step of the way.

Table of Contents

List of Tables and Figures

Tables:

Figures:

Introduction

The field of marine and environmental affairs is a broad discipline concerning issues in marine and environmental policy and management. This includes such topics as marine and coastal law, fisheries resource management, environmental justice, and many more. Recently, another area of study has emerged in the field of marine and environmental affairs, known as anthrozoology. Anthrozoology is the study of human-animal interactions and while relatively new in academia, it has actually been around for centuries. Since its official debut in the academic world in the 1970s, anthrozoology has continued to grow in both the social and natural sciences. The study's insight into human behavior makes it a valuable tool in creating conservation strategies and policy decisions. Anthrozoology can also help researchers understand how interactions with animals influence peoples' perceptions of the species.

An example of this can be seen with the great white sharks off the coast of Cape Cod, Massachusetts. Like other coastal communities in the United States, the Cape has a long history of shark interactions. These interactions have been both direct and indirect, ranging from great whites biting paddleboards to shark themed art festivals. In September 2018, a bodyboarder off the shore of Newcomb Hollow Beach on Cape Cod was bitten by a great white shark. Unfortunately he died of his injuries, becoming the first person to die of a shark attack on Cape Cod in over 80 years. Given this history of interactions and the recent shark attack, this thesis looks to understand what the public perception of sharks is on Cape Cod by asking three research questions: How are sharks understood by people, how do sharks influence people's behavior, and what other sharks issues are salient in people's minds?

The Plan of This Thesis

This thesis examines the field of human-animal interactions and the perceptions of sharks on Cape Cod. Chapter 1 introduces the field of anthrozoology, examining its history, definitions, and role in academia. Chapter 2 looks at the biology and management of sharks with a focus on the great white. Chapter 3 dives into the world of anthrozoology and sharks, looking at how human-shark interactions have shaped human life over time. In Chapter 4 the history of Cape Cod is discussed as well as the area's past interactions with sharks, focusing once again on the great white. Chapter 5 remarks on the mixed qualitative method approach that was used to collect the data for this thesis. Research results are presented in Chapter 6, while the significance of these results is assessed in Chapter 7. An Autoethnographic Note in the appendix section highlights my personal experience as a young, female researcher in the field and the influence this may have had on my work.

"They are wrong about our departure, thinking it to be part of their progress instead of their emptying. When we have gone they will not know who they are."

--Paul Shepard,
The Others: How Animals Made Us Human (1997), p. 333.

Chapter 1: Anthrozoology

Anthrozoology is the study of human and nonhuman animal (henceforth referred to as "animal") interactions. It is often used simultaneously with the term human-animal studies (HAS) or human-animal interactions (HAI). Anthrozoology is an interdisciplinary field which, "Transcends normal academic boundaries" (Herzog, 2010, p. 17). Anthrozoology researchers represent a large range of different fields[1] including biology, psychology, anthropology, history, and marketing. As a field of study, anthrozoology aims to examine the influence animals can have on human life and raises questions that evoke emotional reactions and explore what is morally acceptable (Herzog, 2010). This includes such topics as is it okay to feed a kitten to a boa constrictor or should you eat your pet dog after it dies?

1.1: History of Anthrozoology

Anthrozoology is still considered a relatively new field of study, with interest in the field beginning in the 1970s. However, humans have been interacting with animals since the dawn of mankind (York 2013). These interactions have included hunting animals, being hunted by them, using them as tools or trade, eating them, and domesticating them. There have also been less direct forms of interaction which include worshiping animal deities and using them for inspiration in stories, songs, and myths. Their influence on humans can be seen throughout history; from cave paintings and animal headed gods to superhero names and sports mascots. Books on animals can be traced throughout the centuries, starting with Aristotle's zoology book *Historia animalium* (History of the Animals), which was written in the 4th century (Dunn 2006). However, it was not until the late 1900s that researchers really started to focus on studying these interactions and anthrozoology became an academic discipline.

Some contribute this sudden academic interest to the rise of the animal protection movement. Books like *Animal Liberation* by Peter Singer and *The Case for Animal Rights* by Tom Regan, published in 1975 and 1983

[1] For a more complete list of disciplines represented in anthrozoology see Appendix I.

respectively, helped spread the philosophical debate of animal welfare and ethics throughout the general public and academia. Historical books on attitudes towards animals also started appearing at this time, starting with Keith Thomas' *Man and the Natural World: A History of the Modern Sensibility* (1983) and Robert Darnton's *The Great Cat Massacre and Other Episodes in French Cultural History* (1984). Six other books[2] were also published throughout the 1980s touching on both past and present anthrozoological topics, which helped to further expand this growing field (Demello, 2012).

In 1987, a new peer-reviewed journal called *Anthrozoös* was established. Its goal was, "To address the characteristics and consequences of interactions and relationships between people and non-human animals across areas as varied as anthropology, ethology, medicine, psychology, veterinary medicine, and zoology" (Anthrozoös, 2019). It became one of the first sources for academic discussion on anthrozoology and paved the way for other journals and groups.

One such group is the International Society of Anthrozoology (ISAZ), formed in 1991. As this new field began emerging, researchers such as Lynette and Benjamin Hart (Veterinary Science), Dennis Turner (Animal Behavior), Erika Friedmann (Nursing), John Bradshaw (Animal Behavior), and James Serpell (Veterinary Science), felt a need for colleagues to get together and support each other as they traversed into uncharted territory. The ISAZ continues to this day with the aim to, "Promote the study of human-animal interactions and relationships, by encouraging and publishing research, holding meetings, and dissemination and exchanging information" (ISAZ brochure, 2009).

1.2: Definitions

As the field grew, the term "anthrozoology" came to mean more than just human-animal interactions, with many researchers expanding on this original definition. An example of this can be seen in Samantha Hurn's definition:

> "The multi- and inter-disciplinary study of the many and varied ways in which humans interact with and think about other-than-human animals" (Hurn, 2015, p. 179).

[2] These books include Coral Lansbury's *The Old Brown Dog: Women, Workers, and Vivisection in Edwardian England* (1985), Harriet Ritvo's *The Animal Estate* (1987), J.M. Mackenzie *The Empire of Nature: Hunting, Conservation and British Imperialism* (1988), James Serpell's *In the Company of Animals* (1986), Yi-Fu Tuan's *Dominance and Affection: The Making of Pets* (1984), and Donna Haraway's *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (1989) (Delmello, 2012).

Hurn describes anthrozoology as a way people think and engage with animals. As a social anthropologist studying human-wildlife conflict and conservation, Hurn's definition focuses more on the human side of anthrozoology.

In Michael Tobias and Jane Morrison's book *Anthrozoology: Embracing Co-Existence in the Anthropocene,* they emphasis the animal, or "other species", side of anthrozoology. They do this by placing humans into the animal's world and using the definition, "The role of humans amid a remarkable profusion of other species" (Tobias & Morrison, 2017, p. 2). The authors further discuss the human reliance on their animal counterparts and how it is important to recognize these relationships instead of remaining ignorant:

> "Our relationships with these Others are fraught with an order of complexity we should have become accustomed to during our past 200,000 years. But most of the social integuments linking our kind have been severed even though we remain biologically interdependent upon every last one of them, whether the majority of people acknowledge that or not" (Tobias & Morrison, 2017, p. 6).

> "This near universally human belief system constitutes nothing less than a deeply flawed and pernicious bias predicated on the brink of our species' self-destruction. The continuing insistence upon ourselves as the ultimate agents of knowledge has only given escalating pall to a most devious, indeed ruinous proposition. We either recognize the miracle of sentient, sapient, self-reflective, and intentional morality all around us – an infinity of feelings, sophistication, and genius in Others (all other species and individuals of those species) – or risk enshrining the shortest-lived epitaph of most likely any known vertebrate species in Earth history" (Tobias & Morrison, 2017, p. xiii).

Tobias and Morrison stress the importance of understanding the influence animals have had on humankind and the role they had in our progression as a species. They view anthrozoology as a need for communication, not just between other people but also allowing humans to *listen* to the animals themselves.

1.3: Human-Animal Studies

As the field of anthrozoology continued to develop, other names began to appear. The term human-animal studies (HAS) began to be used interchangeable with anthrozoology in 1993 when another

anthrozoological journal, *Society & Animals*, was created (Knoth, 2019). The journal describes HAS as, "The ways in which nonhuman animals figure in human lives" (Society & Animals, 2019).

Just like the term "anthrozoology", HAS can have a variety of different definitions depending on how the researcher interrupts "human-animal interactions". Birke and Hockenhull believe HAS, "Embodies a sustained interest in understanding and analyzing how we humans relate to and make sense on other species" (Birke & Hockenhull, 2012, p. 3). Similarly, in her book *Animals and Society: An Introduction to Human-Animal Studies*, Margo DeMello describes HAS as looking at the way animals fit into human lives, focusing on a more human centric world:

> "Human-animal studies (HAS) – sometimes known as anthrozoology or animal studies- is an interdisciplinary field that explores the spaces that animals occupy in human social and cultural worlds and the interactions humans have with them. Central to this field is an exploration of the ways in which animal lives intersect with human societies" (DeMello, 2012, p. 4).

With many different names and definitions, it is easy to lose sight of what makes HAS its own unique field of research. Clif Flynn, a sociology professor from University of South Carolina Upstate, touches on this distinction in his book *Social Creatures: A Human and Animal Studies Reader*:

> "HAS is not biology or animal behavior. There the focus is on the animals in a technical and specific way – their habitat, their feeding habits, their reproduction patterns, etc. – and particular, on their characteristics as a species, not as individuals. Neither is the emphasis on the other animals' social relationship with human animals. Similarly, those who study animal science or welfare center on how the use of animals for human purposes can be improved. Other disciplines or studies that approach animals on the periphery, as commodities, as passive objects, as tools, as property – without examining and questioning those statuses, without respecting their lives, and without attempting to understand ourselves via investigations of our relationships with other animals – cannot legitimates be considered Human-Animal Studies" (Flynn, 2008, p. xvi).

Flynn shows in this description that, while related to many different fields of study, there is a distinct difference between HAS and other natural or social sciences; there is an emphasis on animal rights and concern for how animals influence human life.

1.4: Interactions, Relationships, and Bonds

While some researchers use the terms anthrozoology and HAS interchangeably, others argue there is a discipline bias between the two. An example of this distinction can be seen in DeMello's definitions. She defines anthrozoology as, "The *scientific study* of human-animal interaction and the human-animal bond" and HAS as, "The *study* of the interactions and relationships between human and nonhuman animals" (Demello, 2012, p. 5). Hosey and Melfi also argue there is a difference between the two: "Anthrozoology more commonly used in the natural sciences and HAS in the humanities" (Hosey & Melfi, 2018, pp. 1-2). The authors then go on to further explain that the field human-animal studies can be broken into three main categories: Human-animal interactions (HAIs), human-animal relationships (HARs), and human-animal bonds (HABs).

HAIs are the most basic and common form of the three groups described by Hosey and Melfi, requiring a minimum of one human and one animal. With the size and range of the human population it is unlikely that any person has lived their life without interacting with an animal at least once. Whether it be owning a pet, going hunting, or even just tripping over a pigeon on a crowded city sidewalk. Most HAIs are quick, occurring once or even a few times between individuals. If these interactions continue to occur, they can lead to a HARs (Hosey & Melfi, 2018).

HARs can form when a human and animal interact with each other frequently enough to, "Attain such a familiarity that they can start to anticipate what the other is likely to do" (Hosey & Melfi, 2018, p. 3). These relationships can be seen in settings such as zoos, where routines are created between the two parties and there are generalized expectations on how the other individual will act. HARs are not always positive, or beneficial for both parties. Negative HARs can be seen in a lot in urban settings between people and "pest" animals, such as racoons, foxes, and groundhogs, which can cause damage to human goods. However, good HARs can further develop into HABs as individuals form emotional attachments to one another, which then lead to emotional benefits in the human and/or animal.

HABs are defined by the American Veterinary Medical Association as:

> "A mutually beneficial and dynamic relationship between people and animals that is influenced by behaviors that are essential to the health and well-being of both. This includes, but not limited to, emotional, psychological, and physical interactions of people, animals, and their environment" (American Veterinary Medical Association, 1998).

HABs are typically seen between humans and their companion animals or pets, where long lasting emotional attachments that can survive short term separation are formed (Hosey & Melfi, 2019). This section of HAS can be particularly difficult to study based on the requirement of an emotional bond being formed between the human and animal. While many pet owners tend to show emotional cues, such as grief over an animal's passing, these "feelings" are not as easily measured in the animals themselves.

1.5: Crossing Boundaries

The lack of a singular definition for both anthrozoology and HAS is most likely due to the interdisciplinary nature of the field and the wide range of academic backgrounds represented. As the psychologist Hal Herzog states:

> "Among our numbers are psychologist, veterinarians, animal behaviorists, historians, sociologist, and anthropologist. As in every science, anthrozoologists don't always see eye to eye. We differ in our attitudes toward some of the thorny moral issues that arise in human-animal relationships. We don't even agree on the name of our discipline. (Some prefer to call it human-animal studies). But, despite these differences, researchers who study our relationship with animals have a lot in common. We all believe that our interactions with other species are an important component of human life and hope our research might make the lives of animals better." (Herzog, 2010, p. 17)

1.6: Paul Shepard

The epigraph beginning this chapter came from an excellent literary example of human animal interactions written by Paul Shepard called *The Others: How Animals Made Us Human.* Shepard, an

environmentalist with a PhD in conservation, landscape architecture, and history of art, was one of the founding fathers of modern day anthrozoology, even though he never used the term. He wrote *The Others* as a way to show how humans have been shaped by animals throughout history. The book begins by revealing how interactions with animals, or the others as they are referred to, helped shape humans as a newly formed species:

> "The circumstances in which a series of large carnivores and herbivores became more thoughtful, by watching, pursuing, evading, stalking, hiding, mimicking, and otherwise seeking to comprehend and anticipate each other, set the stage and the terms of our presence, as though we had won a role in a play that had been running for years or married into an ancient lineage." (Shepard, 1996, p. 21)

Although plagued with a diminished sense of smell and hearing, human ancestors instead brought with them large brains and social relations. Due to this, they were able to fill a niche in the environmental world which was originally unoccupied.

Shepard goes on to describe other ways animals have influenced human ancestors as they continued to evolve and grow as a species. Animal voices found their way into human songs, their faces on gods and masks, their movements in dances, and their images in art. As time went on humans began to leave the natural world behind. The others in their wild forms were replaced with domesticated versions of themselves. Humans began to build houses and cities, separating themselves further from the wild and pushing out everything that once defined them:

> "Thus as agriculture and cities came into existence and slowly encroached upon the forager's world, between ten and five thousand years ago, the bear and lion, slow to reproduce, not being herd-follower or placid munchers of hay, unsuited for domestication, could not minister to the new ethos." (Shepard, 1996, p. 212)

In time humans began to fear and hate these wild others; these animals would kill livestock, transmit disease, and rob gardens. Shepard argues that as this separation from the natural world continues, it will not only result in losing the others but losing a piece of what it means to be human as well.

Shepard ends his book with a letter addressed, "Dearest Primate P. Shepard and Interested Parties" (Shepard, 1996, p. 331). In it the authors, the Forest, the Sea, the Desert, and the Prairie, recount their history

with mankind, starting at the birth of the species. They talk of the gifts they have given humans, such as dance, esthetics, and food, and the things they taught people like puzzling, remembering, and planning. In imperfect domesticated forms they have stayed with humans, trying to help them make a connection to the otherness; to something they have lost over the years. Humans have turned their backs on animals and abused and used them, yet the creatures know it will be the people that will suffer in the end. They help humans define who they are and understand their place in the world, and when they are gone humans will not know who they are (Shepard, 1996).

1.7: Chapter Summary

As discussed in this chapter, anthrozoology remains a fairly recent field of study. Due to its interdisciplinary nature there is no one clear, universal definition for exactly what "anthrozoology" is. The name of the field itself can also differ depending on the discipline of the researcher. While definitions and names may change from person to person, all anthrozoological research shares similar themes - respect for the animals and an interest in how they influence the lives of humans. Researchers understand the important role animals play in human lives. They recognize that, "Whether the goal is to conserve or consume them, talk to or train them, befriend or master them – animals matter to us. They have always mattered to us" (Noyes 2006, p. v). For the purpose of this thesis the term "anthrozoology" encompasses both anthrozoology and human-animal studies. It is defined as the interaction between humans and animals with a focus of how these interactions influence human lives. This can include human behavior, attitudes, perceptions, and decision making. At the end of the chapter Paul Shepard and his book *The Others: How Animals Made Us Human* and its relation to anthrozoology was also discussed. His book looks at how animals have influenced humans since their beginning and how the loss of the others will also mean a loss of human identity.

"As the fish drew nearer, he marveled at its colors: the flat brown-greys seen on the surface had vanished. The top of the immense body was a hard ferrous gray, bluish where dappled with streaks of sun. Beneath the lateral line, all was creamy, ghostly white."

-- Peter Benchley
Jaws (1974), p. 285.

Chapter 2: Biology and Management of Sharks

Sharks are older than most people think, first appearing in the Devonian period around 400 million years ago (mya) and predating dinosaurs. The oldest intact shark fossil dates back 408 mya, with sharks becoming more common in the middle of the Devonian period around 380 mya (Klimley, 2013). Between 360-286 mya many different shark species started to emerge, with the first modern day species showing up around 200-145 mya (Eilperin, 2011). Today there are 503 known species of sharks classified into 31 different families (Klimley, 2013) and eight different orders: Frilled/cow sharks (*Hexanchiformes*), dogfish (*Squaliformes*), saw sharks (*Pristiophoriformes*), angel sharks (*Squatiniformes*), bullhead sharks (*Heterodontiformes*), carpet sharks (*Orectolobiformes*), mackerel sharks (*Lamniformes*), and ground sharks (*Caracharhiniformes*) (De Maddalena & Walter, 2010). These different species of sharks can be found in every ocean and are managed on a local, regional, national, and international level.

2.1: Biology

Physical Characteristics

Sharks, along with rays, skates, and chimaeras, belong to the class Chondrichthyes, meaning their skeletons are made of cartilage instead of bone. This cartilage is more flexible and lighter than bone but still supplies strong support for the animal. While sharks have a reputation of being large apex predators, species can actually range dramatically in size, with about half of all sharks growing less than 3 feet. The largest species, the whale shark, can reach a length of almost 40 feet while the smallest, the dwarf lanternshark, only grows to around 8 inches (The Ocean Portal Team, 2018). However, despite these size differences females tend to grow larger than males in most species. Sharks typically live around 12-27 years, though some species have been known to live over 100 years. The Greenland shark, the world's longest-living vertebrate, is estimated to live between 300-500 years with females not reaching sexual maturity till over 100 years of age (Nielsen, 2017)

Most sharks have torpedo shaped bodies with 8 fins used for steering, propulsion, and stability: A caudal (tail) and anal fin as well as two dorsal, pectoral, and pelvic fins (*Fig. 2.1*). The dorsal and anal fins help to reduce the swaying motion caused by the tail as it moves side to side, pushing the shark forward, while the pectoral and pelvic fins keep the body from rotating or rolling (Klimley, 2013). There are two different types of pectoral fins found among sharks. The plesodic fin, which is stiffer, allows for greater swimming speed and makes the shark more hydrodynamic. This type of fin is found in more pelagic (open water) sharks, such as the shortfin mako. The aplesodic fin is more flexible with greater movability, allowing these sharks to move through more confined spaces as seen in some benthic environments located on the ocean floor (Klimley, 2013). Sharks with this type of fin include the bamboo and epaulette shark. The caudal fin on most sharks is asymmetric, with the upper lobe being larger. This larger upper lobe pushes water down as it moves side to side, helping to generate lift as well as propel the shark forward. The upward force created by the fin is important because sharks lack a swim bladder, which allows bony fish to stay afloat in the water column. This lift, along with their lighter cartilaginous skeleton and large oil filled livers, helps sharks stay buoyant (De Maddalena & Walter, 2010).

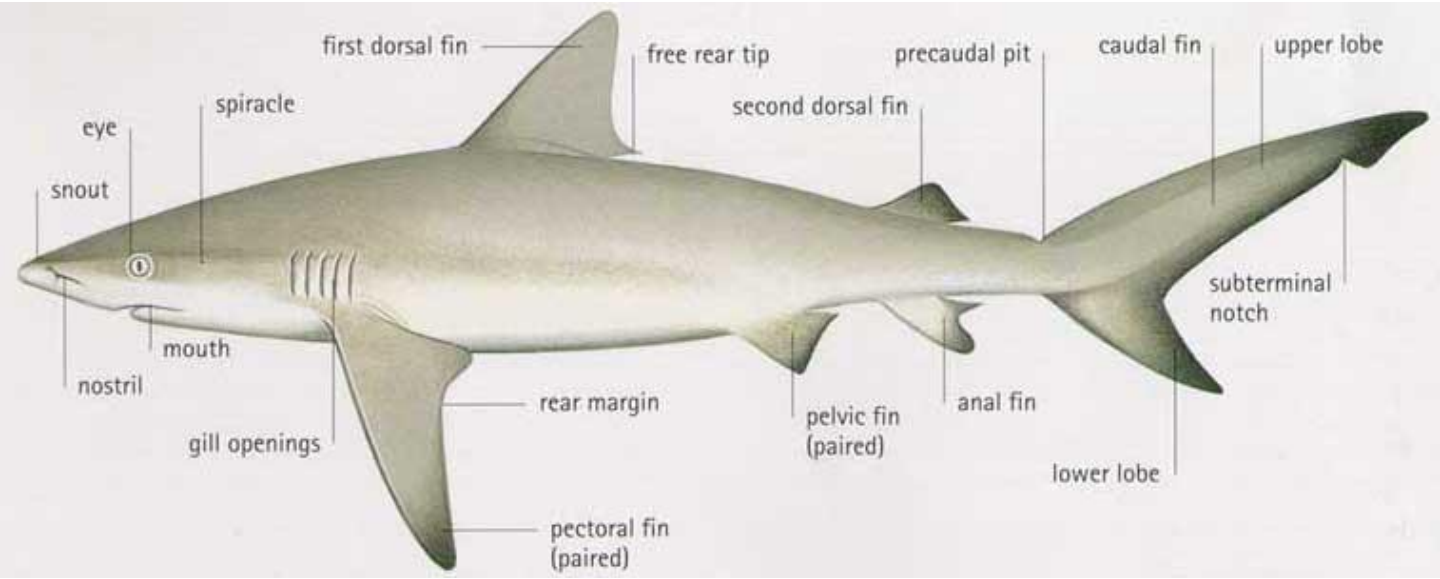

Figure 2.1: A simple diagram of a shark. Credit: Government of Canada

Sharks typically have 5 gill slits on either side of their body, though a few species can have up to 7 (Klimley, 2013). Bony fish possess a modified gill cover called an operculum, which helps move water over their gills and allows fish to breath without moving around. This operculum is absent on sharks, leading to different types of respiratory strategies. Most sharks must constantly move forward in order to breath. These species swim with their mouths open, allowing water to flow through the pharynx and over their gills in a

process called ram ventilation (De Maddalena & Walter, 2010). More benthic species have small gill slits located behind their eyes called spiracles, which allows water to flow through them and over the gills through a process called buccal pumping (Eilperin, 2011). With this process sharks can breathe without constantly having to swim, allowing them to sit on the sea floor or bury themselves in the sand.

One aspect that sharks are usually known for is their sharp teeth. These teeth are connected to the jaw by soft tissue and are continuously falling out and being replaced. This frequent replacement keeps the teeth sharp, not allowing them to be worn down over time (Eilperin, 2011). The rate a shark loses its teeth can be determined by diet. Teeth usually fall out during feeding, either getting knocked out or stuck in the shark's prey (Klimley, 2130). Sharks can grow 5 to 15 rows of teeth with teeth shape differing between species based of their diet. Sharp, triangular teeth, which may be serrated, are used to saw off pieces of flesh from large prey. Long, narrow, and curved teeth help catch small fast-moving prey while smooth and flat teeth crush food like crustaceans (De Maddalena & Walter, 2010). These teeth can also differ between the upper and lower jaw, with teeth on the lower jaw being smaller and narrower. The teeth in the back of the jaw may also be smaller or flatter than the teeth in the front. As some sharks grow their diet will change, resulting in a change of teeth shape as well (De Maddalena & Walter, 2010)

Sharks have directionally rough skin covered in tough scales called dermal denticles. These scales are actually modified teeth covered in enamel and are typically pointed toward the tail end of the shark. This helps to reduce friction as a shark swims through the water (Eilperin, 2011). The shape and size of these denticles can differ between species. Fast swimming sharks have smaller, lighter, and thinner denticles that are densely arranged while less active species have fewer, thicker, heavier denticles that are more spread out (Klimley, 2013). While thinner denticles allow for greater speed they also offer the shark less protection. Like a shark's teeth these scales are also replaced regularly (Eilperin, 2011).

A shark's circulatory system contains a single loop with a 2 chambered heart (De Maddalena & Walter, 2010). Like other fish, most sharks are ectothermic (cold blooded). This means their body temperature is the same as the surrounding water, which lowers the amount of energy used to retain body heat. However, some species of sharks have regional endothermy (warm-bloodedness) allowing them to maintain body heat (De Maddalena & Walter, 2010). This is possible due to a collection of arteries and veins known as the rete mirabile which helps retain heat through a countercurrent exchange. These sharks, found in the order Lamniformes, include species such as the shortfin mako and porbeagle (Carey, Teal, & Kanwisher, 1981).

These endothermic species tend to have large amounts of red muscle compared to the ectothermic species, which have more white muscle. This red muscle generates heat when used and allows for continuous activity over a long period of time. White muscle is better for quick bursts of energy but limited in its use by

the buildup of lactic acid (Klimley, 2013). While ectothermic species spend less energy regulating body temperature they are limited in movement by a lack of red muscle, needing to swim more slowly and spending most of their time at rest. Endothermic sharks tend to have more energy, be more powerful, and swim faster than ectothermic sharks (De Maddalena & Walter, 2010).

Senses

Sharks rely on four main senses when hunting and navigating their environment: Photoreception, mechanoreception, electroreception, and chemoreception. The strength of these senses can vary between species due to hunting habits and the surrounding environment. Photoreception refers to a shark's vision and their ability to detect light, which is extremely important due to ocean's capacity to absorb light. The blue color of the ocean comes from the fact that blue light penetrates more deeply than any other color in the spectrum, followed closely by the color green (Johnsen & Sosik, 2005). As a result, many adult sharks are sensitive to blue light, allowing them to maximize the light that enters the open ocean. The eyes of juvenile sharks and adult species that live in near shore habitats tend to be more sensitive to green light, adapting to the more nutrient rich waters (Collin, 2018).

Sharks can see in both bright and dim light, allowing them to navigate during either the day or night, as well as traverse different depths (Klimley, 2013). Their eyes also have a tapetum lucidum, a reflective surface behind the retinas, which allows for greater light sensitivity and gives their eyes a glowing appearance at night (Gruber, 1977). The size, shape, and location of a shark's eyes can differ between species and their environment. Deep water sharks tend to have larger eyes than near surface sharks, allowing them to absorb what little light there is in the dim or near dark conditions of their habitat. The pupils of a shark's eye can also change size with different light conditions, becoming rounder in low light and more slit like in high light (Klimley, 2013). This can be seen in species living near the surface or traveling up and down in the water column. Since light conditions do not change as rapidly or frequently in deep water, deep sea sharks tend to have round, wide pupils that don't change size very often (Klimley, 2013). The eyes of pelagic sharks tend to be more on the side of their head, allowing them a greater range of vision not only around them but above and below as well. In contrast, the eyes of benthic sharks are typically closer to the top of their head, as they rarely need to see below them (Klimley, 2013). Although sharks have immoveable eyelids, many have a third eyelid called the nictitating membrane that does move. This membrane extends from the bottom of the eye and protects it when the shark bumps into something or is eating. For species, like the great white, that are missing this membrane they will usually roll their eye to the back of their head for protection (De Maddalena & Walter, 2010).

In addition to photoreception sharks also use mechanoreception, which is a sensitivity to pressure and sound changes in their environment. Like humans, sharks can hear a range of sound frequencies, but tend to be more attuned to lower frequencies as those travel further in water. This allows them to detect the low frequency distress signals used by injured or struggling fish from far away (Klimley, 2013). Sharks also have a group of sensory organs along the side of their body called a lateral line. This line, that stretches from their snout to their tail, senses pressure changes and can detect both the intensity and direction of the change, as well as the surrounding water currents (De Maddalena & Walter, 2010). Touch receptors along the shark's body can also help it identify objects. Bumping into potential prey can help a shark determine its size and strength before it attacks (De Maddalena & Walter, 2010).

A shark's ability to sense electric currents in the water is referred to as electroreception. Saltwater is a good conductor of electricity, allowing sharks to detect the electric currents produced by other animals as they move and draw saltwater over their gills (Klimley, 2013). Some species, like the hammerhead, use this skill to find food that may be buried in the sand (De Maddalena & Walter, 2010). This ability to sense electric currents is due to a group of jelly-filled pores located on the shark's rostrum (nose), called the ampullae of Lorenzini (Klimley, 2013). Not only can these receptors detect prey, they can also sense the Earth's magnetic field, allowing sharks to navigate their environment and travel in relatively straight lines across open ocean (Klimley, 2013).

Sharks are probably most known for their sense of smell, especially when it comes to blood. Though despite what Hollywood would want people to believe, not all sharks are sensitive to blood. Some species are actually attracted to the amino acids found in the body fluids of their prey or the smell of decomposing flesh (Klimley, 2013). The strength of a shark's sense of smell and taste, referred to as chemoreception, can also differ between species as some sharks rely on it more heavily than others to find food. While using their sense of smell to hunt sharks use their nostrils independently, allowing them to detect any differences in strength as a smell hits each nostril. This technique, referred to as "smelling in stereo", allows the shark to detect from which direction the smell is coming from (Eilperin, 2011, p. xvii). The nares (nostrils) of slower moving or sedentary species tend to be large and round, allowing maximum water flow. More active, fast swimming sharks have narrow slit-like nares covered with flaps to reduce the amount of water that flows in during high speeds (Klimley, 2013)

Reproduction

The mating habitats of sharks are not as well documented or understood as other animals. While all sharks reproduced internally, with the male inserting its claspers into a female's cloaca, mating rituals can differ between species (Klimley, 2013). Some male sharks use biting as a way to gain a female's attention, keep a prospective mate from escaping their advances, or support themselves during sex. Due to this, the females of these species, like the blue shark, have tougher and thicker skin than their male counter parts, which helps reduce their injuries during mating (Klimley, 2013). Gestation in sharks can range between 9 and 12 months (Ellis, et al., 2015), although some sharks, like the spiny dogfish, can go as long as 20-25 months (Gallucci et al., 2009). When the pups (babies) are born they resemble the adults and are completely self-sufficient and are able to hunt and feed on their own. Litter sizes can range between 1 and 130 young, with the average being around 20 individuals (De Maddalena & Walter, 2010)

There are two different modes of reproduction among shark species, oviparity and viviparity (Klimley, 2013). Oviparity is the process of the young being developed in and hatching from an external egg. These eggs have a tough, leathery like exterior and are released alone or in groups. This type of reproduction is common in smaller sharks and allows them to produce more young per year (Klimley, 2013). Viviparity can be separated into two types, placental and aplacental viviparity, and produces pups that are typically larger but fewer in number than those born through oviparity. Young born through placental viviparity develop inside the female's womb, living off her placenta and connected to the mother through an umbilical cord. In aplacental viviparity, also known as ovoviviparity, the young develop inside eggs while still inside their mother, feeding off the egg yolk instead of the placenta. These pups will hatch from the eggs before they are released by the mother (Klimley, 2013). Aplacental viviparity is the most common type of reproduction among shark species (De Maddalena & Walter, 2010). Some species of sharks can also reproduce asexually through a process called parthenogenesis. In these instances, which have been recorded at aquariums, female sharks are able to produce young in the absence of a male (Eilperin, 2011). These "virgin births", which they are often referred to as, produce pups that are genetic clones of their mothers. This can be beneficial for some species by helping to rebuild their populations. Due to segregation between sexes and the declining population numbers worldwide, some sharks may have trouble finding mates to reproduce with, leaving parthenogenesis as the only reproductive option. However, this also has a negative effect on the species by reducing the amount of new genetic information being introduction into the population (Holtcamp, 2009).

While still in the womb, pups can actually preform two different forms of cannibalism. Oophagous occurs when unborn pups eat their mother's unfertilized eggs. These types of sharks, like the shortfin mako, are born with smaller egg yolks, which means they require another food source before being born (Klimley,

2013). Embryophagous is when the pup eats not only the unfertilized eggs but also the unborn embryos of its siblings before being born. This can be seen in species like the sand tiger shark, where only one surviving pup is born. These methods, while limiting the number of pups, produce larger offspring than other methods (De Maddalena & Walter, 2010).

Diet

Although all sharks are carnivores their diets can differ drastically between species, ranging from small zooplankton to large marine mammals. Even within a single species diets can vary depending on age, sex, and location of an individual (Klimley, 2013). The main source of food for sharks is bony fish, though some species specialize in crustaceans, plankton, and other cartilaginous fish like rays and skates. However, sharks will eat almost anything, feeding on both live and dead prey as well as trash and debris (McKeever, 2019). Many species are nocturnal hunters, resting during the day before venturing out to hunt at night. Though some opportunistic feeders will also eat during the day (De Maddalena & Walter, 2010). Sharks have large stomachs, allowing them to eat sizeable chunks of food at a time or even whole animals. Their digestion process can be long compared to bony fish, with some sharks taking a couple of days to digest a meal. Anything non-digestible can be expelled by a shark by everting its stomach (De Maddalena & Walter, 2010).

Juvenile sharks eat more frequently than adults and their diet may change as they grow in size. Adult sharks usually eat every 1 or 2 days with their diets making up around 3-5% of their body weight. When prey is scarce some species can go up to several weeks without eating, using the oil in their liver to survive (De Maddalena & Walter, 2010). Larger species tend to eat less often than smaller ones, with their diet consisting of large marine mammals such as seals or dead whales.

As active predators, a shark's hunting technique can be broken down into three steps: Approach, seizure, and handling the prey (Klimley, 2013). Sharks can approach prey differently depending on prey type and hunting strategies. One type of approach is speculation, which is when a shark searches an area where it believes food will be (Klimley, 2013). An example of this is demonstrated by whale sharks as they hunt for plankton. Sharks can also ambush prey by hiding and waiting for their food to come close enough for a quick attack, as seen in some benthic sharks. Some species do this through camouflage while others, like the angle shark, bury themselves in the sand and wait for their food to swim over them (Klimley, 2013). The last type of approach is stalking, a technique used by species like the great white. In this method the shark uses camouflage to sneak up to its prey before a final quick attack (Klimley, 2013).

2.2: Distribution

While sharks reside in every ocean, they tend to be found in more temperate and tropical waters with only a few species, like the Greenland shark, living in cold water. Many species inhabit near coastal waters such as around islands, on continental shelves, in lagoons, and can even be found traveling up freshwater rivers. Other species only spend their early lives close to the coast, living in nurseries before traveling out to the open ocean (Eilperin, 2011). Sharks can be found in depths ranging from close to the surface to the deep ocean. The deepest dwelling shark, the frilled shark, can be found at depths reaching almost 5000 feet, and are typically not seen above 160 feet (Smart et al., 2016).

Many species of sharks move from one area to another throughout their lifetime, performing several different types of migrations which can occur daily, seasonally, or yearly. Daily migrations usually occur between deep and shallow water and are referred to as dial vertical migrations. Species, like the blue shark, perform this migration for several reasons such as hunting and temperature needs (The Ocean Portal Team, 2018). Seasonal and yearly migrations can occur along the coasts of countries, from coastal waters to open ocean, or across entire ocean basins. These migrations may be the result of water temperature changes, prey availability, or mating behavior (Camhi et al., 2008).

2.3: Management

All over the world shark populations are decreasing due to habitat degradation, bycatch, and the increasing demand for shark products. In 2000, shark catches reached an all-time high of 888,000 tonnes caught worldwide (Food and Agriculture Organization, 2020). Since not all shark catches are reported to officials, some believe this number could be closer to 1.44 million tonnes (Techera & Klein, 2014). Sharks are considered a K-selected species, meaning they have long life histories, are slow to grow and reach sexual maturity, and have a low fecundity rate. Due to this, overfishing can quickly decimate their populations as many species are unable to recover from the high mortality rate. Recent laws and policies have been created to help prevent this decline, but appear to be more reactive to the problem than proactive, coming later than laws for other marine species such as whales and dolphins (Techera & Klein, 2014). With their negative reputation and fearsome appearance there seemed to be less support for shark conservation efforts as opposed to more charismatic megafauna.

Like other marine life, sharks are not limited to political boundaries and are able to migrate through several countries, or States. Due to this, shark management exists on several different levels of government

including local, regional, national, and international. On the international level[3], some species are protected under the Convention on International Trade in Endangered Species (CITES) and the Convention of Migratory Species (CMS). Even more species are listed under the Shark International Plan of Action (IPOA-Sharks), which allows each State to have influence in the decision making process (Techera & Klein, 2014).

The listing of species under CITES can be broken down into three appendices. Appendix I includes endangered species close to extinction with international trade of individuals or body parts strictly enforced. No shark species are listed in Appendix I (Techera & Klein, 2014). Appendix II recognizes that there is a need to regulate trade in order to keep animals from the threat of extinction. Not only is a strict use of import and export permits placed on species listed in this appendix, but marine species listed can only be harvested if done so in a sustainable way (CITES, 2019). Originally only three shark species were listed under this appendix, the great white, whale, and basking shark. However, some States[4] filed reservations for these listings and so were not bound by the requirements under Appendix II. After a failed attempt to list 8 more species in 2010, advocates were successful in 2013 in listing 5 more shark species under Appendix II: Porbeagle, oceanic whitetip and the scalloped, smooth, and great hammerhead (Techera & Klein, 2014). Some States also filed reservations for these species as well. Today there are 12 species of shark listed in Appendix II, with the addition of the silky shark, thresher shark, and short and longfin mako (CITES, 2019). Appendix III looks to restrict and/or prevent exploitation of species, allowing States that are already regulating trade to garner support and cooperation from other states. No sharks are currently listed in Appendix III.

Similarly to CITES, CMS lists species under two appendices. Appendix I includes species endangered in all or a significant proportion of its range. If a species is listed, "States should endeavor to take steps to protect the habitat of the species concerned, prevent adverse impacts on the migration of the species and respond to factors that may further endanger the species" (Techera & Klein, 2014, p. 33). States that have jurisdiction over part of a species' migratory range or have registered vessels that catch certain species on the high seas are prohibited from taking[5] any animals listed in Appendix I. These States are referred to as Range States (Techera & Klein, 2014). The four sharks listed under Appendix I are the great white, basking, angel, and whale shark (CMS, 2019). Appendix II encourages Range States to create international agreements with one another for the benefit of the listed species. There are currently 13 shark species listed under Appendix II: Spiny

[3] Other international groups advocating for shark management include the Shark Alliance, World Wildlife Fund, and Ocean Conservancy (Herndon et al., 2010).
[4] These States include Japan, South Korea, Norway, and Iceland (Techera & Klein, 2014).
[5] Exceptions to the no-take rule can be made for traditional subsistence uses, scientific study, and extraordinary circumstances. (Techera & Klein, 2014).

dogfish, the smooth, great, and scalloped hammerhead, porbeagle, longfin and shortfin mako, dusky, oceanic whitetip, the common, bigeye, and pelagic thresher, and silky shark (CMS, 2019).

In 2010, States in the CMS also put in place a Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MoU). This non-binding conservation instrument has 48 State Signatories and covers 37 ray and shark species listed under the CMS Appendices I and II. Its Conservation Plan has five main objectives that include improving understanding through research and exchange of information, ensuring direct and non-direct sustainable shark fisheries, the protection of critical habitats, increase public awareness, and enhance cooperation on a national, regional, and international level (CMS, 2019).

The IPOA-Sharks is a non-binding, voluntary management and conservation obligation adopted under the Food and Agriculture Organization's (FAO) Code of Conduct and Responsible Fisheries. It uses a precautionary approach to create plans that sustainably manage and conserve all shark species over the long term (Herndon, 2010). These plans, both regional and national, are adopted by each State and are based on Shark Assessment Reports. The assessment reports also help develop a National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks) and encourage States to create a Regional Plan of Action (RPOA). Progress of the assessments and information on the development and implementation of these plans is reported biennially (Techera & Klein, 2014). However, implementation of NPOAs have been slow, with the FAO stating in 2012 that out of the 143 countries that report shark catch, only 34% had created a NPAO-Sharks. They also found that there seemed to be a lack of species identification, failure to report shark catch, absence of management measures, and little evidence of measures being implemented throughout these countries (Techera & Klein, 2014)

Some countries have tried utilizing marine protection areas (MPAs) as a way to protect shark species. In 2010 the Convention on Biological Diversity (CBD) set a goal to implement MPAs in 10% of the ocean by the year 2020 (Techera & Klein, 2014). According to the International Union for Conservation of Nature (IUCN) MPAs currently only cover around 6.35% of the ocean, with only around 1.9% being exclusively no-take zones (IUCN, 2020). Research has also shown that while these MPAs may be beneficial to certain life histories of some sharks or more sedentary species, they do little in the way of protecting largely migratory species such as tiger sharks (Techera & Klein, 2014). In order to combat this, some countries have created shark sanctuaries and closed large areas of the ocean to shark fishing. The first sanctuary was created by Palau in September 2009. Under the Shark Haven Act of 2009, the country closed its entire exclusive economic zone to shark fishing. Today there are almost 20 shark sanctuaries established throughout the world, with the largest being in French Polynesia which covers 4.8 million km^2 and protects around 23 species of sharks (Techera & Klein, 2014).

Many fisheries have restrictions on the sharks being caught, either as the intended species or a product of by-catch. These restrictions are determined by an assessment of a species' population and can be expressed as the total allowable catch for the species (Techera & Klein, 2014). Shark fisheries are separated into four categories: Pelagic, deep water, tropical, and coastal cold-temperature species. Pelagic sharks tend to be by-catch for other species such as tuna and swordfish. However due to their large size, the fins of these pelagic species are extremely valuable in the fin trade, accounting for around 70% of the fins imported into Hong Kong. In contrast, the deep-water sharks are used mostly for their liver oil. This oil, known as squalene, is used in many cosmetic products throughout the world (Techera & Klein, 2014).

Recreational fishing can also have a large impact on shark populations, even more so than the commercial industry in some instances. Many sharks are hunted as trophy or sports fish, providing large and fearsome adversaries for fishermen. Between 1980 and 2000 recreational fishing actually landed more sharks than the commercial industry in the Gulf of Mexico, helping to decrease the sandbar shark population by 50% (Techera & Klein, 2014). Large shark recreational fisheries can also be found in New Zealand, Australia, and the United Kingdom, with people catching species for their size, meat, teeth, and jaws. Sharks have also been targeted as nuisance animals to other fishing industries and for attacking swimmers (Camhi et al., 2008). Although many recreational fishers are now adapting the catch and release method, management of this industry is still country specific.

Since 2000 shark finning has become a major topic in both international and local shark management. Around 125 countries import shark fins to China, creating a market that was valued at around $455 million USD in 2000. In that same year it was estimated that 63% of the sharks killed had their fins removed before the rest of their body was discarded (Techera & Klein, 2014). As of 2007, finning bans have been implanted in the waters of 19 countries and by 3 international organizations and 9 regional fishery management organizations (RFMOs). Most RFMOs now require all sharks be landed with their fins attached or a fin to trunk ratio on shark catches (Camhi et al., 2008). Several groups such as the International Commission for the Conservation of Atlantic Tunas and General Fisheries Commission for the Mediterranean have ruled that the total number of fins on board a vessel may not exceed 5% of the total weight of sharks. Some RFMOs also prohibit selling, landing, or transporting any part of specifically vulnerable species. The limits for these regulations include the limited membership of some RFMOs, species coverage, lack of addressing by-catch issues, non-binding obligations, and inconstant management across organizations (Techera & Klein, 2014).

There are still many obstacles to face concerning shark management. Data gaps in population sizes, mortality rates, and the number of catches, landings, and discards make it hard for officials to create effective management strategies (Camhi et al., 2008). This can be made even more difficult through underground fin

markets and illegal, unreported, and unregulated (IUU) fishing. Due to a shark's ability to transverse national boundaries, international management is required. However, this management includes a lot of voluntary agreements which can move slowly and are non-binding (Techera & Klein, 2014). In order to solve this problem, some researchers have pushed for the creation of an International Commission for the Conservation and Management of Sharks (ICCMS). This commission would be similar to the International Whaling Commission and would protect sharks on a national and international level (Herndon et al., 2010). In recent years, many RFMOs have also stepped up to help fill in knowledge gaps, practice sustainable shark fishing, and help regulate shark finning.

Sharks play important roles in their environment, with their presence usually indicating a healthy ecosystem. Studies have shown some coral reefs actually have a higher level of biodiversity in the presence of sharks (McKeever, 2019). As apex predators their absence can impact the balance of their habitat, leading to negative consequences. Their removal in an area can lead to top-down impacts throughout the ecosystem, effecting many different species (McKeever, 2019). Due to this, proper management of sharks can have positive benefits for other fishing industries.

2.4: Great White Shark

These thesis focuses on one particular species of shark, the great white. The great white shark (*Carcharodon carcharias*) is a member of the Lamnidae family, also known as the mackerel sharks. People around the world also refer to this species as the blue or white pointer, up tail, tommy, man-eater, and white death (Ellis et al., 1991). While one of the largest modern-day sharks, the size of the great white has been greatly exaggerated over the centuries. Stories of twenty-five, thirty, and forty-foot white sharks have been reported throughout the years. Though before these claims were proven, the evidence, or body, always seemed to mysteriously disappear or be found in incomplete parts. Many of these stories have been discredited by scientists who have examined the teeth and other salvageable body parts (Ellis et al., 1991). Many researchers seem to think the great white actually averages around 15-17 ft in length, though some large females may reach upwards of 20 ft (Techera & Klein, 2014). Females not only grow larger than males but also mature later; females tend to mature around 12-17 years of age, while males average around 7-9 years. While there is still some uncertainty about the life expectancy of this species, some researchers believe they can live to around 40-50 years old, while others think that number can be as high as 60 (Camhi et al., 2008).

Great whites have large, torpedo shaped bodies, plesodic pectoral fins, and a powerful, crescent shaped caudal fin. Like most sharks, the great white has a total of eight fins with an unequal caudal fin. While

the lobes are almost equal on this fin, the top lobe is still slightly larger than the bottom. Their nose is cone shaped and flattened on the top, ending in a blunt tip (Ellis et al., 1991). They have an extremely sharp sense of smell, having the largest olfactory bulb to body weight of all sharks (Klimley, 2013). The great white has sharp, triangular teeth which are serrated at the edges. The top jaw contains an average of 26 broad teeth used to saw off chunks of flesh. The bottom jaw, in comparison, has around 24 narrower and pointier teeth which help pin prey when the shark closes its mouth (Ellis et al., 1991). Its eyes are smaller than deep water sharks, as it spends much of its time near the surface of the water, sometimes even sticking its head out of the water to look around. When compared to nocturnal sharks, the great white has a less developed tapetum lucidum, leading researchers to believe it sees better and is more active during the day (Ellis et al., 1991). Unlike other sharks, the great white does not have a nictitating membrane to protect its eye while feeding. Instead it will roll its pupils back in its head, revealing only the whites and giving them an unsettling appearance.

The great white is named for its white underbelly. The rest of the shark can range from a grey-blue to grey-brown color and becomes lighter as it moves toward the stomach. This type of coloring, with a dark upper half and light bottom half, is referred to as countershading and is common in pelagic sharks (Maddalena & Walter, 2010). It provides camouflage to the shark when looking either down or up on them, allowing them to blend in with the dark sea floor or light surface water respectively. Unlike other animals this camouflage is believed not to protect the shark from predators but instead allows it to sneak up on prey more easily (Klimley, 2013). This camouflage is further aided by black marks on the underside of the pectoral fins and dark patches located were these fins meet the body. Some researchers believe these marks are used to reduce any flashes of the white underside when the shark swims, which may alert potential prey (Ellis et al., 1991).

While considered a pelagic shark, the great white can often be found close to shore and along continental shelves (Maddalena & Walter, 2010). They are typically found in temperate and sub-tropic marine waters throughout the Atlantic, Pacific, and Indian Ocean, as well as the Mediterranean Sea. White sharks tend to gather near large populations of seals or sea lions, usually around New Zealand, Australia, South Africa, and North and South America (Ellis et. al, 1991). They migrate along the continental coasts of these countries throughout the year; moving as the seasons change and following prey. Some individuals have been seen stopping in the same places along the coast, either yearly or every few years (Camhi et al., 2008). While not regularly seen in offshore waters, great whites will travel in the open ocean. Evidence has shown individuals traveling between Africa and Australia, though most of these tend to be younger males (Camhi et al., 2008). While great whites are typically solitary, they can be seen in groups. This usually occurs around a large food source like a whale carcass. When together they tend to form a social hierarchy, which is mandated

through body movements such as jaw gapping, parallel swimming, pectoral fin depressions, and tail splashing (Martin, 2003).

The reproduction of white sharks is poorly documented, but they are believed to reproduce through aplacental viviparity. There is also evidence that the pups are oophagous as seen in other members of the Lamnidae family. Gestation is believed to take around 18 months followed by an 18-month resting period, resulting in a three-year reproductive cycle (Camhi et al., 2008). Reports of litter size vary from 2-17 individuals, with pups reaching 4-5 feet in length and weighing around 50 pounds at birth. Young are born resembling adults and are able to feed and fend for themselves (Ellis et. al, 1991). The diet of a young great white consists mainly of bony fish and smaller sharks or rays. Pups are more agile than the full-grown adults with long and narrow teeth, allowing them to catch and grasp quick moving prey.

As young great whites grow in size, usually around 10 feet, their diet begins to change. While these diets can differ depending on location and prey availability, most adult sharks feed primarily on marine mammals such as seals, sea lions, and whales (Camhi et al., 2008). However, they have also been known to eat sea birds, bony fish, sea turtles, penguins, squid, rays and skates, other sharks, mollusks, and crustaceans (Maddalena & Walter, 2010). Great whites off of California have also been witnessed killing sea otters, though there are few reports of them actually eating the small mammals (Camhi et al., 2008).

There are four steps a great white uses when biting into potential prey. First it drops its lower jaw down as its snout lifts up. The upper jaw then protrudes forward, exposing the animal's gums and giving the shark its classic sharp toothed "frown" seen gracing the cover of *Jaws*. Lifting the bottom jaw and lowering the snout, the shark traps the animal in its mouth. It can then saw off chunks of flesh with its top teeth or by shaking its head back and forth (Ellis et al., 1991). A shark's bite can last less than a second but still cause severe tissue and organ damage, biting through bone and removing over 40lbs of flesh at once. White sharks use the "bite and spit" method when hunting their prey. They do this by attacking quickly and wounding the prey then leaving it stunned and bleeding out. Once the animal has died of blood loss the trailing shark will swim up to eat it (Maddalena & Walter, 2010). This method of attack can also help explain many attacks on humans. Most shark attack victims die of blood loss and shock rather than being eaten. Sharks are not interested in eating people, which is why most researchers believe that sharks leave the person along after the initial bite, sensing they are not a suitable food item (Ellis et al., 1991).

While shark attacks are less common than some people think, they are not unheard of. In 2019, the International Shark Attack File (ISAF) reported 64 unprovoked attacks occurring worldwide. However, out of all those attacks, only 2 were fatal. Of the 64 victims, surfers seemed to be attacked the most, representing over 50% of the shark attack cases for the year (ISAF, 2020). Many scientists believe this is because to a shark

swimming below, a surfer laying on a board may resemble a floating seal (Ellis et al., 1991). A lot of these attacks tend to be blamed on the great white shark. With its large size, sharp teeth, and monstrous reputation in books and movies, they seem like the perfect choice. However, great whites are only one of four main species of shark known to attack humans. The oceanic whitetip, bull, and tiger shark also have a reputation for attacking humans unprovoked (Ellis et al., 1991). Of these four species, the bull shark may actually be responsible for many of the attacks that happen each year. Though smaller than the great white this species is extremely aggressive. Growing to around 10 feet long, a bull shark's testosterone levels are some of the highest of any animal (Eilperin, 2011). This shark also has the unique ability to travel from salt to freshwater systems, often being seen swimming up rivers from the ocean (Ellis et al., 1991). It is because of this that some researchers believe a bull shark may have been responsible for some, if not all, of the infamous New Jersey shark attacks that occurred in the early 1900s. That being said, great white sharks are typically responsible for attacks on boats, being witnessed biting motors and dumping passengers into the ocean. While some people may believe the sharks are attempting to eat everyone on board, researchers do not consider this the case. Many scientists think the sharks are testing the boat by bumping into it and trying to figure out if it is potential prey, like a whale carcass. Others believe the sharks are sensing the electrical fields being produced by the motor or rudder and simply come over to investigate (Ellis et al., 1991).

Although great whites have no natural predators, besides the occasional killer whale, their populations are believed to be decreasing. They are sometimes caught as by-catch in other fisheries, either being discarded or kept for their fins. More recently, these sharks have gotten caught in aquaculture cages; breaking in to reach the fish inside and dying when they cannot get out again (Camhi et al., 2008). Great whites are also popular targets in sport fishing, especially in the United States, New Zealand, Australia, and South Africa (Ellis et al., 1991). Their large size and fierce reputation make them impressive trophies for recreational fishermen. In the past they have also been hunted due to the problems they cause other fishing industries or as revenge for an attack on a human. Besides their fins, the jaws and teeth of a great white shark are also sought-after tourist souvenirs in some places (Camhi et al., 2008).

While population sizes for great whites are still relatively unknown, they are listed on the IUCN Red List as a vulnerable species. In 2004, Australia and Madagascar were successful in nominating the species to be listed internationally by CITES. Today, great whites have received some of the most conservation attention of all the sharks, being fully protected in five countries: The United States, Australia, Namibia, South Africa, and Malta (Camhi et al., 2008).

2.5: Chapter Summary

Sharks have evolved over centuries to become efficient and successful predators. Their cartilaginous skeletons are light weight and strong, making them powerful and agile swimmers. Unlike bony fish, all sharks lack a swim bladder to keep them buoyant and an operculum to push water over their gills. Instead they evolved to have large oil filled livers and different methods of breathing like ram ventilation and buccal pumping. The physical characteristics of different shark species, such as teeth shape and eye location, can vary as a result of their environment and food sources. Sharks can be found in every ocean, though usually in more temperate and sub-tropical waters. They are found in different parts of the water column, ranging from the surface to almost 5000 feet deep. Management of these species occurs on several different levels of government. International management includes groups like the CMS and CITES and is usually slow moving and voluntary. This thesis is focused on a particular shark species, the great white shark, which is known for its reputation of attacking people. Its large size, quick speed, and powerful jaws make it a formidable predator of marine mammals and bony fish. They can be found in sub-tropic and temperate waters throughout the Indian, Pacific, and Atlantic Ocean and are listed as a vulnerable species by the IUCN Red List.

"The evolving relationship between humans and sharks illuminates how we have sought to submit wilderness to our will, with varying degrees of success. But these beasts themselves, and the subterranean world they inhabit, are affecting human society even as it seeks to shunt them aside."

--Juliet Eilperin
Demon Fish: Travel Through the Hidden World of Sharks (2011), p. xx.

Chapter Three: Anthrozoology and Sharks

Human and shark interactions have occurred ever since people started venturing into the ocean (Allen & McCormick, 1996). While many of these interactions have been direct, including shark fishing and attacks on people, the human-shark relationship goes beyond these physical exchanges. In early coastal civilizations they represented gods and demons, helping to explain how the world worked, causing extreme weather events, and protecting fishermen (Baughman, 1948). Their images are found in art throughout the centuries ranging from ancient pottery to modern day masterpieces. Sharks have starred in books, movies, and television series watched by millions. This has allowed people all over the world to indirectly interact with these animals and help shape people's perception of the ocean and what lurks below the surface. Stories of gruesome attacks have made the word shark synonymous with "monster" for many people, with the great white shark often the main culprit.

3.1: Sharks as Gods

Animals are often found in many ancient religions; from the animal headed gods of Egypt to animal deities of North and South America. These gods are often said to bridge human life to the natural, and even supernatural, world (Rudy, 2011). Kathy Rudy, a women's studies professor at Duke University, further explains this bridge:

> "Indigenous people look upon wild animals as living incarnations of special powers, traits, or virtues that humans might learn from if we watch closely and with reverence. Early priestesses and magicians donned animal skins and masks to call in specific virtues and abilities inherent in particular animals." (Rudy, 2011, p. xix)

While not as popular as some animals, sharks can be found in numerous myths throughout many islands and coastal areas. They appear in creation myths, represent powerful gods, control oceans, and destroy ships. People of these communities view sharks as otherworldly and for good reason; they are quick swimmers, fearsome hunters, and capable of tearing a person to pieces (Eilperin, 2011).

Hawaiian folklore tells of many different shark gods. These gods, whether male or female, tended to be red in color or have red associated with them, such as the red girdle worn by Ka-moho-ali'i[6] while in his human form (Beckwith, 1917). Martha Warren Beckwith, an anthropologist and American folklorist, listed over 50 different major and minor shark gods in her article *Hawaiian Shark Aumakua* (1917). Some of these gods created treacherous waters, tossing waves and destroying canoes, while others could change into human form and walk among the locals (Kalakaua & Daggett, 1888).

Most of these sharks took the form of *aumakua*, lesser gods devoted to and worshiped by individual families. Shark *aumakua* were largely worshipped because they protected and helped fishermen: Bringing fish up to the boats, defending people from other sharks, calming oceans, and rescuing drowning men by swimming them to shore on their back (Beckwith, 1917). Unlike other *aumakua*, like owls which were worshipped as a whole population, shark *aumakua* each had individual names, homes, stories, and physical characteristics (Emerson, 1892). These gods are passed down through generations, sustained by prayers and offerings. While *aumakua* were believed to be the offspring of a human and a god, aborted or miscarried children were suspected of being a result of a human and *aumakua* coupling. In some instances, these unborn children become shark *aumakua* themselves when put in the ocean, becoming a protector of their family (Beckwith, 1917).

The ancient Hawaiians often saw these spirits as relatives or friends, with many beginning their lives as humans. Two such examples are Kaahupahau and her brother (or son depending on the myth) Kahi'uka. Both of these shark gods began their lives as humans on the island of Oahu, until one day they disappeared and were transformed into sharks. However, even after their transformation the siblings still shared a strong kinship with the people of their home, protecting the them from man eating sharks like Mikololou[7] and fighting for the humans in the Great Shark War (Emerson, 1892). Although, not all stories painted sharks in such a heroic light. Many tales were told throughout the islands which warned of evil shark *aumakua*. These

[6] Ka-moho-alii is an important shark deity and older brother of the fire/volcano goddess Pele. He is usually associated with areas around the islands of Hawaii and Maui (Emerson, 1892).

[7] Mikololou is man-eating shark from the island of Maui. When he threatened the people in Kaahupahau and Kahi'uka's home they helped the humans capture and kill him. Unfortunately his tongue survived, swimming back into the ocean to gather allies and get his revenge on the humans and siblings that protected them (Emerson, 1892). This is one explanation for the cause of the Great Shark War.

gods could take the form of sharks while in the water and walk on land as a human, usually being identified by a shark's mouth on their back which they tried to keep covered. In these stories the *aumakua* would lure or trick people into the water while in their human form, only to transform back into a shark and eat them. In the end they were typically discovered and killed by local villagers or kings (Beckwith, 1917).

The worship of these gods varied throughout the islands. Many *aumakua* are worshipped through prayers and the offering of food and a drink called *awa*. This worship is overseen by the *aumakua's* keeper (*Kahu*), a position passed down from father to son (Beckwith, 1917). Public ceremonies were used to celebrate more important and widely worshiped gods, like Ka-moho-ali'I. In order to please this shark god, ancient Hawaiian's would host gladiator type games between sharks and humans. Once sharks were lured into the arena using pig or even human bait, fighters would have to defend themselves with a piece of wood topped with a shark tooth. With the lack of a suitable weapon, and the fact that fighters need to wait for the shark to lunge at them before defending themselves, few humans made it out of these "games" alive (Eilperin, 2011).

As seen in Hawaii, sharks were often worpshiped by coastal communties which were reliant on the ocean. To this day, places like Papua New Guinea still practice religious ceremonies, such as shark calling, to honor them (*Fig. 3.1*). Spending time on the ocean allowed people from these areas to interact with the local shark species; letting them observe the sharks' behaviors, skills, and power, which then influenced their religion and beliefs. Humans used these animals to explain weather, tides, fishing success, and even death. Through them people could tell stories of warning and explain moments in history. In Hawaii for example, the evil *aumakua* were thought to represent robbers preying on travelers. In other stories man eating sharks were used to symbolized colonists and Americans (Eilperin, 2011). Many even believe the Great Shark War of Hawaii was symbolic of warring chiefs on the islands or the banishment of cannibalistic practices, though the latter is less likely according to historians (Beckwith, 1917). Even in the early 1900s sharks were believed to cause the sudden collapse of the Pearl Harbor dry dock during construction, which locals credited to the Queen Shark (Allen & McCormick 1996).

Figure 3.1: The shark callers of Kontu still practice traditional shark fishing in Papa New Guinea. Callers shake the cane and coconut shell *larung* (*left*) to attract the sharks by mimicking the sound of distressed fish (O'Rourke, 1982). Once the shark is close the caller will slip the cord noose (*right*) over its body and trap the fish before subduing it. Only men can be callers and the rituals are usually passed down from father to son (Eilperin, 2011). Credit: Vlad Sokhin

3.2: Sharks as Food

Sharks, like other fish, have often been used as a food source for many near coastal communities. While most species can be eaten whole, they may also be incorporated into specific dishes. In Japan, for example, a fish paste tube called *chikuwa* is made from local dogfish sharks. In what is now modern-day Tokyo, spotted sharks were used to create *henpen*, a fish cake popular in the early 1600s (Eilperin, 2011). Native to Iceland, Hákarl is a popular food made from fermented Greenland shark. It is typically eaten during the Þorri festival and is known for its strong ammonia smell. In recent years, these small white cubes of shark meat have become a popular tourist attraction, with people coming from all over to try and stomach the regional dish (Simke, 2020). A popular English dish people may not consider of when thinking of food made from sharks is fish and chips. While typically made from cod or haddock, spiny dogfish is also used to make this deep-fried favorite. However, many consumers may not know this, as the dogfish is typically labeled as rock salmon or huss on the menu (Karasz, 2019).

As mentioned in Chapter Two, many sharks are currently hunted for their fins which are a key ingredient for shark fin soup. This delicacy first appeared in China during the Sung Dynasty, dating between 960 and 1279, and became more popular in the Ming Dynasty during the fifteen century (Eilperin, 2011) Today, it is estimated that up to a 100 million sharks are killed each year for the fin trade, decimating the populations of these slow growing species. Once caught most sharks are finned alive, with the rest of their body thrown overboard where they will die of blood loss, drown, or be eaten (Animal Welfare Institute, 2020). These fins are then sold at markets in areas such as Hong Kong, China, Japan, Singapore, and Taiwan. There

the fins can sell upwards of $800 per pound, including a single basking shark fin that sold for $57,000 in Singapore (Eilperin, 2011).

3.3: Sharks as Symbols

Throughout the centuries, sharks have been used as symbols by groups ranging from ancient tribes to modern day sports teams. People have used these animals to symbolize traits like persistence, greed, aggression, deceit, unpredictability, and sensitivity, as well as human fears of unknown danger and dismemberment (Lane & Chazan, 1989). Some early tribes, like the ones found in Australia and New Zealand, even saw sharks as representing concepts like law, justice, fertility, warfare (Eilperin, 2011).

One trait in particular that sharks have long been associated with is power, with their image representing this strength on Ingenious totems and European family crests (Allen & McCormick 1996). Their power was so revered in Mayan culture that many rulers had the word "shark" in their name; two such rulers were Yax Ehb Xook, *First Step Shark*, and Ix K'abal Xook, *Lady Shark Fin* (Newman, 2016). This powerful and aggressive reputation also made sharks ideal candidates for sport team mascots. Their likeness can be seen representing teams in baseball, softball, cheerleading, hockey, football, and rugby. These teams range from college sports, as seen at Nova Southeastern University, to the major leagues, with hockey's own San Jose Sharks.

The shark symbol can also be used in times of war. Planes in particular favored the shark face, with pilots painting the tooth filled jaws on their craft's nose. One of the most famous examples of this is the Flying Tigers, an American Volunteer Group (AVG) in World War II, which helped China fight off the invading Japanese forces (Eisel, 2009). These faces, becoming a mascot of sorts, boosted moral for the men in the AVG who were starting to fade after a long time abroad, grueling training exercises, and the training death of one of their own (Kleiner, 2018). Its position on the plane was also a deterrent for the enemy. When the AVG faced the Japanese fighters head on in the air the opposition would be staring down the face of an angry shark coming in for the attack. The United States also has a long history of naming navy ships after these animals. From a Confederate blockade runner in the Civil War to a nuclear-propelled submarine in the late 1900s, a total of six ships in the U.S armed forces were named *Shark* (Allen & McCormick, 1996). This name was most likely chosen in order to use a sailor's fear of sharks to intimidate the enemy.

Sharks themselves can be seen as symbolic, especially in storytelling. As seen in the previous section they can used to represent humans, like Hawaiian chiefs or American colonists. They can also be used to represent ideas or concepts like tearing down people and their successes, as some believe the sharks in Ernest Hemingway's *The Old Man and the Sea* do (Sandamali, 2015).

3.4: Sharks as Art

Sharks are found in many different works of art. Their images have been discovered in ancient mosaics, adorning temple walls, and on pottery (Allen & McCormick, 1996). In these pictures sharks can be seen as gods, helping and protecting humans, or demons, attacking swimmers and fishermen. While some of this imagery was lost in time others were passed down through tradition from one generation to the next. An example of this can be seen in the ankle tattoos worn by Hawaiian women. These tattoos, which are an artform themselves, were used to remember a chieftainess who escaped a shark after being bitten on her ankle and are thought to protect the wearer from shark bites (Allen & McCormick, 1996).

Another artform sharks can be found in is poetry. The ancient Greek poet Oppian mentioned blue sharks in his poem *Halieutica,* referring to how these animals protect their children and love them beyond all others (Baughman, 1948). Another poem, *Summer*, written by James Thomson in 1783 looks at sharks in a very different light. Thomson's work describes a shark following a slave ship, "Lured by the scent of steaming crowds, of rank disease, and death" (Thomson, 1892, p.63). The poem then follows the animal as it closes in on the ship, chasing its prey. At the end the shark catches the boat, devouring all aboard; "He dyes the purple seas with gore, and riots in the vengeful meal" (Thomson, 1892, p. 63). There is a strong contrast between how the two sharks are portrayed in each of the poems; one appearing to be a doting parent while the other a savage killer. This difference could be a result of how interactions between sharks and humans changed over time. Around the time Thomas was writing his poem, shark attacks on sailors were becoming a common occurrence, leading to sharks having a very monstrous reputation. This killer shark image can also be seen in other works of art from that time.

Watson and the Shark, painted by John Singleton Copley in 1778, shows a man being pulled in from the sea as a looming shark moves in for the attack. This painting depicts an actual event from 1749 when Brook Watson, a fourteen-year-old English orphan, lost his right leg in a shark attack while traveling on a ship through Cuba. As he grew to become a successful merchant, Watson commissioned the painting and a family crest to immortalize the incident (Eilperin, 2011).

British artist Damien Hirst took this idea of sharks as art one step further in 1992 when he used a 14ft tiger shark in his art piece. This shark, caught by an Australian fisherman hired by Hirst, was suspended, mouth open and teeth exposed, in a glass case filled with formaldehyde. As time went on the shark in the piece, *The Physical Impossibility of Death in the Mind of Someone Living*, began to deteriorate, leading the artist to question how to salvage the piece. Originally, he used the shark's skin to create a taxidermized copy of the animal but thought it took away from the drama of the piece and appeared fake. Hirst was then able to

convince the 2006 buyer, who paid 8 million dollars for the piece, to let him replace the shark with another body (Vogel, 2006).

3.5: Sharks as Entertainment

Throughout the years, shark interactions have also shaped human entertainment. Some of this entertainment took the form of games, such as "playing at shark". This game, still played today by children in Central America, is a form of tag. People are tagged by the "it" person, or shark in this case, when they are bitten or pinched underwater (Allen & McCormick, 1996). Shark interactions also inspired stories, full of both good and bad sharks. These stories were especially popular with sailors, who found that the superstition and fear associated with sharks made for good sea tales (Allen & McCormick, 1996).

As technology advanced in the 1900s, these stories moved from oral tales and books to full length movies. According to the Internet Movie Database (IMDb), there are around 170 movies about or containing sharks. These range from family friendly cartoons to gruesome horror films. One of the earliest examples of these movies is the famous man vs. shark thriller, *Jaws*, which opened in 1975. This movie grossed over $470 million worldwide and paved the way for future shark franchises like *Sharknado* and *47 Meters Down*, as well as three sequels of its own (IMDb, 2020). Like the stories before them, these movies allowed audiences to interact with sharks indirectly, shaping how people view them. Discovery Channel went beyond the scope of movies by putting sharks directly in the audience's home with their yearly special *Shark Week*. This program, which started in 1987, began with educational documentaries which taught viewers all about the science, biology, and history of these animals. Today *Shark Week* has become a culture icon; featuring celebrity cameos and pulling in millions of viewers, reaching 29 million at its peak in 2008 (Gibson, 2010).

Songs can also take their inspiration from sharks, as seen with the famous earworm "Baby Shark". This catchy song, believed to start out as a song sung by campers, has spread across the globe. It has even become the unofficial song of the Washington Nationals baseball team, with a whole stadium of people performing the shark mouth hand motions each home game (Allen, 2019). Memes and cartoons have also begun popularizing these fish. Using drawings or photos of real-life sharks, internet users usually portray sharks as awkward, shy, and harmless creatures. One of the more popular examples of this is "The Life of Sharks", a cartoon series revolving around sharks while often including pop culture references and shark facts (*Fig. 3.2*). While some of these shows, stories, or songs may make people admire and respect these animals, many forms of entertainment actually do the opposite. Stories of shark attacks and people being dragged underwater by an unknown monster has led many people to retaliate against sharks and fear the ocean itself.

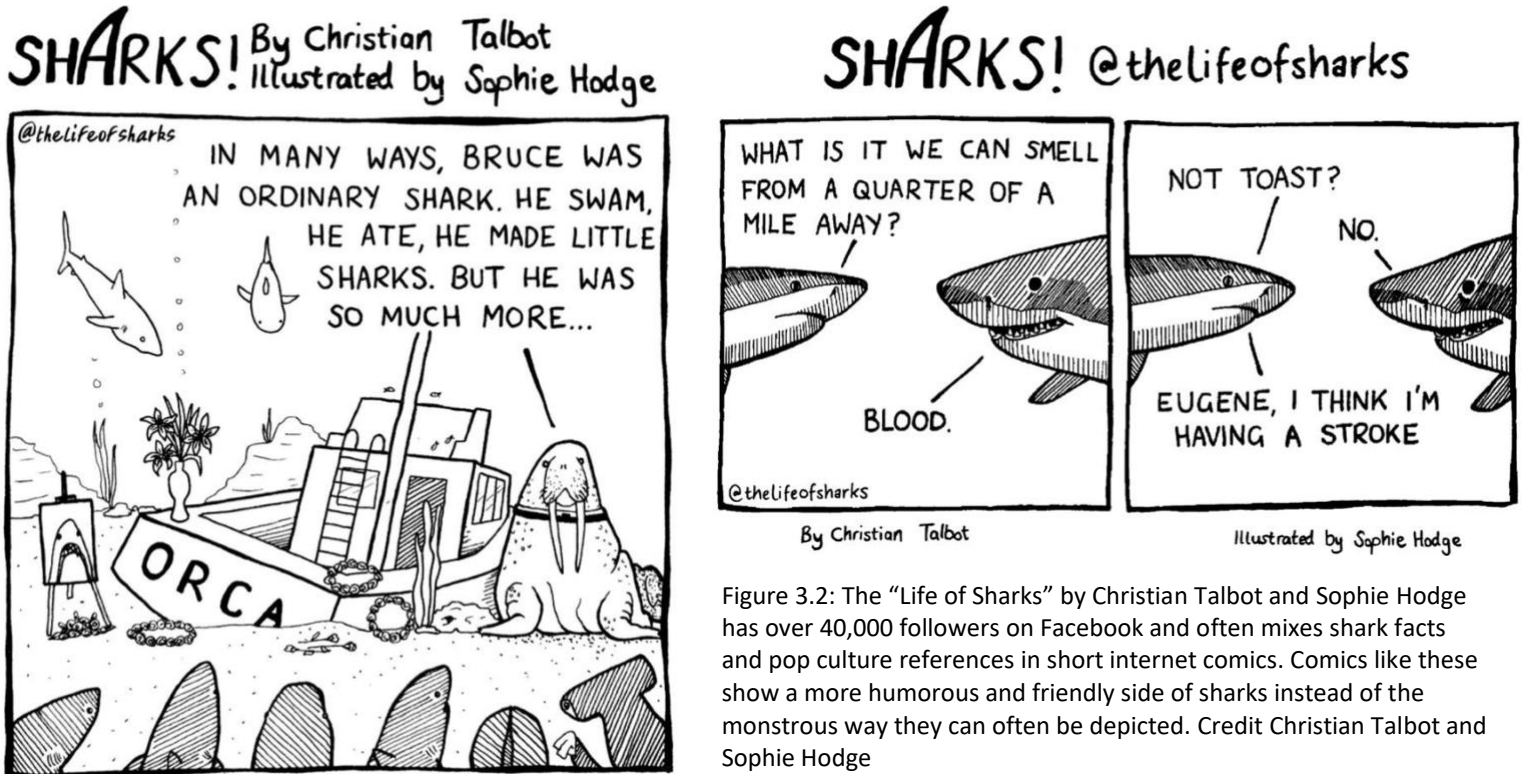

Figure 3.2: The "Life of Sharks" by Christian Talbot and Sophie Hodge has over 40,000 followers on Facebook and often mixes shark facts and pop culture references in short internet comics. Comics like these show a more humorous and friendly side of sharks instead of the monstrous way they can often be depicted. Credit Christian Talbot and Sophie Hodge

3.6: Sharks as Monsters

The fear of sharks began long before *Jaws*[8] scared an entire generation out of the ocean. Their ability to travel unseen, attack quickly, and then retreat into the depths only adds to their frightful reputation (Eilperin, 2011). Ancient tribes would perform human sacrifices, feeding people to sharks in order to please their gods or ward off demons. While most of the time the people were already dead when their bodies were given to the sharks this was not always the case. Other times, as seen in the Hawaiian shark fights, an audience watched as sharks attacked and killed living people (Allen & McCormick, 1996). These attacks also occurred outside of religious ceremonies. A Greek poet from the 3rd century B.C., Leonidas of Tarentum, told of a shark tearing away the lower half of a sponge diver as he tried to get back into his boat (Allen & McCormick, 1996). Images on pottery found in Central and South America show swimmers being eaten by sharks (Allen & McCormick, 1996), while some ceramics in Greece dating back to 725 B.C. also show shark-like fish attacking a man (Eilperin, 2011).

As humans began to build bigger boats they were able to travel farther out to sea and for longer periods of time. Due to this, shark encounters became more common and left many sailors in fear of these

[8] The author of *Jaws*, Peter Benchley, has since said he regretted writing the book stating, "Knowing what I know now, I could never write that book today" (Nelson, 2006). In the years that followed Benchley would continue to study sharks and go on to advocate for shark protection and marine conservation. He would also write other books, such as the nonfiction novel *Shark Trouble* in 2002, in hopes to help dispel common shark myths (Nelson, 2006).

fish. In 1580, one of the first English accounts of a shark attack tells of a sailor falling overboard. As his ship mates tried pulling him in on a rope a shark came up from below and tore him apart in front of the helpless crew (Allen & McCormick, 1996). Slave ships traveling from Africa to the Americas in the 1600s were often followed by sharks. As slaves and crew members died at sea their bodies were tossed overboard. Survivors watched as the trailing sharks tore these bodies apart, helping to solidify their man-eating reputation and discouraged any escape attempts into the sea (Rediker, 2008). It soon became common for sharks to follow ships in hope of a free meal. Many sailors believed these animals could actually sense when a sailor was close to death, appearing in time to snatch the body before it sank to its ocean grave. This led some of the more superstitious crew members to view a shark's presence around a ship as a death omen (Allen & McCormick, 1996).

European sailors brought these gruesome shark stories with them as they traveled the world. This caused people to associate sharks with negative attributes, getting to a point where the meaning of the word began to change all together. In 1713, the term "shark" began to be used interchangeably with the word "predator" when describing people (Eilperin, 2011). It soon became a name for someone aggressive and cutthroat; a person one would not want to associate with. As time went on the word "shark" was used to describe other groups. People started to use it as a derogatory term to describe lawyers in 1806, a title which spread to reporters in 1828. In the 1940s, Americans were using it to describe a person displaying lascivious behavior (Eilperin, 2011). Even today, using the word shark to describe someone carries a negative implication, like the term "loan-shark".

While fishermen and sailors learned to fear these big fish, many people saw no danger from sharks. Even some experts like Dr. John Treadwell Nichols[9], Dr. Robert Cushman Murphy[10], and Dr. Frederick A. Lucas[11] told the public they had nothing to fear from a shark attack; Dr. Lucas even went as far as to say shark jaws were not powerful enough to severely hurt humans (Allen & McCormick, 1996). However, that all changed in the early 1900s as sharks began to terrorize the east coast of the United States of America. During a one-week period in the summer of 1916 four people were killed as a result of shark attacks off the New Jersey coast, with a fifth victim managing to survive (Fernicola, 2016). These attacks would go on to inspire the 1974 novel, *Jaws*, which later would become a major motion picture and bring "shark terror" to viewers around the world (Eilperin, 2011).

[9] Dr. John Treadwell Nichols was an ichthyologist that worked at the American Museum of Natural History in New York, as a curator for the Department of Fishes.
[10] Dr. Robert Cushman Murphy, an ornithologist, worked at the Brooklyn Museum at the time of the 1916 attacks.
[11] Dr. Frederick A. Lucas was the director of the Museum of Natural History with a degree in zoology.

As years passed and the fear of the New Jersey attacks subsided from memory, new shark horrors came to the surface. During the course of World War II stories began to circulate of soldiers surviving shipwrecks only to be eaten by sharks as they waited in the water for rescue. Examples of this can be seen with the *USS Indianapolis,* the *Novia Scotia*, and the *Cape San Juan* which were all torpedoed during the war, forcing their crew to jump ship and wait in the water for rescue (Allen & McCormick, 1996). Survivors from these wrecks told horrifying stories of watching their friends get picked off one by one as sharks began circling the stranded crew. One seaman from the *USS Indianapolis*, Gus Kay, described the first round of attack;

> "Finally they attacked-they pulled guys right out of the water. We thrashed, trying to keep 'em away from us, but they came right into the group. Took the net and everything right up into the air. Tore guys' limbs off. The water was bloody" (Stanton, 2001, p. 155).

These testimonies fueled the public's image of sharks as man-eating beasts. By the end of WWII, it was estimated that sharks caused more fatalities during these maritime disasters than all near shore shark attacks throughout history (Allen & McCormick, 1996).

As attacks continued to happen on both coasts of the United States, the shark's monstrous identity solidified. The fear of another attack caused people to lash out and try to rid themselves of the "shark problem", leading to many different wars on sharks (Allen & McCormick, 1996). After the New Jersey attacks many fishermen took to the seas to try and decrease the shark population. Policemen told stories of shooting sharks from docks to save swimmers, while the community around the Matawan Creek[12] used dynamite to try and rid themselves of the shark believed to be attacking swimmers. The government even tried stepping in and sent a US Coast Guard Cutter to help in the fight on the east coast (Allen & McCormick, 1996). Hawaii also retaliated against sharks after 15-year-old Billy Weaver was killed by a shark attack in 1958. Fear of another attack lead government officials to devise a plan to exterminate all sharks around the island. Using money raised from the Billy Weaver Shark Control Fund, a boat called the *Holokahana* was hired to hunt nearby sharks. In one year the crew caught and killed 697 sharks, as well as 641 unborn pups (Allen & McCormick, 1996). To put that in perspective, according to the International Shark Attack File there were only 283 unprovoked shark attacks worldwide between the years 1990 and 1995. Of these 283 attacks, only 40 proved

[12] Matawan Creek is the location of the last three attacks during the 1916 New Jersey attacks. The first two victims at Wyckoff dock died of their injuries while the third victim, who was attacked further downstream, survived an attack to his leg (Allen & McCormick, 1996).

to be fatal (Allen & McCormick, 1996). That means over 30 times the number of sharks, including unborn pups, were killed in Hawaii in one year than humans killed by sharks worldwide in a 5-year period.

Today, when people think of monster sharks they usually think of the great white shark. This is not without some justification, as this species does have a history of attacking people. After the New Jersey attacks a great white shark was caught off the shore about four miles from the last attack. When the fishermen cut the shark open, they found what was believed to be a boy's shinbone and a human rib. This led many to believe that one or more great white sharks were responsible for all five attacks (Allen & McCormick, 1996). This history alongside their large size, fearsome appearance, and nicknames like White Death and Man-eater, it is no surprise the great white is the villain for most Hollywood oceanic thrillers (Philpott, 2002). The trailer for *Jaws* even describes the shark as;

> "There is a creature alive today that has survived millions of years of evolution without change, without passion, and without logic. It lives to kill; a mindless, eating machine. It will attack and devour anything. It is as if God created the devil and gave him…jaws." (Crawford, 2008, p. 13)

Of the 170 shark movies made about sharks 56 star great whites[13], with almost all of them portraying these animals as the monster or killer. The shark from *Jaws* was even listed as number 18 in the American Film Institute's 50 Top Villains list, sharing the honor with the likes of Hannibal Lecter, The Evil Queen, and Count Dracula (American Film Institute, 2003). These movies exposed many people, who have never lived near an ocean or seen a shark in real life, to terrifying and gruesome scenes of great white shark attacks. This helped to spread the fear of sharks throughout the world and led to even more retaliation against these animals, as seen with the harpooning of fifteen great whites off the coast of California after the premiere of *Jaws* (Allen & McCormick, 1996).

3.7: Chapter Summary:

This chapter focused on the ways humans and sharks have interacted over the centuries. In ancient times sharks were viewed as gods in many coastal communities, influencing human religion. Over time sharks were used as symbols in different groups, ranging from ancient tribes to modern day businesses. The animal's connection to fierce and aggressive characteristics made it an idol mascot for sports teams and a powerful

[13] Forty other movies featured either unidentified shark species or fictional species, though many of these showed a resemblance to the great white.

totem for Indigenous people. Sharks have also been represented in different works of art, including oil paintings and poems, as well as different forms of entertainment, such as stories, movies, and songs. However, these forms of entertainment have also been used to spread the fear of sharks throughout the globe, often portraying them as man-eating monsters.

As seen in this chapter, anthrozoology is not the same as biology or animal behavior, but a separate field altogether. When studying sharks in an anthrozoological sense, researchers are not looking for their life span or physical characteristics. Instead they are focusing on how people interact with sharks and the influence this has on human life for better or worse. Over the centuries these interactions have shaped human religions, artwork, and fears. From the shark gods of Hawaii to the dead-eyed monster in *Jaws* these interactions have been both direct and indirect. They have shaped how people not only view sharks but also how they live their lives in and around the ocean. This thesis focuses specifically on the great white shark, which tends to have a very negative reputation among humans, often being referred to as a monster.

"Where friendly little houses are
With blinds of blue or green,
Where water-lilies lift their cups -
The fairest ever seen –
Within the sound of Ocean's roar,
Along the ever changing shore
That's Cape Cod"

-- Bernice Hall Legg
That's Cape Cod (1930).

Chapter Four: Cape Cod and Sharks

Cape Cod, also known simple as "the Cape", is located in Massachusetts on the northeast coast of the United States. Extending 65 miles out into the Atlantic Ocean, this tourist destination is known for its natural beauty and sandy beaches which cover almost 560 miles of coastline (Cape Cod Chamber of Commerce, 2020a). In recent decades a population of migrating great white sharks has been increasing off of the Cape's shores. In the late summer of 2018, a young man was bitten by a great white shark and died of his injuries, marking the first shark related death on Cape Cod in over 80 years. Since then residents of the Cape have been struggling to figure out what to do about these aquatic predators.

4.1: The Cape

Cape Cod was formed around 21 thousand years ago as glaciers moved down the east coast of North America (Cumbler, 2014). As these glaciers broke up 4-6 thousand years ago, they left behind deposits of sandy soil forming a bent arm shaped peninsula off the coast of present-day Massachusetts. Large pieces of ice were also left behind as the glaciers retreated, leaving large depressions in the land as they melted and creating the many ponds and lakes throughout the Cape. Sea level also rose as a result of these melting glaciers, leading to low areas around the Cape to fill with saltwater and eventually forming Buzzards Bay and Nantucket Sound (Cumbler, 2014). Over the next few centuries, natural elements such as wind and waves continued to shape the Cape into its present-day form (*Fig. 4.1*).

Due to the poor nutrient and sandy soil many trees were unable to thrive on early Cape Cod and plant life consisted of mostly moss and tundra type plants. The white pine, however, thrived in this environment and slowly spread throughout the Cape. As years went on, the dropped needles from these pine trees added nutrients to the soil which allowed other types of trees take root, including hemlock and oak. Today many species grow on the Cape including beech, maple, birch, and chestnut trees (Cumbler, 2014). Closer to the coast, cordgrass and salt meadow grass flourished in salt marshes, creating important ecosystems for many

different species. Sources of freshwater on Cape Cod included over 900 ponds (Cape Cod Commission, 2020) and two rivers which separated the peninsula from the rest of continent; these were later named the Monomet (Monument) and Scusset River (US Army Corps of Engineers, 2020).

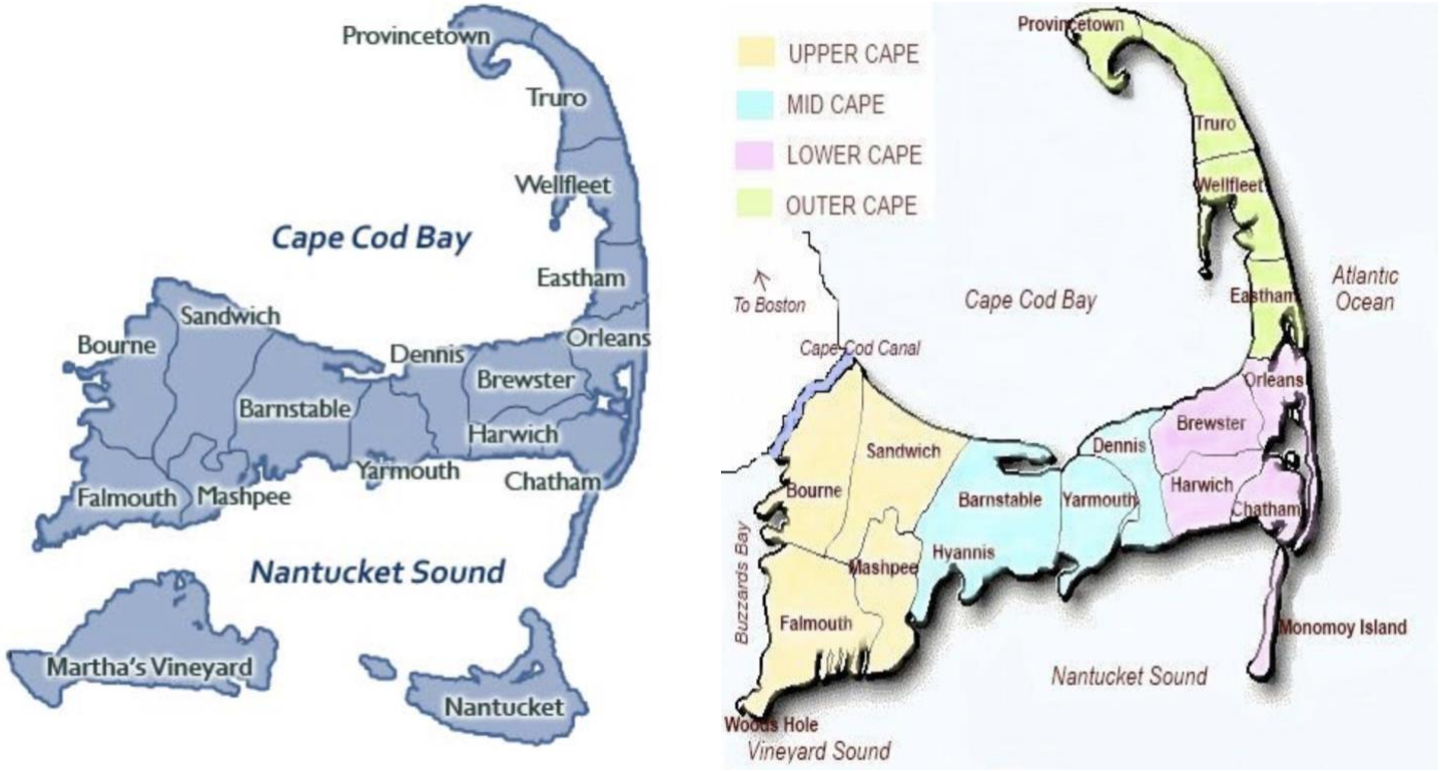

Fig 4.1: (*Left*) Ranging in areas between 1 to 20 miles wide, the Cape is home to 15 different towns and several islands including Nantucket and Martha's Vineyard (The Editors of Encyclopaedia Britannica, 2020). It is often referred to as the Arm of Massachusetts due to its shape resembling a flexed arm. (*Right*) Towns are grouped into four different regions of the Cape, the Upper, Mid, Lower, and Outer Cape, with Lower and Outer regions experiencing the most shark activity. Cape Cod is also surround by five main bodies of water: Cape Cod Bay, the Atlantic Ocean, Nantucket Sound, Vineyard Sound, and Buzzards Bay. Credit: Cape Guide (*left*) and The Captain's Manor Inn (*right*).

Around 3-8 thousand years ago the first humans came to Cape Cod, gathering plants and hunting for birds, fish, and shellfish. Around 1-2 thousand years ago they began planting crops such as beans, corn, and squash (Cumbler, 2014). These people would later become part of the Wampanoag nation[14] with several different tribes[15] inhabiting the Cape, including the Mashpee Wampanoag Tribe and Wampanoag Tribe of Gay Head or Aquinnah Tribe (Native America Travel, 2020). In the late 1500s the first European sailors visited Cape Cod to trade with local tribes. The first expedition of the peninsula was conducted in 1602 by Bartholomew

[14] Wampanoag means "People of the First Light" (Mashpee Wampanoag Tribe, 2020). At its peak the Wampanoag nation had 67 tribal communities covering parts of current day Massachusetts and Rhode Island. Today only 6 remain, including the Mashpee and Aquinnah Tribes (Wampanoag Tribe of Gay Head (Aquinnah), 2020).

[15] The Nauset people were also living on Cape Cod during this time. This tribe was believed to be allies of the Wampanoag people and later became part of the Wampanoag nation (Native Language, 2015).

Gosnold (Cumbler, 2014). In 1620 the Pilgrims landed on Cape Cod after seeking refuge from rough seas in Cape Cod Bay. After staying on the Cape for five weeks they moved more inland and established Plymouth Plantation west of the Monomet and Scusset rivers (Cumbler, 2014). As more European settlers visited Cape Cod in the early 1600s, diseases such as smallpox began to spread throughout the area. These diseases killed many Indigenous people living on the Cape, decreasing their population from around 2000 to less than 500 over the next century (Cumbler, 2014).

As the Plymouth colony grew in size, settlers began to spread eastward towards Cape Cod. By 1638 colonist had reached modern day Bourne and Sandwich before moving on to Barnstable. In the mid 1600s they had settled in Wellfleet, with colonist occupying most of the Cape by the end of the century (Cumbler, 2014). Many of these early settlers were farmers, bringing with them cows, sheep, and pigs. By the end of the 18th century whaling, ship building, and salt production also become large industries on Cape Cod. Trees were cut down to make room for pastures and build houses. Ship builders harvested white oak, ash, chestnut, and white pine for timber, resulting in a 60% loss in tree coverage and leaving behind the pitch pine and black oak that dominate the landscape today (Cumbler, 2014; National Park Service, 2015). The depletion of so many trees led to sand erosion throughout Cape Cod. Parts of the Outer Cape eroded, and many harbors become filled in with sand in the late 1700s (Cumbler, 2014).

Even with the change in topography the Cape continued to flourish into the 1800s, leading to what residents called the Golden Age (Cumbler, 2014). Some visitors began to travel to the area to hunt and fish while others came to build large vacation houses along coast. Cod fisheries increased off the coast and around George's Bank while salt marshes were transformed into cranberry bogs. The first train reached Cape Cod in 1848 with a stop in Sandwich. By 1873 passengers from areas like New York and Boston could travel the complete length of the Cape to Provincetown (Cumbler, 2014). Woods Hole also opened its doors in 1871, which held the U.S. Commission of Fish and Fisheries. Eighteen years later the Marine Biological Laboratory was created, followed by the Woods Hole Oceanographic Institution in 1930 (Woods Hole, 2016). However, while the science community grew other industries on the Cape began to diminish near the end of the century. Farmland was abandoned as younger generations moved away in search of better jobs. In the last quarter of the 1800s the Cape's population dropped by over 20% (Cumbler, 2014).

As the 1900s began so did the tourist industry on Cape Cod. Younger people who moved off the Cape began to return in the summer to visit family members whom stayed behind. Religious camps and hunting lodges began to appear on old farmland while hotels and summer homes popped up along Buzzards Bay. Wealthy families began visiting the Cape to escape crowded and polluted cities in the summer months, building large homes and supporting the local economy (Cumbler, 2014). During this time other industries on

Cape Cod continued to suffer. Farmers and salt producers struggled to compete with mainland suppliers while fishermen and whalers found many of their stocks overfished. In order to survive many industries shifted focus to the incoming tourists: Fishing captains began to take people out in search of sportfish[16], boat builders switched from making fishing boats to sailboats, shops switched from selling fishing gear to tourist souvenirs, and farmers supplied hotels and summer residents with fresh products (Cumbler, 2014).

The tourist industry continued to increase with the invention of automobiles, making the Cape more accessible for middle class families. Lower income families avoided hotels in favor of small cottages around the coasts, as wealthy visitors continued to build large summer homes (Cumbler, 2014). On June 22, 1909 financier August Belmont II enlisted the help of a Civil Engineer named William Barclay Parsons to create a canal between Cape Cod Bay and Buzzards Bay. The 17-mile canal, built over the location of the Monomet and Scusset rivers, was officially opened on July 4th, 1914. This canal effectively separated the Cape from the rest of Massachusetts, technically making Cape Cod a man-made island. Three bridges were built to cross the canal[17]: The Buzzards Bay Railroad Bridge (1910), Bourne Bridge (1911), and Sagamore Bridge (1913) (US Army Corps of Engineers, 2020). In 1910 electricity made its way to most of the Cape and the population began to increase again in the 1920s. With the increase of people visiting and living on the Cape, residents began to worry about environmental impacts and new construction. As a result, the Cape Cod Chamber of Commerce was created in 1921 to help protect the Cape's natural environment (Cumbler, 2014). However, even with the Chamber of Commerce natural resources continued to disappear. In order "To preserve the natural and historic values of a portion of Cape Cod for the inspiration and enjoyment of people all over the United States", President John F. Kennedy established the Cape Cod National Seashore in 1961 (MassMoments, 2020). This park covers over 43,000 acres of forests, marshes, and beaches between Chatham and Provincetown, protecting the land for recreational use. Also preserved within the park are many historical architecture structures including several lighthouses and the remains of the Marconi Towers, where the first Morse code message was sent across the Atlantic Ocean in 1903 (NASA, 2016).

After World War II more tourists began to flock to Cape Cod in the summer months. By the middle of the century the Cape was hosting over 200,000 visitors a year, causing some town populations to increase 400-800% between winter and summer (Cumbler, 2014). New residents also started to come to the Cape along with the tourists. Retirees and young people looking for construction and transportation jobs began to

[16] Tuna became a popular sportfish in the early 1900s. This fish was not considered valuable to the fishing industry, so its population had not decreased over the years like mackerel and cod (Cumbler, 2014).

[17] The U.S. Army Corps of Engineers widened and deepened the canal between 1935 and 1940. All three bridges were raised to 135 feet above the canal. The Bourne and Sagamore Bridges were changed from draw bridges to fixed structures, while the train bridge became a vertical lift bridge. All three reopened in 1935 and are still in use today (US Army Corps of Engineers, 2020).

settle around Cape Cod. During the 1940s the population increased by 10,000 people in ten years, reaching a total of 47,000 permanent residents in 1950. This number continued to rise throughout the rest of the 1900s, reaching 222,230 people by the end of the century (Cumbler, 2014).

Since 2000 the population of Cape Cod has decreased once again. In the 16 years after the new century began the Cape lost about 3% of its total population. Many of the residents that left were younger in age, mid 20s to 30s, and unable to afford the high cost of living in the area (Foulkes, 2018). By 2018 there were only around 214,000 full time residents on Cape Cod (Stats Cape Cod, 2019). While the population has decreased, the tourism industry continues to increase on the Cape. In 2016 around 27 million people visited Cape Cod, spending $1.1 billion dollars throughout the county and directly supporting 12,000 jobs (Cape Cod Chamber of Commerce, 2020b; 2020c). The Cape Cod National Seashore alone attracted just under 4 billion visitors in 2018. These visitors spent $495 million dollars throughout nearby communities and supported 6,098 jobs (National Park Service, 2019).

4.2: Sharks of Cape Cod

From the first inhabitants to modern day residents the people of Cape Cod have always relied on the ocean, whether it be for food, transportation, protection, or recreation. So it is no surprise that Cape Codders have a history with one of the ocean's most ancient predators: Sharks. Many species of sharks,[18] ranging from large whale sharks to small chain catsharks, can be found in Cape Cod waters (De Maddalena & Heim, 2010). While many of these species are seasonal visitors, venturing to the Cape in the warm summer months, some species use the local waters for nurseries. Smooth dogfish and sandbar sharks are believed to have nurseries in Nantucket and Vineyard Sound. Young dusky and tiger sharks can also be found off the Cape and are thought to use the area as a secondary nursery (Skomal, 2007). Other species, such as the porbeagle, can be found off of Cape Cod all year round (Lyman, 2019). In the past, many of these species, like the spiny dogfish, were hunted for food by the people of the Wampanoag Tribe (McGill University. 2020). Some Aquinnah Tribe members still fish for sharks today (Cultural Survival, 2017). Recreational fishermen also hunt sharks, as both food and sportfish. In the late 1980s one of the largest shark fishing tournaments in the United States began on Cape Cod (Shark Fund Fishing, 2020a).

For over three decades fishermen have gathered on the third weekend of July to participate in the Monster Shark Tournament (MST). This tournament, hosted at Oak Bluffs on Martha's Vineyard, lasts an entire weekend with fishermen catching large porbeagle and thresher sharks (*Table 4.1)*. At its peak in 2006 this

[18] Other species of shark found in the waters of Cape Cod include the shortfin mako, porbeagle, sand tiger, common thresher, sandbar shark, smooth dogfish, tiger shark, smooth hammerhead, and basking shark (Mass Gov, 2020a)

contest attracted 268 boats before numbers began to decline in 2008 (Stetson & Brown, 2016). While this tournament still continues today it no longer takes place on Cape Cod. In the past decade residents of Oak Bluffs became tired of the unruly crowds and the killing and stringing up of large sharks on their docks (*Fig. 4.2*). In order to keep the tournament going Captain Steven James, an organizer of the event, planned to move the tournament to Newport, Rhode Island in 2014 (Stetson & Brown, 2016). However, after his untimely death in early 2014 the MST broke up into two separate tournaments; the MST in Newport and the newly formed North Atlantic Shark Tournament in New Bedford, Massachusetts located on Buzzards Bay. This separation only lasted two years before the two groups merged again creating the North Atlantic Monster Shark Tournament (NAMST) in New Bedford (Stetson & Brown, 2016). Today tournament officials work closely with groups such as the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, and Massachusetts Environmental Police to help learn more about the local shark population. Scientists also take measurements of the sharks caught: Recording the size and sex, preforming a necropsy, collecting tissue samples, and examining stomach contents. Over the course of the contest, anglers participating in the event have helped tag around 2,000 sharks and released over 25,000 (Sharks Fund Fishing, 2020c).

Figure 4.2: (*Top*) Large crowds would appear in Oak Bluffs every July to watch the MST. During the peak years of the tournament visitors brought 3-4 million dollars to the local economy (Stetson & Brown, 2016). However, many residents got tired of dealing with the mischievous and often drunk tourists. (*Bottom*) Local and national activists also protested the displaying of sharks caught. These dead and often bloodied animals were tied up and weighed on local docks, drawing large crowds to look at them. As a result, in 2013 many residents voted to make any local shark tournaments catch and release, prompting the MST to move elsewhere (Stetson & Brown, 2016). Credit: Ralph Stewart (*Top*) and Chris Aumer (*Bottom*)

Table 4.1**:** Past winners, species and weight (lb), of the MST and NAMST (Sharks Fund Fishing, 2020b). In 2006 Captain James removed two species from the category list. Due to their rarity in North Atlantic waters, tiger sharks were removed from the list of catchable species. Blue sharks, while more plentiful than tigers, were also removed as they are not considered edible (Stetson & Brown, 2016). All sharks caught in the tournament are processed and given to the crew to eat, sell in the fish market, or donate to feed people of the community. Since blue sharks are not edible their category was dissolved as not to waste any fish caught and practice sustainable fishing (Sharks Fund Fishing, 2020c).

Year	**Species**	**Weight (lb)**
1987	Tiger	452
1989	Blue	341
1990	Dusky	424
1991	Blue	337
1992	Blue	360
1993	Mako/Blue	784/381
1994	Blue	360
1995	Blue	320
1996	Blue	356
1997	Blue	337
1998	Blue/Blue	330/327
1999	Mako	330
2000	Blue	311
2001	Mako	1,221
2002	Blue	383
2003	Thresher	506
2004	Thresher/Thresher	548/262
2005	Porbeagle/Porbeagle	378/378
2006	Thresher	482
2007	Thresher/Thresher	327/311
2008	Thresher	399
2009	Porbeagle	361
2010	Thresher	413
2011	Thresher/ Mako	538/278
2012	Porbeagle	447
2013	Porbeagle/ Porbeagle	429/313
2014	Porbeagle/ Porbeagle	430/378
2015	Porbeagle/ Porbeagle	432/ 354
2016	Thresher	412
2017	Thresher	360
2018	Mako	327
2019	Porbeagle/ Thresher	376/365

Although home to many different sharks, there is one species in particular that Cape Cod is known for: The great white shark. Interactions between this species and the people of Cape Cod can be seen in early fishing reports. Records show great white sharks were caught in 1839, 1848, 1937, and 1940. These catches were documented as occurring anywhere between 10 feet of water and 2 miles offshore (Bigelow & Schroeder, 1948). In a five-year period between 1935 and 1940 there were nine shark encounters in Cape Cod Bay. While these sharks were believed to be great whites, some species were unidentified and could have been another aggressive species such as the tiger shark (Bigelow & Schroeder, 1948). Great white sharks were also believed to be responsible for two attacks on fishing dories in 1867 and 1928, overturning the boats in both instances (Mollomo, 1998). The first recorded fatal attack[19] on Cape Cod occurred July 25th, 1936. A young swimmer was attacked by what was believed to be a great white in Buzzards Bay, later dying of his injuries (De Maddalena & Heim, 2010).

Encounters with great whites on the Cape seemed to drop off in the mid 1900s. This could be due to less sharks coming to Cape Cod as their food source in the area, gray and harbor seals, diminished. From the late 1800s to the mid 1900s fishmen competed against these seals for fish such as cod (Bittel, 2018). In order to solve this problem New England states, such as Massachusetts, began paying a bounty to fishermen for every seal they killed. Between 1888 and 1962 it is believed that over 135,000 seals were killed in the Gulf of Maine (Lelli, B. et al., 2009). With their main food source gone, great white sharks spent less time foraging in Cape Cod waters.

Although real great white sharks were less frequently seen on Cape Cod in the mid 20th century, another type of white shark appeared in 1974 (IMDb, 2020). From May to October of that year director Steven Spielberg set up base on the island of Martha's Vineyard to film the blockbuster thriller, *Jaws*. With him he brought three 25-foot long mechanical sharks, each dubbed Bruce, which would later star as the movie's monstrous antagonist (Turner, 2010). This movie, which would go on to gross over $400 million worldwide, has become a staple in many Cape Cod communities ever since. Today visitors can find sold out showings of *Jaws* every Fourth of July weekend at the Chatham Orpheum Theater. Across the street from the theater artists can be seen showing off decorated shark pieces during the yearly Sharks in the Park exhibit (Sherman, 2019). In other towns the Cape Cod Symphony plays live versions of the classic film's score for both tourists and locals alike (Cape Symphony, 2019). Across the sound on Martha's Vineyard tourists can take a *Jaws* tour,

[19] An earlier fatality occurred in Massachusetts in 1751, but it is unclear where exactly it happened. Other attacks in Cape Cod Bay took place in 1830 and 1897. However these attacks, which both involved fisherman, occurred in Swampscott and south of Lynn respectively, which are located in the northern part of the state and not on Cape Cod (Woods Hole Group, 2019a).

visiting different filming locations around the area. The island has also hosted a few JawsFests over the years, including one in 2005 for the 30th anniversary of the movie (Juul, 2015).

Also around the time of *Jaws*, seals began to return to the Cape thanks to the Marine Mammal Protection Act (MMPA) of 1972. In 1994 over 2,000 seals could be found in the waters around Cape Cod, and by 2011 that number had jumped to almost 16,000 individuals (Lippsett, 2013). Today there is an estimated 30,000-50,000 seals living year-round on Cape Cod (Lynch, 2019). With the return of the seals, great white sharks also began appearing in Cape waters again near the end of the 1900s. Along with an increasing food source, new protections were created for the species as well. In 1997 the great white was designated a protected species throughout federal waters, a protection that spread to Massachusetts' waters in 2005 (Kim, 2019). In recent years biologist Greg Skomal, one of the Cape's top shark scientist, has tagged over 130 different great white sharks in the area. His team has also identified almost 300 individuals, but it is believed the population may be larger (Laskowski, 2017).

The tourism industry has also embraced sharks in recent years. Recreational shark fishing, shark sight-seeing, and cage diving industries can all be found throughout the Cape. Shark silhouettes can be found on clothing, bags, and furniture in tourist shops accompanying phrases such as "nice to eat you" (Fitzgerald, 2019). Their images, showcasing toothy grins, are also seen on many restaurant and shop signs. As tourists flocked to the beaches in search of sharks in the earlier 2010s, some swimmers were unfortunate enough to meet these large predators in the water.

In the summer of 2012, the first shark attack on Cape Cod since 1936 occurred off a beach in Truro. A 50-year-old man swimming about 500 feet offshore was bitten, his right leg caught in the animal's mouth before he kicked it in the snout which caused the shark to release him. He survived the attack, suffering puncture wounds to his leg and needing 47 stitches but able to walk again after recovery (Ballou & Ellement, 2012). Six years later another attack happened in the same town. In August 2018, a 61-year-old man was bitten on the leg and torso in about 10 feet of water. He was able to punch the shark in the gills, causing it to release him. After he swam back to shore, off-duty nurses present at the time were able to help stop the bleeding before getting him to the hospital. The victim survived after being flown to a Boston hospital, undergoing six surgeries and receiving 12 pints of blood (Marcelo, 2018). The next victim would not be so lucky.

4.3: The 2018 Attack

Newcomb Hollow Beach is located in the town of Wellfleet along the Outer Cape. The sandy beach, boarded by sand dunes, is a popular destination for tourists and locals alike. Like other areas of the Outer

Cape, this beach was not immune to the increase of shark activity along the shore, with many surrounding beaches closing throughout the summer for shark sightings. Thirteen minutes down the road at Marconi Beach a shark bit a paddleboard in 2017, while the Truro attack in August 2018 occurred only 4 miles away. Researchers warned swimmers in these areas to be vigilant and that peak shark activity on the Cape occurs between August and October (Sherman, 2019).

On September 15, 2018 two friends, 16-year-old Isaac Rocha and 26-year-old Arthur Medici, traveled to Newcomb Hollow to bodyboard. Just after noon a large shark attacked Medici, biting his thigh and causing him to lose consciousness (Sherman, 2019). Rocha was able to drag him to shore and use Medici's board strap to create a tourniquet. Lifeguards performed CPR on Medici before the ambulance arrived to bring him to Cape Cod Hospital where he was pronounced dead (Sherman, 2019). His death would mark the first shark related death on Cape Cod since 1936.

4.4: Reactions

Medici's death greatly affected the Cape Cod community, with many locals trying to find a way to deal with the sharks. Some politicians were also vocal about the Cape's shark problem, including Barnstable County Commissioner Ron Beaty Jr. Beaty had been pushing officials to deal with the shark issue even before Medici's death. A year before the fatal attack, Beaty proposed to cull sharks using baited hooks to catch the fish before they reached the beaches (Tracy, 2017). After push back from local animal groups Beaty changed his stance, looking at the seals as the new culprit. As the 2019 summer season approached, the Commissioner pushed to amend the MMPA and cull the seal population, effectively removing the shark's food supply. Other groups such as the Atlantic White Shark Conservancy (AWSC) argued back against Beaty stating that removing the seals may cause sharks to attack humans more often (Sherman, 2019).

Stores and towns along the Cape also started to change how they represented sharks. Chatham's Sharks in the Park was changed to simple Arts in the Park. Artists switched from decorating shark profiles to mermaid and Cape Cod silhouettes. The Christmas Tree Shop pulled shark merchandise, deemed inappropriate by locals, from its stores around the Cape. Shirts, towels, and stationary with sayings such as "Send More Tourists, The Last Ones Were Delicious" and "Dangerous Summer" featuring an image of shark seemed to hit to close to home after the recent attack (Dunn, 2019). On the contrary, the Orpheum in Chatham reported they had no plans to stop their *Jaws* viewings in the coming summer.

The state of Massachusetts reacted by granting $383,000 dollars to the four Outer Cape towns as well as Chatham and Orleans to prepare for sharks in the upcoming beach season. Towns planned on using that money to help improve the safety of their beaches in case of an attack (Niezgoda & Rendon-Alvarez, 2019). In

places where cell coverage is spotty, emergency call boxes were built and lifeguards given satellite phones. All-terrain vehicles and stretchers were supplied to help move lifesaving equipment and victims up and down steep sand dunes, while trauma kits with tourniquets were placed on more remote beaches. Many towns also hired more lifeguards, beach staff, and emergency personal to handle any future attacks (Niezgoda & Rendon-Alvarez, 2019).

While towns focused on how to react to another attack some people looked at how to prevent attacks from happening in the first place. Buoys which are used to detect great white sharks were deployed off beaches, alerting lifeguards to their presence (Fraser, 2019). However, these buoys have their weaknesses. Due to poor cell service on many Outer beaches, some buoys showed signs of delayed notices. For example, alerts from the buoy off of Wellfleet came 2-7 minutes after a shark was detected. Each system is also fairly expensive with buoys ranging between $10,000-$14,000 each (Fraser, 2019). Finally, these buoys only work for tagged sharks, accounting for only 171 individuals out of the supposed 300+ great whites in the area (Mass Gov, 2020b).

New shark warning signs also began showing up at the entrance of all Cape beaches. These signs warn beach goers of the presence of sharks, to avoid any seals seen in the water, and encourage people to call 911 in an emergency (*Fig. 4.3*). Purple flags with a white shark were also flown from lifeguard towers beneath the swim condition flags. These flags are used to remind people that they are entering a shark's habitat and to be aware of their surroundings (Bonner, 2019). Officials also began closing beaches after shark and seal sightings to minimize the chances of an attack. If a shark was sighted off a beach, lifeguards would call all swimmers back onto shore and close the beach for one hour to allow the shark to move on (Bonner, 2019).

The AWSC in Chatham also came out with a new app that allows people to track sharks on the Cape and report sightings (*Fig. 4.4*). This app, dubbed Sharktivity, was created by the AWSC with help from the Cape Cod National Seashore, Massachusetts Division of Marine Fisheries, and Cape Cod and South Shore officials (Atlantic White Shark Conservancy, 2020). It is advertised on all new shark warning signs, has a four-color icon system, and reports information such as the time of the sighting or beach closure and the name and size of the shark if tagged (Atlantic White Shark Conservancy, 2020).

Figure 4.3: (*Top Left*) Ocean condition flags are flown from most lifeguard towers on the Outer Cape. The colors (red, yellow, and green) signal swimming conditions for any given day. Recently many towers have also began flying dangerous marine life flags (purple). The white shark on the flag indicates the possibility of sharks in the water (Bonner, 2019). (*Top Right*) For beaches with poor cell coverage emergency call boxes have been installed near the entrance of the beach in case of another attack. (*Bottom*) New shark warning signs have been placed at the entrance to all Cape beaches. These signs warn people of the presence of great whites, when shark activity is most common on the Cape, where to find more information on sharks, and how to download the Sharktivity app. Also alongside these signs are seal warnings. Not only do these animals attract sharks but they can also be dangerous to humans and are protected under the MMPA. Credit: Jessica O'Toole

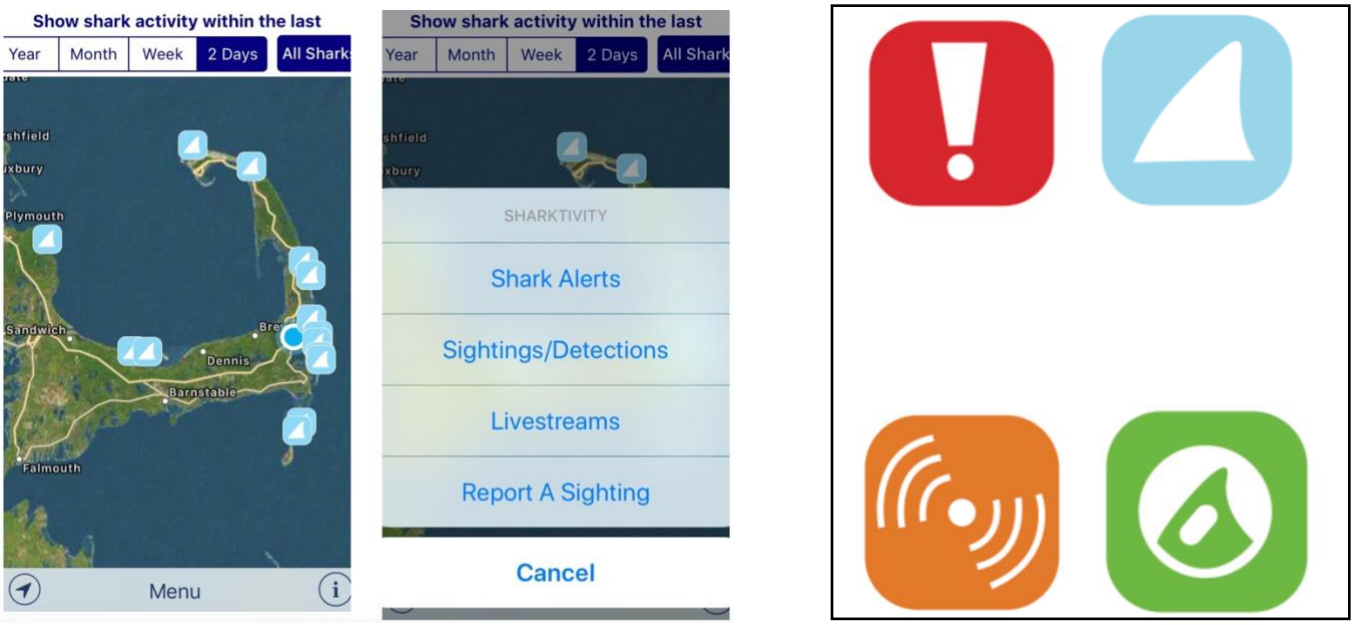

Figure 4.4: (*Left*) The Sharktivity app lets users track and report shark sightings throughout the Cape, and allows them to view sightings in the last two days, week, month, or year. (*Right*) Four different color-coded icons are used to indicate different warnings: Beach closure (red), confirmed sighting (blue), acoustic tag transmitter (orange), and Smart Position and Temperature Tags (SPOT) satellite detection (green). All but the acoustic transmitter information is reported in real time to the user. Credit: Atlantic White Shark Conservancy.

4.5: Chapter Summary

Cape Cod is beautiful beach destination, as described in Bernice Hall Legg's poem *That's Cape Cod* in the beginning of this chapter. However, it was not always the tourist destination it is today. Originally home to the Wampanoag people, the Cape later became an extension of Plymouth Plantation. It eventually became known for its fishing, farming, and boatbuilding industries which helped support the community up through the 1800s. By the 1900s the tourist industry began to take off in the area with people looking for a summer get-away from the crowded cities of Boston and New York. Due to new environmental protections, great white sharks also began to return to Cape waters by the end of the 1900s. As the population of sharks increased, the people of Cape Cod began to worry about what it meant for beach visitors. In 2018 the first shark related death in over 80 years occurred off the coast of Cape Cod. This attack pushed residents to look for ways to handle the growing shark problem. The response to this problem came in the form of increased medical staff and supplies at beaches, new detection equipment, and proposed culling strategies.

"Mostly I think, successful interviewing is a matter of professional – and, one hopes, genuine – curiosity overtaking the writer's innate shyness."

-- John Brady
The Craft of Interviewing (1976), p. 4.

Chapter 5: Methodology

For this thesis I wanted to know what people on Cape Cod presently think about sharks. I went into the field to research three main topics: People's perceptions of sharks and what affected them, how people physically and emotionally responded to sharks, and how people's behavior has changed with the sharks around. Due to the restrictiveness of surveys I decided to use a mixed qualitative methods approach. In order to conduct this research, I had to first be approved by the University of Washington's Human Subjects Division. My research proposal was accepted on May 24, 2019 with exempt status. Going into this research I was also interested in seeing if who I am as a person affected my data collection. For a short note on how my personal experience and gender effected this study see Appendix III.

5.1: Research Questions

This was an exploratory research project used to understand the general perceptions and people's reactions in response to sharks as a stimulus. I primarily used interviewing to examine this by devising three main research questions (RQs), each with two or three more specific posed questions (PQs):

RQ1: How are sharks understood by people?

- PQ1: How do you feel about sharks?
- PQ2: What do you know or believe about sharks?

RQ2: How do sharks influence people's behaviors?

- PQ1: Have you changed your behavior in the water knowing there are sharks present?
- PQ2: Did the 2018 attack cause you to change your behavior?
- PQ3: What are these changes?

RQ3: What other shark issues are salient in people's minds?

- PQ1: What else about sharks is on your mind?
- PQ2: Can you say any more about sharks?

The first two research questions were designed to be very focused, looking at people's perceptions, feelings, attitudes, and behavior. The third research question was deliberately left vague. This is because RQ3 was extra exploratory and used to tap into understandings that I could not anticipate.

5.2: Mixed Methods Data Collection

The mixed qualitative methods approach used in this thesis included three different types of data collection: Interviewing, unobtrusive observation, and secondary source information. Interviewing was further broken down into two different types, elite and semi-structured interviewing. For more in-depth analysis, strengths, weaknesses, and problems faced using each method see Appendix II.

Elite Interviewing

Elite interviewing as described by Dexter is, "An interview with any interviewee-and stress should be placed on the word 'any'-who in terms of current purpose of the interviewer is given special, non-standardized treatment" (Dexter, 1970, p. 5). For this thesis a total of ten elite interviews were conducted, consisting of eight male and two female participants (*Table 5.1*). While some open-ended questions were prepared before each interview, participants were encouraged to control the pace of the interview and, to some extent, the path it took. Each interview lasted an average of 45 minutes and was recorded with the permission of the interviewee. Interviews were then fully transcribed, taking about 3-4 hours to complete each one (*see next page for an expert of an elite interview*). In order to find participants for these interviews purposive and snowball sampling methods were used. After contacting one interviewee they were then asked if they knew anyone else who would be willing to be participate in this research project. Most interviewees were contacted via email or phone number, either provided by past interviewees or via government and research websites. Four of the nine participants were contacted in person at their place of business. Interviews were conducted throughout Cape Cod and covered seven different occupations held by local residents.

Table 5.1: List of the number, sex, and occupation of elite interviewees.

Occupation	**Number of Interviewees**	**Male (M)/Female (F)**
Bar Tender	1	M
Theater Director	1	M
Parks and Recreation Employee	2	M (2)
Educational Director	1	F
Fisherman	2	M (2)
National Park Ranger	2	M (1) F(1)
Shark Researcher	1	M
Total	10	

Excerpt from an Elite Interview with a Retired Sea Food Industry Employee and Fisherman:

So we have already have had one summer since the attack but going forward how do you think the Cape is going to handle the increase of sharks?

Well, assuming that we all can go to Cape Cod and all that, assume that (*laughs*). I think you'll (*pause*) you know, there will be a more watchful eye and as you, living near the Cape too, you know residents are probably going less to the beaches and building pools. Yeah, so I think that there will be an affect. I think that it will just really be less swimmers than people just hanging on the sand and getting their tan. Just need to be more aware. I mean I never had to worry about a problem before but like I said when I go to the beach I do look out to the horizon. Especially if it is late July or August, and the water is warm. They are on the other side of Cape Cod. Like I said they have been spotted in Manchester and Rockport. You have to be aware of it, that's one more thing you have to aware of.

What is the first thing that comes to mind when you hear the words "great white shark"?

Well (*pause*), of course you know, a very sleek and very skillful shark and… You know a lot of times what the first thing that comes to my mind when I think about that? There's a guy that lives in Florida, he scuba dived a little bit and he worked with me and he was telling me '[name] when you see a shark coming at you what you got to do is you got to face him and you got to hit it. And let him know that you are not, you know, a dead animal'. So that always comes to my head first. It's what a coworker said, think shark and immediately think about what to do if you see one coming towards you. And of course, my question to myself is 'how much strength can I have (*laugh*) underwater to whack a shark', (*laughs*) you know what I mean? I can't picture it being a real good swing. But yeah, that's what he said so yes. So, what I think of when you tell me about a great white shark I think of defensive measures.

Is there anything else you want to add?

No but… you know. Being, like I said, being from the industry in itself I never think of the seals as being good for the economy, good for the industry. I don't see that as a positive. They are just problematic. Not that I want to see them disappear form the Earth but…like everything else. Well even with this virus the way it makes it kind of, you know, cull down the herd of humans. It's a natural mechanism of Mother Nature, you know, so… So that's just, I just think they need to be culled a little bit because they are not a positive attribute to the industry. Maybe to the aquarium but not to the fishing industry. (*Pause*) But really the only ones that like seals are the ones that aren't related to the industry, that has to make a living out of it. That's the mess with it. But I am, as a behavioral of humans, I am now conscious of them. Like I said, did not use to be but I am conscious of them now. When I go into the water I am always looking at the horizon to see if I see a little Jaws coming my way (*laughs*).

Semi-structured Interviewing

The second type of interview used was the semi-structured interview. Semi-structured interviews contain open ended questions that allow for in depth and descriptive responses (Baumbusch, 2010). Over the course of this research thirteen semi-structured interviews were conducted with six male and seven female participants (*Table 5.2*). They represented five groups of people including surfers, beach goers, tourist industry workers, national park rangers, and tourists. Each participant was approached in person and selected due to having a relationship with the beach or ocean, making them more likely to have been affected by shark interactions. Interviews ran between 5 and 15 minutes, with all notes and quotes being recorded in a notebook with permission from the interviewee.

Table 5.2: List of the number, sex, and occupation of semi-structured interviewees.

Occupation	**Number of Interviewees**	**Male (M)/ Female (F)**
Surfer	2	M (2)
Beach Goer	3	M (1) F (2)
Tourist Industry Worker	4	M (1) F (3)
Tourist	3	M (2) F (1)
National Park Ranger	1	F
Total	**13**	

Unobtrusive Observations

Unobtrusive observations were also conducted in four different towns throughout the Cape (*Table 5.3*). These observations, which were made without the knowledge of the subject, were used to study people's reactions to the new shark warning signs posted at Cape Cod beaches. Both physical and vocal reactions were recorded in a notebook for a total of eight hours at beaches in Chatham, Orleans, Wellfleet, and Truro (*Fig 5.1*).

Table 5.3: The towns where unobtrusive observations were conducted and the amount of time spent at each location in hours (Hrs).

Town	**Hours Spent Observing (Hrs)**
Chatham	3
Orleans	2
Wellfleet	2
Truro	1
Total	**8**

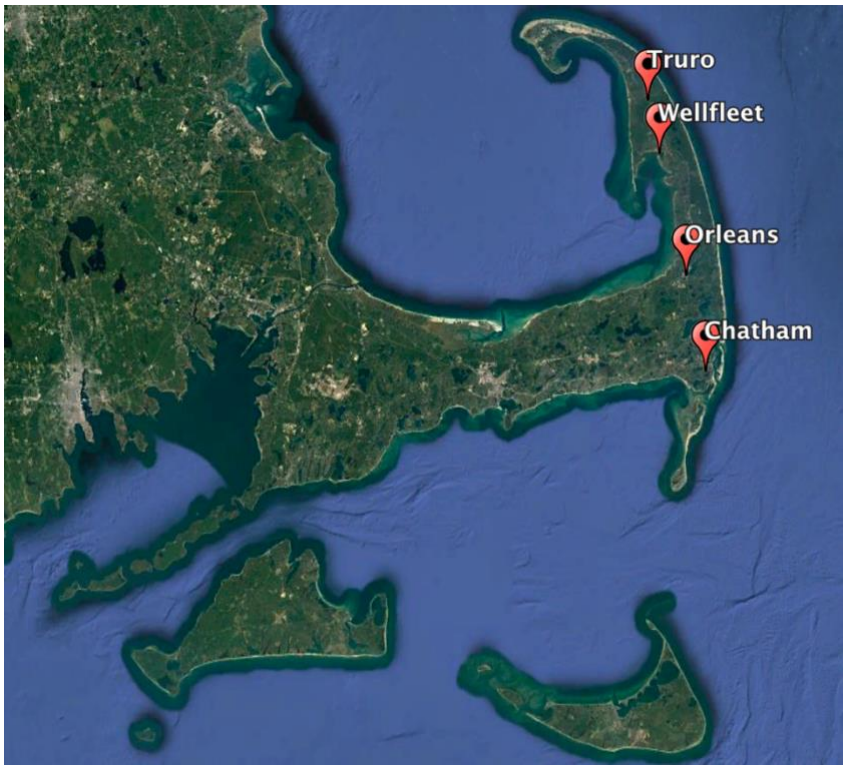

Figure 5.1: This map shows the locations of the four towns where unobtrusive observations were performed. These towns were selected due to the access to Outer Cape beaches and high level of past shark activity. Map captured using Google Earth.

Secondary Source Information

Five types of secondary source information were used for this research (*Table 5.4*). Newspaper articles from Massachusetts and surrounding areas were examined including the *Boston Herald*, *Cape Cod Times*, *The Boston Globe*, and *Providence Journal*. Two TV shows, *60 Minutes* and Discovery Channel's Shark Week *Sharks of the Badlands*, which both aired in the summer of 2019 were also used. These two shows talked about the great whites of Cape Cod and included interviews with local shark experts and residents. Other sources of information included magazine articles, a pamphlet from the National Park service, and Facebook comments[20].

Table 5.4: List and number of each type of secondary source used.

Type	**Number**
Newspaper Articles	20
TV Shows	2
Facebook Posts	10
Magazine Article	2
Pamphlet	1
Total	**35**

[20] Facebook posts were from the Boston, Massachusetts Facebook page. Comments were recorded on all post regarding *Boston Globe* articles concerning sharks on Cape Cod. Issues with this form of data collection occur in regard to validity; unknown if the person is posting truthful responses, no way of supporting responses, do not know if people posting are actually from the area, etc.

Chapter 6: Results and Analysis

These results were analyzed using a content analysis. Aspects from other ethnographic research, as found in Boynton's *New New Journalism* (2005), were also applied to examine the data for patterns. These patterns were themes that emerged after looking through the interviews, notes, and observations. The three research questions resulted in five patterns; two of which were reaction based with examples of both positive and negative responses, and three other themes including changed behavior, seals, and education.

RQ1: How are sharks understood by people?

This first research question was used to examine people's attitudes and feelings towards great whites, as well as their understanding about the species. This resulted in two main reactions, positive and negative. Negative reactions were classified as any reaction where people expressed an anger toward sharks or a fear of them. These reactions appeared fairly frequently among residents as stated by one researcher;

> "I think in some cases it's just pure fear and as a result of it people are choosing not to go to Cape Cod. And then for those people who are already on Cape Cod, there is some fear but mostly anger. I think there is anger involved."

He continued by explaining where this anger could be coming from:

> "People who are maybe running a small business are saying that, 'if we didn't have these sharks my business would not be suffering', or 'I would be able to go swimming.' You know, 'I moved to Cape Cod because I love it. I run a surfing company', or 'I love to surf on Cape Cod because it's such a spectacular place, but now I can't and I blame the sharks'."

An employee from the Atlantic White Shark Conservancy (AWSC) also noticed this anger:

> "They are looking at it and thinking bout, 'well this is where I go swimming, this is where I go surfing, this is what I do.' Or, you know, there are some people now that are claiming that this is going to hurt our property value. It's all coming from a place of fear."

The way people referred to the sharks also took on a negative tone. When asked about the sharks one local man responded with, “What are sharks? They are apex predators. Predators. That is not a nice word, it’s not a compliment.” He continued by comparing sharks to abusers and criminals. A tourist visiting one of the beaches referred to them as “monsters” after seeing a shark warning sign. Other people used terms like “deadly”, “creepy”, and “oh hell no” when reading the posted warnings.

Many Massachusetts residents expressed fear when asked about sharks. One woman simply said, “This is why I am scared of the ocean!”. Another focused more on the unseen aspect of the animals saying, “I know they are in there and I can’t see them, and I’m petrified”. A local bartender confessed, “They got me pretty good. They’re pretty scary”, but followed it up with, “I don’t have any ill will against sharks… they are just there, you got to be mindful of it, stay out of their way”.

One group of people who were concerned about shark attacks were the Cape’s lifeguards. One town official touched on the fear some lifeguards were facing when it came to their job:

> “I mean a legitimate concern from the lifeguards has been ‘what if’, and if you’re on the tower and you’re at one of these beaches and somebody gets hit… The question is, am I putting myself in harm’s way if I jump on a rescue board and go out there to save this person, that’s obviously just been hit?”

Other people shared this mentality of what to do if there was a shark attack. When mentioning last year’s attack one women responded with, “Could you imagine? I don’t know what I would do if I ever saw something like that happen.”

Some people touched on the fact that they did not always see sharks in a negative way, and that it was only after the attack that they became mad or fearful. One woman working at a local tourist shop mentioned, “I didn’t think too much of them till that guy died last year, now I can’t bring myself to go into the water.” An interesting aspect of this shift in attitudes was explained by the researcher quoted above. He talked about this change that occurred in people’s attitudes towards sharks after the attack, shifting blame from people to the animals:

> "It's one thing I think for people to be bitten vs somebody to get killed. And I think there is definitely a dramatic shift in attitude that occurs between being bitten and being killed. A lot of feedback when we had a couple of bites were that that person shouldn't have been doing that. That was a lot of the public saying that. In newspapers, in comments, social media, saying that person put themselves at risk. I think when the fatality happened though, less and less people were blaming the victim and became convinced that now the shark was the perpetrator of the crime. And certainly the shark did kill the person but I saw dramatic shift in attitudes that occurred."

While negative reactions were categorized by anger and fear, the opposite were labeled as positive reactions. These responses included any examples of people expressing excitement about the sharks, saw them as sublime or extraordinary animals, or as good result and indication of a healthy ecosystem. In contrast to the negative adjectives used by some people when describing sharks, people with positive reactions used words like "amazing", "beautiful", and "awesome" to describe the animals. One local liked them despite the danger they posed:

> "I think they're cool (*laughs*) I like them. I don't like the threat that they pose to humans but that's sort of nature, right? It's like going in the woods with wolves or bears or anything like that. You know, we need to learn that its part of nature and have to deal with it or live with it."

Many fishermen talked positively about the sharks as well. Some captains even think of them as added bonuses for their customers:

> "On a charter boat it's sort of like (*laughs*), you get a great white attack your striped bass sort of adds to the experience. It's sort of cool (*laughs*), I think. Some people see it as a downer but imagine your charter going, 'oh my god that's amazing'."

Another fisherman agreed stating, "Great whites add to the experience, people love to see them. It's not something many people get a chance to see". Others even see it as a way to balance the ecosystem a bit.

“Maybe the more sharks that come, the less seals will be left”, responded one man fishing off a beach in Orleans.

Kids especially showed positive reactions to sharks. At the AWSC kids love to show off their shark knowledge, as one employee pointed out:

> “Kids love sharks. They find it to be so interesting. We have so many kids that come in here and they know all these facts about sharks and different shark species and they’re excited to talk about it and share what they know.”

Children also showed great interest in the shark signs posted at the beaches, often pulling their parents over to take a closer look. Other people, both adults and kids, were seen posing for photos with the signs, even situating themselves so it looked like they were interacting with the shark image.

Some people did not understand the level of fear overcoming residents. A Chatham businessman began talking about people’s fear of sharks and stated that it is an overreaction:

> “It’s not like the sharks are coming out of the water and attacking people. So, I think it’s this overreaction. I mean people are being eaten by sharks in Hawaii every day. You don’t see Hawaii freaking out and shutting things down. Reality is, in this part of the country we have never had to live with them like this. And now that we’re back to our more natural ecosystem out there, which is a positive thing I think, we just have to be more diligent as the land animal here when we go into their world. There are ways of not being sensitive to the situation and overreacting to it.”

This defense of the sharks can be seen in a lot of comments made on shark articles posted by the *Boston Globe* (*Fig 6.1*). Out of the 121 Facebook comments that illustrated people’s feelings on great white sharks, 100 either showed positive reactions toward the sharks or defended their right to be in the water. These post included statements like, “I’d give just about anything to see those magnificent, incredible creatures” and “You are going into their home, don’t be surprised if they show up.”

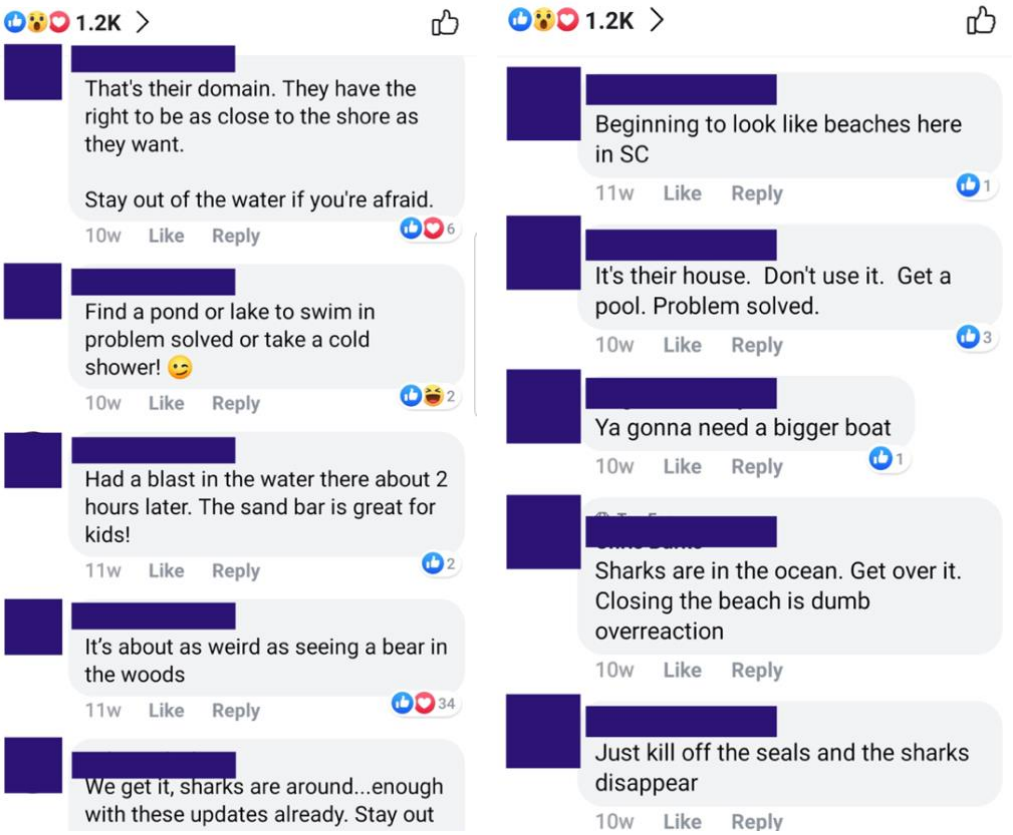

Figure 6.1: Facebook comments left on articles posted by the *Boston Globe*. On the ten shark related articles posted around the 2019 summer season, 100 out of the 121 comments regarding people's attitudes toward sharks showed positive reactions. Credit: Facebook.

Several residents saw the sharks as an indication of a healthy environment and believe their return is a good sign, as explained by one researcher;

> "The fact that an apex predator is able to grow in numbers, is able to thrive in this coastline, shows that we have a really healthy marine ecosystem right now here."

This sentiment was also repeated by a member of the Chatham government:

> "I've heard somebody describe that as it's just an indication of a very healthy ecosystem. An ecosystem that's on the rebound and things are in the process of coming back to balance."

While some people think sharks would drive away visitors, others believed the animals may actually attract more tourist to the area. A man from the Chatham Orpheum compared this phenomenon to the classic movie *Jaws*:

> "You know, there is that scene in the movie where it says 'you yell shark on Fourth of July people are going to run'? Well now you yell shark people run to the beach, not from the beach."

A ranger on the National Seashore agreed saying, "More and more people are flocking to the beach in hopes to see a shark." Another ranger added, "People are always asking me, when's the best time to see a shark? What beach should I go to if I want to see a shark?" And this is apparently not a new tourist attraction. An official in Chatham said people have been coming to the Cape for years in order to see the sharks:

> "I can tell you when we first learned there were sharks in the area, and it happened on a Labor Day weekend … I don't remember what year… but ten years or more than ten years ago, Chatham had one of its busiest Labor Day weekends ever, because people were flocking to town. They thought, you just walk out on the beach and there would be a shark."

Even some locals are attracted to the sharks. One Chatham man mentioned how he wanted to see a shark in action: "I would love to see a seal get air Jaws-ed. Like flipped up. I hope to see that. I mean in a boat, but that would be awesome." Others mentioned the possibility of more shark attractions on the Cape such as cage diving and shark tours.

One local even defended the sharks by pointing out that they are not the biggest threat to humans on Cape Cod, stating that there were other dangerous found in the area:

> "Over the past week three people have drowned in ponds around the Cape. You know there are other dangers to this environment outside of the sharks and I think a lot of people who know this environment know and understand that and know if they are going to go into the water that there is a risk of not just of wildlife but of rip tides and such".

She went on to further explain how these other dangers and not the sharks are why she stays out of the water:

> "Somebody asked me the other day, 'Would you swim up here at Lighthouse Beach?', and I was like no, never. And they were like, 'Oh, yeah because of the sharks, right?' and I'm like no, do you know what kind of current goes through there!? Like it's so strong!"

Some people even think the "sharks get a bad rap", as pointed out by one beach goer at Nauset Beach. Another man added, "They are just doing what comes natural." A resident supported this idea by reminding people that the sharks were here first, humans are just visiting:

> "They live here, they have been living here way longer than we have. This is their home, we're just temporary visitors here. I have always viewed it as they're neighbors, just like everybody else. And when we go into their world, it's like going into somebody else's neighborhood."

One fisherman even talked about feeling bad for the sharks. At one point in our interview he mentioned shark finning, which while not a specific Cape Cod or a great white issue still showed concern for the species:

> "Being a fisherman, you of course need rules and regulations but one thing I didn't really like was the way they went after sharks and then they would cut off their fins for that shark fin soup. And making those animals drown. I thought that was something that shouldn't have been done. So, I felt bad for them in that sense, you know. So, this harvesting for one little fin just doesn't make sense. You know what I mean?"

Other members of the community also showed sympathy for the sharks, saying things like, "I don't want to see the sharks gone", "why would people want to kill them?", and "I like that none of these plans look to hurt the shark, it's not really their fault." Most people that were interviewed were opposed to the idea of shark culling and did not want to see the animals hurt.

RQ2: How do sharks influence people's behaviors?

Each interviewee expressed having changed their behaviors either since the attack or in recent years as the shark population has increased. Most participants mentioned simply being more conscious of sharks now and being more aware of their surroundings, as described by one fisherman:

> "I am conscious of them now. When I go into the water I am always looking at the horizon to see if I see a little Jaws coming my way."

Other people mentioned staying in shallow water and only going up to their knees or waist. One woman at Mayflower Beach in Dennis stated, "I don't really go beyond waist deep", while her friend added, "I just quickly dunk to cool off then get right back out". A park ranger also mentioned changing her swimming habits: "My friends and I always use to swim at night during the summer. We don't do that anymore." Upon seeing the new warning signs at the entrance to Lighthouse Beach one mother announced to her daughter, "That's it, you are not going in pass you knees. I'm not letting you in too far."

It is not just swimmers that are taking these precautions. People participating in other recreational activities in the ocean have also begun to change their behaviors. Many surfers, for example, will not let sharks keep them from using the water and are trying to find ways to protect themselves. Showing off a black bracelet on his wrist one surfer explained, "It's supposed to deter sharks. Sends out electrical currents so the shark stays away." Another surfer mentioned hearing of another type of shark deterrent for one's board: "It's like the bracelet, but bigger, I think. Suppose to keep them away from you." Members of the Parks and Recreation Department have also noticed changes in the surfing community:

> "They have been very adaptive in their own minds, as I was told, they are learning the Stop the Bleed technique, they are keeping those kits even on them."

Other recreationalists have also become more thoughtful while in the water. A man who likes to fly fish on the bay side of the Cape talked about how the attack makes him think about sharks more:

> "You do have a greater sense of awareness, it's one more thing you need to think about when you're walking around out there is. We're always aware of currents and things like that, and especially when you are fishing at night, there are drop offs and things like that, you need to be able to find your way around when its darker. But now you are also being aware of, okay you know, is there anything out here with me? Where might that come from?"

Lifeguards on Cape Cod have also found they needed to change their behavior in the wake of the 2018 attack. Stop the Bleed techniques are now being taught alongside the usual CPR and first aid training for all lifeguards. Bleed kits have also been added to mandatory first aid kits at each lifeguard tower. Even lifeguard events have changed. "It has forced us to rethink our lifeguard competition", said one official, "We've been running a lifeguard competition here on the Cape for years." Although this competition usually rotates between towns, officials decided not to run the competition at any of the Outer beaches for fear of putting people in harm's way. Though, one official explained that in some ways the attack has made their job easier:

> "Lifeguards don't have to whistle people back that are trying to swim halfway to Portugal, people stay closer. The public in the water and around that area is much more manageable. They're in tune to what the lifeguards are doing."

After the attack some people stated they refuse to go in the ocean at all, as seen when talking to one town employee: "I talk to people that won't go near the water when they learn sharks were there or not. You know, I've heard tourist call me from places and say that." Another Massachusetts local talked about how people are finding other ways to beat the Cape Cod heat: "A lot of the locals on Cape Cod are now building swimming pools, cause they don't want to go to the beach anymore." Others will go to the beach to sit by the water, but refuse to go in. A few ladies on an Outer beach mentioned they had, "No intentions of going in the water", but instead planned on catching up with one another and reading their books.

Whole towns have also begun changing how they respond to the presence of sharks. According to one member of the Chatham Parks and Recreation Department, towns have started collaborating through a Shark Working Group:

> "We've created a Shark Working Group, which has been individuals from Atlantic White Shark Conservancy, the Cape Cod National Seashore, the National Park Service, and the local communities, beach managers from local communities."

This working group helps distribute information to different towns, allowing for a uniform message throughout the Cape. Besides warning signs, flags, and call boxes some towns have also began using a beach closure system. The Parks and Recreation employee went on to describe this system:

> "We've developed a policy that we follow here in Chatham, and its used by other communities, where if we see a seal or seals, if that's the case, within 300 feet of a public swimming beach we close that beach until the seals have not been in that zone, if you will, for at least thirty minutes… The general protocol has been if a shark is seen within the vicinity of a public swimming beach then the beach is closed for at least an hour."

Reports of these shark and seal sightings are also sent to nearby beaches to warn lifeguards and beach managers of a possible encounter headed their way. Sightings are also reported to the general public through the Sharktivity app.

<u>RQ3: What other shark issues are salient in people's minds?</u>

The advantage of using interviews to collect data is that they are open ended. This allows people to talk about things that may not have been thought of by the interviewer. This third research question was designed to be vague. It let participants fill in any blanks about the perceptions of sharks that I may not have thought of when designing this thesis. As a result, two other themes emerged from this question that I had not previously considered as effects on shark reputations on the Cape.

The first theme actually looked at another animal on the Cape that was affecting people's feelings towards sharks, the seals. Since the implementation of the Marine Mammal Protection Act (MMPA) in 1972 the seal population on Cape Cod has increased, as stated by one Chatham official:

> "The seals have been an ever-expanding population and they have spread out across the Cape here now, so it's become not just Chatham's problem, it's really become the Cape Cod problem."

These seals are a favorite food source for the visiting great whites, and their large population could be a major draw for the sharks as one local points out:

> "There's 15-20 thousand seals or whatever there are in this general area, and the shark species has learned that they're here and that's one of their favorite food sources and they're coming to lunch."

Due to this fact many locals are blaming the seals for bringing the sharks back to Cape waters. "If there were no seals in the water there would be no sharks", explained on beach goer. Another man agreed, pointing out, "They are only here for the seals, get rid of them and you get rid of the sharks, problem solved". As mentioned in Chapter Four, some politicians on the Cape have pushed for culling the seal population even before the 2018 attack. Since then groups such as the Seal Action Committee, based on the island of Nantucket, have pushed to amend the MMPA to allow culling as a way to manage the local population. This movement was not isolated to Nantucket either, as one women pointed out: "The owner of Muskeget Island too just had some press releases go out saying how the MMPA needs to be modified and all this stuff."

Another group which was very vocal about the seals were fishermen. One charter fisherman in Chatham expressed similar views to the Seal Action Committee:

> "Manage the seal population. Right now there's no management for seals. There's no management plan. The plan is don't touch 'em, don't interfere them. You know the seals are having a huge impact on a lot of other fisheries."

This captain was not alone. Every fisherman that was interviewed expressed some concern about the seal population. They believe the seals are the biggest threat to their industry, especially the charter fishermen, who typically stay closer to shore. One captain expressed his concern over keeping his customers happy. "I promised them a fish, not a seal cruise" he said wearily, "they are eating everything".

A retired fisherman whose family has fished Cape waters for generations talked about the effect seals have on the industry:

> "Being, like I said from the industry in itself I never think of the seals as being good for the economy, good for the industry. I don't see that as a positive. They are just problematic. Not that I want to see them disappear form the Earth but… I just think they need to be culled a little bit because they are not a positive attribute to the industry. Maybe to the aquarium but not to the fishing industry."

He went on further to discuss how they are competing with local fishermen and the ways Canada has dealt with a similar problem:

> "We never use to have problems before the seals with the lobsters and all that. But now they're around and you see them anywhere and you have to stay away from them. But they are the ones that love to attack the lobster traps and get in there and feed on the bait. They have become a nuisance in that sense. For those who really live by the sea and earn money by the sea, they aren't exactly the number one pet. And I can understand what the Canadians did, when they used to do those pup killings. They understood the effect of what it meant on fisheries."

Not all locals wanted to see the seal population attacked, however. Also on Nantucket, the Marine Mammal Alliance Nantucket advocates not only for seals but all marine mammals in the area. Some residents saw the idea of seal culling as ridiculous and cruel. A local business owner expressed frustration with the idea of seal culling and the people who push for it:

> "The culling of seals? Really? That's the problem? That's how you are going to solve it… but you know, it always shocks (*hits table*) me and blows my mind how people can go from being a reasonable person to (*hits table*) a completely irrational and unreasonable about certain things and its purely emotional."

However as one fisherman pointed out, these people who are advocating for the seals are not the ones being affected by them. He states, "But really the only ones that like seals are the ones that aren't related to the industry, that has to make a living out of it. That's mess with it."

Tourists also contributed to the discussion. One visitor liked seeing the seals calling them “cute”. Another man visiting from New York said, “My kids love seeing them. How often are you going to see one of them in the wild, it’s a cool experience.” The seals can even be seen as an attraction. For example, a few tourists could be seen jogging down the steep dunes of Newcomb Hollow Beach just to take photos of two seals popping their heads out of the water. It is off this same beach that Arthur Medici was attacked a year prior.

While groups argued over the seals, other people seemed to be between the two parties. One local man said he was unsure what was right and that we should turn to local professionals and listen to what they advise:

> “And the whole seal thing? I don’t know what the issue with that is, I don’t know what the solution to that is, that’s a tough one. You know? Because there is a point where it can become dangerous and a nuisance, and not the best thing for everybody. But you know, I leave that to the professionals.”

As with the returning shark population, some said a large seal presence was an indication of a healthy ecosystem. When talking about these increasing populations, an employee from the AWSC said, “These are major conservation success stories, and we have an opportunity to learn about them right here.” An official from the Parks and Recreation Department in Chatham also commented on the local population, its relation to a healthy ecosystem, and what the future may bring:

> “The seals are why sharks are here in such numbers. You know, somebody was saying the other day that is why you are starting to see the orcas now. And, there will be balance, and may be fewer sharks around if there are a few more orcas around. This is just hearsay, this wasn’t any scientist telling me this, but…I mean if there’s some science or some truth to that, maybe we are at some point here going to get to a more balanced thing. But I have no idea what a balanced number of seals in the area is, or what a balanced and healthy shark population is, orca population is, and all the other, you know, subspecies under that, as to what goes on.”

The second pattern to appear from this research question was the importance of public education. As a Chatham Parks official pointed out education is one of the main tools used by the Shark Working Group: "Most of that has really focused on public education; signage, brochures, and what not." Other groups are also trying to educate the public about sharks in hopes that people will understand them better. One such group is the AWSC in Chatham. When asked how they are addressing some of the fear people are facing one employee said, "Our way is education. You know, we are just really trying to build peoples understanding." She added that part of that includes dispelling some misinformation that is out in the public:

> "Unfortunately there is some misinformation out there, like some people think that the tags actually anger the sharks and that's what causes them to attack. There's no data or anything that supports that… Or some people genuinely think that sharks eat people. That we are a diet source for them. We are nowhere near, especially when talking about the white shark, we are nowhere near the size of the seals that they want to feed on."

She felt that if people understood the sharks it may lessen the fear of them:

> "So really just trying to educate the public and build their understanding. Cause there is a lot behind 'you fear what you don't know'. So maybe, and hopefully, if we can educate the people better, it won't be so scary for them. But also in terms of that fear, if people are still nervous at least they understand what is going on here and they can use the information and decide how they feel comfortable using the water."

Another group that is trying to educate the public is the Chatham Orpheum Theater. A board member for the theater explains, "One of the things we also have done that's important to us, you know as the nonprofit community theater, while our job is to entertain people, but we can also educate people." He stated that they are currently partnered with different groups, working together to help generate awareness about sharks:

> "So we have always partnered with, since the time we have opened, we have always partnered with the Atlantic White Shark Conservancy. Our friends over there at the shark center, providing not only entertainment but also education. So, we ran out and shot a video, shark video segment, with Greg Skomal, that he introduces *Jaws* here at the theater. It talks about sharks right outside these waters and these amazing creatures."

The lobby in the theater was also adorned with photos of not just sharks but other marine life found on the Cape, all taken by a spotter for the AWSC. Newsletters giving information on these animals were also available for free on the ticket stand, allowing customers to read up on different species. The theater also partners with the conservancy to host a weeklong showing of the documentary *Great White Shark*, giving people a chance to learn more about these animals for little to no money. The board member ended the topic by looking to the future:

> "So I think moving forward, really all you can do is entertain and educate. You know what I mean? You be reasonable and I think you teach people and you educate people and you hope that that sticks."

A shark researcher touched on the public interest in these animals during his interview, commenting on the crowds he sees when giving talks about sharks:

> "Certainly when we give talks they are jammed pack, so based on that there is really a strong interest from the public to learn more about it."

Examples of this interest can be found other places on the Cape. After an hour of observation at Lighthouse Beach in Chatham, eleven parents brought their kids over to the shark warning sign. Out of these eleven parents, six spent time reading the sign out loud to their kids, allowing for a discussion about the species. These parents answered questions regarding topics such as why the sharks were there, do they hurt people, and will they get to see real one. When one parent was asked why he spent so much time talking to his children at the sign he responded with, "I just wanted to teach my kids there is nothing to be scared of."

Even adults started talking to each other about the information on the signs. One couple explained to another man how he should download the Sharktivity app. "It comes in handy", the husband explained, "I

never knew how many were around this area." They went on to explain to the man how the app works and all the different features it offers. Other people interviewed also mentioned self-educating. One man stated, "I read up on them, after last year I wanted to know what was what." A woman said she felt better after learning a little more about the shark attacks: "I just needed to see that it's not a common thing, you know? I felt better getting in the water after that."

Chapter 7: Discussion

After examining the results, there seemed to be a relation between people with positive reactions and their willingness to change their behaviors in order to accommodate the sharks. These people seemed opposed to shark culling and were willing to tolerate the animals in Cape waters. As for the negative reactions, many of these appeared to come from a place of fear for both locals and tourists. Many residents also expressed anger when discussing the sharks. Some of this anger was a result of being forced to change their behavior in the ocean, while other people showed concern over the shark's effect on tourism in the area. There were also two other factors that influenced people's perceptions of sharks that were not anticipated: The public's feelings about seals and the relationship between education and people's attitudes towards sharks.

Positive Perceptions and Willingness to Change

Each person that was interviewed admitted to changing their behavior in some way in or around the ocean since the shark attack. These changes ranged from something as simple as being more aware of their surroundings in the water to drastically avoiding the ocean altogether. While some people were angry the sharks forced them to change their behaviors, others said they were fine changing their ways if it meant the sharks could stay. This readiness to change showed many Cape residents are willing to tolerate, if not accept, these animals and share the ocean with them. The tolerance shown by residents was also seen in the lack of retaliation after the attack. Although many people did express fear or anger regarding the sharks, the people of Cape Cod responded to the 2018 attack less violently than past attacks in the United States. As seen in Chapter Three of this thesis, past attacks such as the New Jersey attacks in 1916 and the 1958 Hawaiian attack resulted in the death of many sharks. However, no sharks were killed on Cape Cod to avenge Medici's death. In fact, almost every person interviewed mentioned that they were opposed to killing sharks or the use of methods, such as drum hooks and steel nets, that may hurt the animal.

This current view of sharks and shark attacks could be due to how sharks are now represented in our culture. As noted in Chapter Three, sharks have often been seen as monsters in stories and other media. However, this negative portrayal seemed to have changed in recent years. Shows like those seen on Discovery Channel's *Shark Week* have introduced audiences to a new side of sharks, exposing people to things other than the animal's sharp teeth. Videos of sharks peacefully swimming along divers are typically shared on websites like Facebook, Instagram, and Reddit. Comics and memes now portray the animals as awkward, goofy, and often loveable creatures. Some interviewees also pointed out the difference of how sharks are

viewed between generations. Although the movie *Jaws* freighted many people growing up in the 1970s and 80s, kids today do not seem so shaken by it. One person even commented on this, stating how her niece makes fun of the movie:

> "Kids know it's fake. They're growing up in such a different realm of movie making and the technology that's available it's…they look at it and go 'well that's just not real'. You know, when my niece watched it, she was like 'this is silly'. Like, oh my gosh, you have no idea what you are missing out of in life (*laughs*). I still jump when the head pops out."

Other people commented on how common it is to see kids today in shark clothing or carrying shark toys. They pointed out that this was typically not the case for older generations. Being exposed to sharks at a younger age, through TV, toys, or education institutions like the aquarium, may change how individuals view sharks. If this exposure has increased in recent decades, it may explain why people are more willing to accept the sharks today, compared to the early and mid 1900s.

Negative Reactions and Tourism

While no interviewees showed an interest in shark culling it does not mean people in the area do not support the idea. Many newspapers in the area quoted residents pushing for shark fishing and ways to decrease the shark population. Though many of these people expressed a fear of being attacked, a lot of people showed concern for the effect the sharks' presence may have on the tourism industry on Cape Cod. Interactions between people and great white sharks are not uncommon in Cape Cod's history. However, it has only been in recent decades that the Cape has had to handle these interactions while also being a tourist destination. As tourism grew on the Cape in the 1900s, the seal population was declining due to hunting. As the seals disappeared, the great whites also became less common on Cape Cod. Tourism on the other hand was reaching its peak in the area and attracting thousands of people to the local beaches. Though some argued the sharks would actually attract more tourist, many residents believe these animals may scare people out of the ocean. In fact, some of the areas around the Cape did see less tourists in summer of 2019 compared to 2018. According to the Cape Cod Chamber of Commerce, 8,877 less people visited the Cape Cod National Sea Shore between the months of June and September[21] in 2019 compared to the year prior. However, the

[21] These months were used for comparison as they are considered the tourist season for the area.

Barnstable Municipal Airport and the Hyannis Welcome Center saw more traffic in 2019 than 2018 (Cape Cod Chamber of Commerce, 2020b).

Although some residents were quick to blame any decline in tourism on the sharks, there were other events on the Cape that may have also contributed to this fall. In July 2019 a new rental tax was implanted on Cape Cod. This tax increased the price for lodging on the Cape, which may have discouraged people from renting in the area. A member of the Chamber of Commerce mentioned traffic over the bridges to the Cape was heavier in July 2019 than the year before, indicating more people may be taking day trips as opposed to renting homes (Marcelo, 2019). This could also explain the higher visitor count at the Hyannis Welcome Center, which is located on one of the major roadways on the Cape.

The weather during the summer of 2019 also did not help the tourism industry. During the month of June it rained every weekend, discouraging people from venturing out on the Cape. On July 23rd, three tornados, causing wind speeds of over 100 mph, touched down in the area. This storm caused downed trees, power outages, and damage to many buildings and cars throughout Cape Cod, including ripping the roof off a motel. Although no injuries were reported, it took officials a few days to get the power back to residents and around a week to clean up most of the debris left by the storm. Some tourists interviewed for the evening news even stated they were cutting their vacation to the Cape short after the storm.

Other Factors Influencing Perceptions

Though it is unclear exactly how the sharks effected tourism on Cape Cod, there were other factors that seemed to influence the perception of great whites. The first was the relationship between locals and the seals. Many people, especially fishermen, stated that seals were the real problem on the Cape. Residents complained that the seal population is overpopulated and the animals are a threat to the fishing industry. They also argued that the sharks are only in the area because the seals are there. However due to the Marine Mammal Protection Act, locals are unable to do anything about this increasing population. This negative reaction to seals was interesting because it seemed to affect some people's perceptions of the sharks. When asked what they thought of the sharks, some locals related them back to the seals. They stated they liked the sharks because they saw them as good population control; a natural way to keep the seals in check. Whether or not their perception of the great whites would be less positive if the seal population was not a problem is unclear.

Others blame the seals for attracting the sharks, stating that by eating the seals the sharks are only doing what comes natural to them. Although the seals were also doing what comes natural to them, they were still reacted to in a negative way. People blamed them for the shark attack because they brought the

predators to the area. As for the sharks, people's perceptions were either positive or neutral, seeing the great whites as in their natural habitat and behaving like they should. It is unknown if people would feel the same way about the sharks if they were coming to the area to eat fish or other less populated and problematic species.

The last theme that emerged from the results was education. Many officials saw education as their strongest tool in keeping people safe. Some residents and tourists also admitted to self-educating to alleviate their fears about sharks. Most people interviewed stated they had a positive perception of sharks. These people also demonstrated knowledge of the species, often referring to this knowledge as reasons why they like the species and want them to stay in the area. Those who responded with negative perceptions also admitted to having limited knowledge on the species. There have been studies that highlight this connection, stating that the more knowledge a person has of a species the more positive their perceptions of the animal are (Prokop, Kubiatko, & Fancovicova, 2008).

In a study done by Thompson and Mintzes (2002), they saw that students who had more knowledge on sharks had more positive perceptions of them than students who knew little about the species. Another example that supports this is a study published in 2014. In a group with relatively strong knowledge about sharks, only 26% of the participants associated the animals with danger or fear while the rest showed positive perceptions (Fredrich, Jefferson, & Glegg, 2014). Lastly, Seraphin (2010) measured high school students' perception of sharks before and after teaching them about the animals and allowing them to interact with live specimens. The results showed that after the study there was a decrease in negative words used to describe sharks as well as an increase of positive words (Seraphin, 2010).

Many of the interviewees touched on the subject of "you fear what you don't know". Since some of the negative perceptions were fear based, these public education efforts may help to change perceptions for the better. Using methods like signs, brochures, and apps may not physically stop any shark attacks. However, people may be able to avoid future shark encounters by understanding more about the species, such as avoiding potential prey like seals and what time the sharks are active offshore.

Conclusion

As the population of great white sharks continue to grow in New England, other states have started to watch Cape Cod carefully. With sharks moving further north to New Hampshire and Maine, officials from those states have begun looking at the Cape for answers on how to deal with these animals. However, as of today there is no Cape wide mitigation strategy or policy regarding the sharks. Different towns and communities in the area are still trying to figure out the best way to deal with the increasing shark population. This includes methods like shark warning signs, beach closures, and the Sharktivity app.

In October 2019, the Shark Working Group released their report titled *Outer Cape Shark Mitigation Alternatives Analysis*. Its purpose was to, "Provide a consolidated resource where various information can be obtained for stake holders to review when considering alternatives" (Woods Hole Group, 2019b, p. 2). It did not state what methods or products should be used but simply provided information and recommendations to decision makers. The group identified 27 different alternatives in three different categories: Technology-based, barrier-based, and biological-based alternatives (Woods Hole Group, 2019a). Nonetheless, as of the spring of 2020 none of these alternatives have been officially implemented Cape wide and individual towns are using different methods to protect their beaches and swimmers.

In this thesis, the majority of people interviewed expressed positive perceptions of great white sharks, with few people stating neutral or negative perceptions. Unobtrusive observations resulted in a more even mix of positive and negative reactions. Secondary source information from local newspapers leaned towards more negative perceptions while Facebook comments seemed to be more positive, with many people defending the animals. I believe the results of this thesis, and studies like it, can help officials decide on what mitigation strategies would be successful in their area. Understanding how people in the area perceive sharks could help identify which strategies would get the most public support. Officials can also try to change public perception in order to garner support for other ideas by learning what influenced these perceptions in the first place.

Although this thesis is a start to understanding the public perception of great white sharks on Cape Cod, more research is needed. Due to time and money constraints this thesis had a fairly small sample size: Ten elite interviews, thirteen semi-structured interviews, and eight hours of unobtrusive observation. While some secondary source information was used for this research, that information was not collected with this thesis in mind which resulted in missing data that may have contributed more to this project. By using snowball sampling for elite interviews, data could have also been skewed. Although different contacts were used to make these connections and seven different occupations were represented in the data, these

participants may not be a true representation of the area. While the semi-structured interviews and unobtrusive observations resulted in a more random sample, they still only covered a small portion of the population.

This research could be continued in the future, reaching more people and getting a better idea of what the overall public opinion of sharks on Cape Cod is. Understanding this perception of sharks and where it comes from can further help officials and policy makers in their decision-making process, creating a safe environment for humans and sharks.

The effect sharks have on tourism in the Cape and the perception of seals could also be researched. While some residents blame the sharks for the decrease of tourists, others credit the animals for attracting people to the Cape. It is unclear how much these animals impact the tourism industry, whether negatively or positively. As mentioned in the previous section, other factors can also influence the number of tourists coming to the Cape, including travel expenses and weather. Another factor that may also influence Cape tourism in the future is health related, with the 2020 summer season beginning in the wake of the COVID-19 pandemic. A study on the perception of seals in the area is also recommended. Not only could it help in determining how to handle seal problems in the future, it can also help understand how perceptions of one species may affect the perception of other species in the area.

As the field of anthrozoology continues to grow as more people engage with it, studies like this thesis can go on to help decision makers. Understanding how interactions influence peoples' perceptions of animals can lead to better policy and conservation strategies. This can be especially true for animals typically not seen as charismatic megafauna and do not have the public's support such as some large predators. As a field of study, anthrozoology is comprised of many different researchers and helps contribute to a large range of disciplines. Due to this diverse background, it fits in with the interdisciplinary nature of marine and environmental affairs and aligns well with other research being conducted in this field.

References:

Allen, S. (2019). How 'Baby Shark' became the anthem of the Nationals' 2019 season and World Series run. *The Washington Post.* Retrieved From: https://www.washingtonpost.com/sports/2019/10/21/how-baby-shark-became-anthem-nationals-season-world-series-run/

Allen, T., & McCormick, H. W. (1996). *Shadows in the Sea: The Sharks, Skates, and Rays* (Fully updated ed.). New York, NY: Lyons & Burford.

American Film Institute. (2003). *AFI's 100 Years… 100 Heroes & Villains.* Retrieved From: https://www.afi.com/afis-100-years-100-heroes-villians/

American Veterinary Medical Association. (1998). Statement from the Committee on the Human-animal Bond. *Journal of the American Veterinary Medical Association*. 212 (11), 1675.

Animal Welfare Institute. (2020). *Shark Finning*. Retrieved From: https://awionline.org/content/shark-finning

Anthrozoös. (2019). Retrieved From: https://www.tandfonline.com/toc/rfan20/current

Atlantic White Shark Conservancy. (2020). *Meet Sharktivity-Atlantic White Shark Sighting and Resource App*. Atlantic White Shark Conservancy. Retrieved From: https://www.atlanticwhiteshark.org/sharktivity-app

Atwell, J. (1982) Human Rights in Human Subjects Research. In A. Kimmel (Ed.). *Ethics of Human Subject Research.* San Francisco, CA: Jossey-Bass

Aumer, C. (2013). Retrieved From: https://www.mvtimes.com/2013/07/31/few-ripples-as-monster-shark-tournament-returned-oak-bluffs-16585/

Ballou, B.R., & Ellement, J.R. (2012). *Man Attacked by Great White Shark off Ballston Beach in Truro Jokes About Surviving.* Boston Globe Media Partners. Retrieved From: https://www.boston.com/uncategorized/noprimarytagmatch/2012/08/03/man-attacked-by-great-white-shark-off-ballston-beach-in-truro-jokes-about-surviving

Baughman, J. (1948). Sharks, Sawfishes, and Rays: Their Folklore. *The American Midland Naturalist, 39*(2), 373-381. doi:10.2307/2421591

Baumbusch, J. (2010). Semi-Structured Interviewing in Practice-Close Research. *Journal for Specialists in Pediatric Nursing, 15*(3), 255-258.

Beckwith, M. (1917). Hawaiian Shark Aumakua. *American Anthropologist, 19*(4), 503-517.

Benchley, P. (1974). *Jaws.* Garden City, NY: Doubleday.

Berry, J. (2002). Validity and Reliability Issues in Elite Interviewing. *Political Science and Politics, 35*(4), 679-682.

Bigelow, H.B, & Schroeder, W.C. (1948). Sharks. In W.C. Schroeder, et al. (Eds.). *Lancelets, Cyclostomes, Sharks: Part 1* (pp. 59-546). New haven, CT: Yale University Press. DOI: 10.2307/j.ctvbcd08p.8

Birke, L., & Hockenhull, J. (2012). Introduction: On Investigating Human-animal Relationships. *Human-Animal Studies, 14*, 1-12.

Bittel, J. (2018). *Cape Cod's Gray Seal and White Shark Population is Anything but Black-and – White.* Natural Resources Defense Council. Retrieved From: https://www.nrdc.org/onearth/cape-cods-gray-seal-and-white-shark-problem-anything-black-and-white

Bonner, M. (2019). *From 'Ferocious' Signs to Shark Detecting Buoys, Here's How Cape Cod's Out to Protect Visitors from Shark this Summer.* Mass Live. Retrieved From: https://www.masslive.com/capecod/2019/09/from-ferocious-signs-to-shark-detecting-buoys-heres-how-cape-cod-sought-to-protect-visitors-from-sharks-this-summer.html

Boucher, J.D., & Ekman, P. (1975). Facial Areas of Emotional Information. *Journal of Communication*, *23*, 17-46.

Boynton, R. (2005). *The New New Journalism: Conversations with America's best nonfiction writers on their craft*. NY: Vintage Books.

Brady, J. (1976). *The Craft of Interviewing*. NY: Vintage Books.

Camhi, M., Pikitch, E. K., & Babcock, E. A. (2008). *Sharks of the Open Ocean: Biology, Fisheries and Conservation* (Fish and aquatic resources series; 13). Oxford; Ames, IA: Blackwell Science.

Cape Cod Chamber of Commerce. (2020a). *About Cape Cod*. Retrieved From: https://www.capecodchamber.org/life-on-cape-cod/living-here/about-cape-cod/

Cape Cod Chamber of Commerce. (2020b). *Statistics*. Retrieved From: https://www.capecodchamber.org/members/membership/statistics/

Cape Cod Chamber of Commerce. (2020c). *Tourism*. Retrieved From: https://www.capecodchamber.org/members/public-policy-and-advocacy/tourism/

Cape Cod Commission. (2020). *Ponds and Lakes*. Retrieved From: https://www.capecodcommission.org/our-work/ponds-and-lakes/

Cape Guide. (2017). Retrieved From: http://www.capeguide.com/beaches.htm

Cape Symphony. (2019). *Jaws in Concert.* Retrieved From: https://www.capesymphony.org/blog-news/press-releases/329-perform-film-score-jaws-movie

Captain's Manor Inn. (2020). Retrieved From: https://captainsmanorinn.com/2015/03/01/cape-cods-best-bed-and-breakfasts/

Carey, F., Teal, J., & Kanwisher, J. (1981). The Visceral Temperatures of Mackerel Sharks (Lamnidae). *Physiological Zoology, 54*(3), 334-344.

Collin, S. (2018). Scene through the eyes of an apex predator: A comparative analysis of the shark visual system. *Clinical and Experimental Optometry, 101*(5), 624-640.

Convention on International Trade in Endangered Species. (2019). *Appendices*. Retrieved From: https://www.cites.org/eng/app/appendices.php

Convention of Migratory Species. (2019). *Sharks*. Memorandum of Understanding on the Conservation of Migratory Sharks. Retrieved From: https://www.cms.int/sharks/en

Crawford, D. (2008). *Shark* (Animal (Reaktion Books)). London, UK: Reaktion.

Cultural Survival. (2017). Respecting the Sea: A Conversation with Elizabeth James-Perry. *Cultural Survival Quarterly, 41*(4), 16-17. Retrieved From: https://www.culturalsurvival.org/publications/cultural-survival-quarterly/respecting-sea-conversation-elizabeth-james-perry

Cumbler, J. (2014). *Cape Cod: An Environmental History of a Fragile Ecosystem (Environmental History of the Northeast)*. Amherst: University of Massachusetts Press.

De Maddalena, A., & Heim, W. (2010). *Sharks of New England*. Camden, ME: Down East Books.

DeMello, M. (2012). *Animals and Society: An introduction to human-animal studies*. NY: Columbia University Press.

Denzin, N. (1970). *The Research Act; A Theoretical Introduction to Sociological Methods (Methodological perspectives).* Chicago, IL: Aldine Pub.

Dexter, L.A. (1970). *Elite and Specialized Interviewing*. Evanston, IL: Northwest University Press.

Dunn, P. (2006). Aristotle (384-322 BC): Philosopher and scientist of ancient Greece. *Archives of Disease In Childhood-Fetal And Neonatal Edition, 91*(1), F75-F77.

Dunn, T. (2019). *Christmas Tree Shops Pull 'Offensive" Shark Related Items from All Cape Cod Stores.* Sandab Communications II LP CapeCod.com. Retrieved From: https://www.capecod.com/newscenter/christmas-tree-shops-pulls-offensive-shark-related-items-from-all-cape-cod-stores/

Eilperin, J. (2011). *Demon Fish: Travels Through the Hidden World of Sharks* (1st ed.). NY: Pantheon Books.

Eisel, B. (2009). *The Flying Tigers: Chennault's American volunteer group in China* (Air Force sixtieth anniversary commemorative ed.). Washington, D.C.: Air Force History and Museums Program

Ekman, P., Frieson, W.V. (1969). Nonverbal Leakage and Clues to Deception. *Psychiatry, 32*, 88-106.

Ellis, R., McCosker, J. E., & Giddings, A. (1991). *Great White Shark* (1st ed.). New York, NY: HarperCollins in collaboration with Stanford University Press.

Emerson, J. (1892). *The Lesser Hawaiian Gods.* (Papers of the Hawaiian Historical Society ; no. 2). Honolulu, HI.

Empson, L. (2017). Elite Interviewing in Professional Organizations. *Journal of Professions and Organization, 5*(1), 58-69.

Fernicola, D. G. D. (2016). *Twelve Days of Terror: Inside the Shocking 1916 New Jersey Shark Attacks*. Rowman & Littlefield.

Fitzgerald, R. (2019). Retailer Ditches Shark Souvenirs After Backlash. *Wicked Local Wellfleet*. Retrieved From: https://wellfleet.wickedlocal.com/news/20190517/retailer-ditches-shark-souvenirs-after-backlash

Flynn, C. (2008). *Social Creatures: A human and animal studies reader*. NY: Lantern Books.

Food and Agriculture Organization. (2020). *Sharks*. International Plan of Action for Conservation and Management of Sharks. Retrieved From: http://www.fao.org/ipoa-sharks/background/sharks/en/

Foulkes, H. (2018). *The Reality of Cape Cod's Population Trend.* Pioneer Institute. Retrieved From: https://pioneerinstitute.org/blog/the-reality-of-cape-cods-population-trend/

Fraser, D. (2019). Shark-Detection Tech Quietly Deployed on Cape Cod. *Cape Cod Times*. Retrieved From: https://www.govtech.com/public-safety/Shark-Detection-Tech-Quietly-Deployed-on-Cape-Cod.html

Friedrich, L., Jefferson, R., & Glegg, G. (2014). Public perceptions of sharks: Gathering support for shark conservation. *Marine Policy, 47*(C), 1-7.

Gallucci, V., McFarlane, G. A, Bargmann, G. G., & American Fisheries Society. (2009). *Biology and Management of Dogfish Sharks*. Bethesda, Md.: American Fisheries Society.

Gibson, M. (2010). A Brief History of Shark Week. *Time.* Retrieved From: http://content.time.com/time/arts/article/0,8599,2008020,00.html

Gorden, R. (1987). *Interviewing: Strategy, techniques, and tactics* (4th ed.). Chicago, IL.: Dorsey Press.

Government of Canada. (2017). Retrieved From: https://www.dfo-mpo.gc.ca/species-especes/sharks/info/id-eng.html

Grindsted, A. (2005). Interactive Resources Used in Semi-structured Research Interviewing. *Journal of Pragmatics, 37*(7), 1015-1035.

Gruber, S. (1977). The Visual System of Sharks: Adaptations and Capability. *Integrative and Comparative Biology, 17*(2), 453-469.

Harper, R., & Wiens, A. (1979). Nonverbal Behaviors as Unobtrusive Measures. In. L. Sechrest (Ed.). *Unobtrusive Measurement Today (New Directions for Methodology of Behavioral Science)* (pp 59-73). San Francisco, CA: Jossey-Bass.

Herndon, A., Gallucci, V., Demaster, D., & Burke, W. (2010). The Case for an International Commission for the Conservation and Management of Sharks (ICCMS). *Marine Policy, 34*(6), 1239-1248.

Herzog, H. (2010). *Some We Love, Some We Hate, Some We Eat: Why it's so Hard to Think Straight About Animals* (1st ed.). New York, NY: Harper.

Holtcamp, W. (2009). Lone Parents: Parthenogenesis in Sharks. *BioScience,59*(7), 546-550.

Hosey, G., & Melfi, V. (2018). *Anthrozoology: Human-animal Interactions in Domesticated and Wild Animals* (First ed.). Oxford, UK: Oxford University Press.

Hurn, S. (2015). Anthrozoology: An Important Subfield in Anthropology. *Interdisziplinäre Anthropologie*. 179-188. Springer VS, Wiesbaden.

IMDb. (2020). *Jaws*. Retrieved from: https://www.imdb.com/title/tt0073195/

International Shark Attack File. (2020). *Yearly Worldwide Shark Attack Summary.* Florida Museum. Retrieved From: https://www.floridamuseum.ufl.edu/shark-attacks/yearly-worldwide-summary/

International Union for Conservation of Nature. (2020b). *Marine Protected Areas and Climate Change.* IUCN Issues Brief. Retrieved From: http://www.fao.org/ipoa-sharks/background/sharks/en/

ISAZ Brochure. (2009). Retrieved From: http://www.isaz.net/isaz/history/

Johnsen, S., & Sosik, H. (2005). Shedding light on light in the Ocean: New research is illuminating an optically complex underwater environment. *Oceanus, 43*(2), 24-28.

Juul, M. (2015). *Martha's Vineyard won't Host JawsFest to Mark the Film's 40th Anniversary*. Boston Globe Media Partners. Retrieved From: https://www.boston.com/culture/entertainment/2015/06/14/marthas-vineyard-wont-host-jawsfest-to-mark-the-films-40th-anniversary

Kalakaua, D., & Daggett, R. M. (1888). *The Legends and Myths of Hawaii: The Fables and Folk-lore of a Strange People*. C.L. Webster & Company.

Karasz, P. (2019). Fish-and-Chip Shops in U.K. Found to Fry Endangered Species. *The New York Times.* Retrieved From: https://www.nytimes.com/2019/02/01/world/europe/uk-fish-and-chips-shark.html

Kim, A. (2019). Great White Sharks are Invading Cape Cod this Summer. *Cable News Network*. Retrieved From: https://www.cnn.com/2019/07/03/us/sharks-cape-cod-trnd/index.html

Klandermans, B., & Staggenborg, S. (Eds.). (2002). *Methods of Social Movement Research* Minneapolis: University of Minnesota Press.

Kleiner, S. (2018). *The Flying Tigers: The Untold Story of the American Pilots who Waged a Secret War Against Japan*. New York, NY: Viking.

Klimley, A. (2013). *The Biology of Sharks and Rays.* Chicago; London: The University of Chicago Press.

Knoth, J., & Miller, M. L. (2019). *Anthrozoology, Anthropomorphism, and Marine Conservation: A Case Study of Southern Resident Killer Whale, Tahlequah, and her Tour of Grief*. Seattle, WA: University of Washington.

Lane, R., & Chazan, S. (1989). Symbols of Terror: The Witch/Vampire, the Spider, and the Shark. *Psychoanalytic Psychology, 6*(3), 325-341.

Laskowski, A. (2017). *Tracking Cape Cod Sharks.* Boston University. Retrieved From: https://www.bu.edu/bostonia/fall17/greg-skomal-cape-cod-sharks/

Leandro, L. (2006). *Etmopterus perryi*. *The IUCN Red List of Threatened Species* 2006: e.T60240A12332635. Retrieved From: https://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T60240A12332635.en.

Legg, B.H. (1930). *That's Cape Cod*. E.D. West Company.

Lelli, B., Harris, D.E., & Aboueissa, A. (2009). Seal Bounties in Maine and Massachusetts, 1888 to 1962. *Northeastern Naturalist, 16*(2), 239-254.

Lippsett, L. (2013). The Return of the Seals. *Oceanus, 50*(2), 59.

Lyman, D. (2019). Besides Great Whites, There's Little to Fear Among Local Sharks. *Boston Globe*. Retrieved From: https://www.bostonglobe.com/metro/globelocal/2019/08/14/besides-great-whites-there-little-fear-among-local-sharks/Rh0ztH5dDavxtVCGKI8EmI/story.html

Lynch, P. (2019). *A Field guide to Cape Cod: Including Nantucket, Martha's Vineyard, Block Island & Eastern Long Island*. New Haven: Yale University Press

Maccoby, E. E., & Maccoby, N. (1954). The interview: A Tool of Social Science. In L. Gardner (Ed.) *Handbook of Social Psychology*, *1*, 449-87. Reading, MA: Addison-Wesley

Marcelo, P. (2018). Shark Attack Victim in Truro Says He Punched Shark to Escape. *The Associated Press.* Retrieved From: https://www.wbur.org/news/2018/08/29/shark-attack-victim-truro

Marcelo, P. (2019). Sharks, Tornadoes and Taxes: Cape Cod has had a Tough Summer. *Associated Press*. Retrieved From: https://www.wbur.org/bostonomix/2019/09/01/business-tourism-beach-closures-great-white-vacation-rentals

Marrelli, A. (2007). Unobtrusive Measures. *Performance Improvement, 46*(9), 43-47.

Martin, R. A. (2003). *Brief Overview of the Great White Shark (Carcharodon carcharia)*. Biology of Sharks and Rays. Retrieved From: http://www.elasmo-research.org/education/white_shark/overview.htm

Mashpee Wampanoag Tribe. (2020). Retrieved From: https://mashpeewampanoagtribe-nsn.gov

Mass Gov. (2020a). *Shark Movement and Habitat.* Department of Marine Fisheries. Commonwealth of Massachusetts. Retrieved From: https://www.mass.gov/service-details/shark-movement-and-habitat

Mass Gov. (2020b). *Shark Research in Massachusetts.* Department of Marine Fisheries. Commonwealth of Massachusetts. Retrieved From: https://www.mass.gov/service-details/shark-research-in-massachusetts

MassMoments. (2020). *J.F.K Signs Bill Creating Cape Cod National Seashore*. Retrieved From: https://www.massmoments.org/moment-details/j-f-k-signs-bill-creating-cape-cod-national-seashore.html

McGill University. (2020). *Sharks*. Traditional Animal Foods of Indigenous Peoples of Northern North America. Retrieved From: http://traditionalanimalfoods.org/fish/saltwater/page.aspx?id=6440

McKeever, W. (2019). *Emperors of the Deep: Sharks--the Ocean's Most Mysterious, Most Misunderstood, and Most Important Guardians* (First ed.). New York, NY: HarperOne, an imprint of Harper Collins.

Mollomo, P. (1998). The White Shark in Maine and Canadian Atlantic Waters. *Northeastern Naturalist, 5*(3), 207-214.

NASA. (2016). *Cape Cod National Seashore.* Earth Observatory. Retrieved From: https://earthobservatory.nasa.gov/images/89171/cape-cod-national-seashore

National Park Service. (2015). *Forests.* Cape Cod. Retrieved From: https://www.nps.gov/caco/learn/nature/forests.htm

National Park Service. (2019). *Cape Cod National Seashore Creates Over $638 Million Dollars in Economic Benefits Report Shows Visitor Spending Supports 6,098 Jobs in Local Economy*. [News Release]. Retrieved From: https://www.nps.gov/caco/learn/news/econ19.htm

Native America Travel. (2020). *Wampanoag History and Cape Cod*. Retrieved From: https://nativeamerica.travel/experiences/wampanoag-history-cape-cod

Native Language. (2015). *Nauset Tribe.* Retrieved From: http://www.native-languages.org/nauset.htm

Nelson, V.J. (2006). Peter Benchley, 65; 'Jaws' Author Became Shark Conservationist. *Los Angele Times.* Retrieved From: https://www.latimes.com/archives/la-xpm-2006-feb-13-me-benchley13-story.html

Newman, S. (2016). Sharks in the Jungle: Real and Imagined Sea Monsters of the Maya. *Antiquity, 90*(354), 1522-1536

Nielsen, J. (2017). Dating a Greenland Shark. *Natural History, 125*(2), 10-13.

Niezgoda, A., & Rendon-Alvarez, K. (2019). State Gives Cape Cod Nearly $400K Grant for Shark Safety. *New England Cable News*. NBC Universal Inc. Retrieved From: https://www.necn.com/news/local/massachusetts/state-gives-cape-cod-nearly-400k-grant-for-shark-safety-2019/207141/

Noyes, D. (2006). *One Kingdom: Our Lives with Animals : The human-animal Bond in Myth, History, Science, and Story*. Boston, MA: Houghton Mifflin.

O'Rourke, D. (1982). *The Shark Callers of Kontu* (Ethnographic Video Online, Volume 3). Cairns, QLD: Camerawork Pty.

Philpott, R. (2002). Why sharks may have nothing to fear more than fear itself: An analysis of the effect of human attitudes on the conservation of the Great White Shark. *Colorado Journal of International Environmental Law and Policy, 13*(2), 445

Porter, B., & Schänzel, H. (2018). *Femininities in the Field: Tourism and Transdisciplinary Research*. Bristol; Blue Ridge Summit: Channel View Publications.

Prokop, P., Kubiatko, M., & Fancovicova, J. (2008). Slovakian Pupils' Knowledge of, and Attitudes toward, Birds. *Anthrozoos, 21*(3), 221-235.

Rediker, M. (2008). History from below the water line: Sharks and the Atlantic slave trade. *Atlantic Studies, 5*(2), 285-297.

Rudy, K. (2011). *Loving animals: Toward a new animal advocacy.* Minneapolis, MN: University of Minnesota Press.

Sandamali, K. P. S. (2015). Symbolism in Ernest Hemingway' s The Old Man and The Sea. *International Journal of Scientific and Technology Research*, *4*(12), 125-129.

Seidman, I. (1998). *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences* (2nd ed.). New York: Teachers College Press.

Selltiz, J., Deutsch, C., & Selltiz, C. (1959). Research Methods in Social Relations. *Megamot, 10*(2), 96-189.

Seraphin, K.D. (2010). A Partnership Approach to Improving Student Attitudes About Sharks and Scientists. (Report). *School Science and Mathematics, 110*(4), 203-219.

Sharks Fund Fishing. (2020a). *MST Facts.* Retrieved From: http://www.sharksfundfishing.com/history/mst-facts/

Sharks Fund Fishing. (2020b). *Past Champions* Retrieved From: http://www.sharksfundfishing.com/history/

Sharks Fund Fishing. (2020c). *Sustainable Fishing.* Retrieved From: http://www.sharksfundfishing.com/sharks/sustainable-fishing/

Shepard, P. (1997). *The Others: How Animals Made Us Human*. Island Press.

Sherman, C. (2019). The Shark Attack That Changed Cape Cod Forever. *Boston Magazine*. Retrieved From: https://www.bostonmagazine.com/news/2019/05/14/cape-cod-sharks/

Simke, A. (2020). Is Eating Fermented Shark in Iceland Sustainable? *Forbes*. Retrieved From: https://www.forbes.com/sites/ariellasimke/2020/02/13/is-eating-fermented-shark-in-iceland-sustainable/#634fe5c032ad

Skomal, G. (2007). *Shark Nursery Areas in the Coastal Waters of Massachusetts.* American Fisheries Society. Retrieved From: https://www.mass.gov/files/documents/2016/08/qd/skomal-2007.pdf

Smart, J.J., Paul, L.J., & Fowler, S.L. (2016). *Chlamydoselachus anguineus*. *The IUCN Red List of Threatened Species* 2016: e.T41794A68617785. Retrieved From: https://www.iucnredlist.org/species/41794/68617785

Society & Animals (2019). Retrieved From: https://www.animalsandsociety.org/human-animal-studies/society-%20%20and-animals-journal/

Sokhin, V. (2013). Retrieved From: https://ramumine.wordpress.com/tag/shark-calling/

Stage, F., & Manning, K. (2003). *Research in the College Context: Approaches and methods*. New York, NY: Brunner-Routledge.

Stanton, D. (2001). *In harm's way: The sinking of the USS Indianapolis and the extraordinary story of its survivors* (1st ed.). New York: H. Holt.

Stats Cape Cod. (2019). *Data by Town: Population.* Cape Cod Commission. Retrieved From: https://www.statscapecod.org/towndata/population.php

Stetson, D.J., & Brown, B. (2016). 30 Years of the Monster Shark Tournament. *The Fisherman*. Retrieved From: https://www.thefisherman.com/index.cfm?currentpage=1&fuseaction=feature.display&feature_ID=1444&ParentCat=2&start=0

Stewart, R. (2014). Retrieved From: https://www.mvtimes.com/2014/01/28/monster-shark-tournament-may-live-again-in-oak-bluffs

Talbot, C., & Hodge, S. (2020). *Life of Sharks*. Retrieved From: https://www.facebook.com/thelifeofsharks/?epa=SEARCH_BOX

Techera, E., & Klein, N. (Eds.) (2014). *Sharks: Conservation, governance, and management* (Earthscan oceans). London; NY: Routledge, Taylor & Francis Group, Earthscan from Routledge.

The Editors of Encyclopaedia Britannica [Eds.]. (2020). *Cape Cod*. Retrieved From: https://www.britannica.com/place/Cape-Cod

The Ocean Portal Team. (2018). *Sharks*. Smithsonian. Retrieved From: https://ocean.si.edu/ocean-life/sharks-rays/sharks

Thomson, J. (1892). *Summer*. Estes and Lauriat.

Thompson, T., & Mintzes, J. (2002). Cognitive structure and the affective domain: On knowing and feeling in biology. *International Journal of Science Education, 24*(6), 645-660.

Tobias, M., & Morrison, J. (2017). *Anthrozoology: Embracing Co-existence in the Anthropocene*. Cham, CH: Springer.

Tracy, B. (2017). *Ron Beaty's Political "Penance"-A Profile.* Cape Cod Wave. Retrieved From: https://capecodwave.com/ron-beatys-political-penance-profile/

Turner, C. (2010). Hunting Bruce, or, on the Trail of the 'Jaws' Shark. *National Public Radio.* Retrieved From: https://www.npr.org/templates/story/story.php?storyId=127370664

US Army Corps of Engineers. (2020). *Cape Cod Canal History.* Retrieved From: https://www.nae.usace.army.mil/Missions/Recreation/Cape-Cod-Canal/History/

Vogel, C. (2006). Swimming with Famous Dead Sharks. *New York Times (1923-Current File)*, p. A28.

Wampanoag Tribe of Gay Head (Aquinnah). (2020). *Wampanoag History.* Retrieved From: https://wampanoagtribe-nsn.gov/wampanoag-history

Webb, E. (2000). *Unobtrusive Measures* (Rev. ed., Sage classics; 2). Thousand Oaks, CA: Sage Publications.

Wicker, K., & Connelly, L. (2014). *The practice of Elite Interviewing in Politicised Policy Areas* (SAGE research methods. Cases). Los Angeles, CA: SAGE.

Woods Hole. (2016). *History of Woods Hole*. Retrieved From: http://woodshole.com/about/history-of-woods-hole/

Woods Hole Group. (2019a). *Shark Mitigation Alternative Analysis Technical Report*. Woods Hole. Retrieved From: https://parkplanning.nps.gov/document.cfm?parkID=217&projectID=91210&documentID=99161

Woods Hole Group. (2019b). *Shark Mitigation Executive Summary*. Woods Hole. Retrieved From: https://parkplanning.nps.gov/document.cfm?parkID=217&projectID=91210&documentID=99161

York, R., & Mancus, P. (2013). The Invisible Animal: Anthrozoology and Macrosociology. *Sociological Theory, 31*(1), 75-91.

Appendix I: Disciplines Represented in Anthrozoology Literature

Anthrozoology is a large field comprised of researchers from many different academic disciplines. Using the journal *Anthrozoös*, one of the oldest anthrozoological journals still in circulation, the field of study for each contributing author was examined (*Table 1*). The number of authors in each discipline is also recorded on the table below. A total of 98 different fields are represented in the journal, from the first issue up until Volume 33 Issue 2 released in March 2020. Disciplines were discovered using the *Anthrozoös* website, LinkedIn, or university websites which the author was associated with. The top three most represented fields were psychology (513), veterinarian science (177), and biology (72).

Table 1: A list of all the academic disciplines represented in *Anthrozoös* and the number of authors in each field.

Discipline	**Number of Authors**
Acupuncture	1
Agricultural Science	10
Anesthesiology	1
Animal Assister Therapy	2
Animal Nutrition	2
Animal Physiology	1
Animal Science	34
Animal Welfare	20
Anthropology	45
Archaeology	3
Architecture	1
Art History	1
Behavioral Biology	5
Behavior Studies	6
Biochemistry	4
Biology	72
Biomedical Science	1
Biophysics	1
Biostatistics	2
Botany	1
Business	12
Criminology	1
Cognitive Science	1
Communication	1
Computer Science	2
Conservation Biology	9
Counseling	4
Education	26
Ecology	17
Economics	15

Endocrinology	1
Engineering	1
English	5
Entomology	2
Environmental Health	2
Environmental Policy	2
Environmental Science	11
Epidemiology	13
Ethics	3
Ethology	46
Equine Science	3
Food Science	2
Forensic Science	2
Forestry and Environmental Studies	7
Geography	7
Health Science	12
Herpetology	1
History	6
Hospitality	1
Human Development and Family Studies	24
Humanities	3
Kinesiology	3
Law	6
Linguistics	1
Literature	2
Mathematics	4
Marine Biology	2
Marketing	4
Medical Science	24
Microbiology	5
Molecular Chemistry	1
Molecular Medicine	6
Museology	3
Natural Science	2
Naturopathic Medicine	6
Neurology	1
Neuroscience	3
Nuclear Physics	1
Nursing	46
Nutrition Science	2
Occupational Therapy	2
Osteopathy	2
Parks, Recreation, and Tourism Management	10
Parasitology	1
Pathobiology	1
Pharmacy	3

Philosophy	30
Physical Education	4
Physical Therapy	1
Physiology	16
Population Medicine	5
Public Health	22
Public Policy	9
Psychiatry	13
Psychology[22]	513
Rehabilitation	1
Religious Studies	2
Social Work	32
Sociology	36
Special Education	7
Speech and Language	3
Statistics	9
Urban Planning	2
Veterinarian Science	177
Wildlife and Fisheries Science	12
Women and Gender Studies	3
Zoo Management	1
Zoology	37

[22] Includes specialist in fields such as Pychotherapy, Psychophysiology, Psychotherapy, Psychodiagnostics, and Conservation Psycology

Appendix II: Data Collection Methodology

A mixed qualitative method was used for this thesis which included interviewing, unobtrusive observations, and secondary source information. This appendix further defines these methods and discusses their strengths and weaknesses.

Interviewing

The art of interviewing has been around for centuries, with earlier forms found in books written in the middle ages, such as *The Book of Marjorie Kemp*. Although, some scholars believe this practice can be traced even further back, stating a form of interview can be seen in a 4,000-year-old Egyptian book called *Instructions of Ptah-Hotep* (Brady, 1976). During the 1700s interviews began to gain popularity throughout England with magazines, such as Daniel Defoe's *Review*, including interviews in their publications. Although some of these interviews were the work of fiction, the practice of conducting interviews began to spread. The *New York Herold* became one of the first publishers in the United States to capitalize on the interviewing method, utilizing the question and answer method while reporting on a dramatic murder of a prostitute in 1836 (Brady, 1976). Even as its popularity grew into the late 1800s, some members of the press dismissed interviews, calling them unreliable. The stories that come from conducting interviews seemed too personal, with reporters appearing to invade people's privacy and using these stories to push their own agenda (Brady, 1976). However, this criticism did not stop some reporters from using interviews in their work. As the 1900s wore on, interviews became more common in media, with magazines like *Playboy* publishing interview-based pieces. Today using interviews as a data collection method is considered reliable and accepted, with people using them for newspaper stories, magazine articles, and academic research. But what exactly is an interview and how is it used to collect significant data?

Interviewing has been described several different ways: A guided conversation, a social relationship between two or more people, or a respectful exchange. While it may be those things on some level, an interview is more than just a conversation or exchange. They have a plan, are strategical, and collect data and information. Maccoby & Maccoby, in their article *The Interview: A tool for social science*, describe an interview as, "A face to face verbal interchange in which one person, the interviewer, attempts to elicit information or expressions of opinions or belief from another person or persons" (Maccoby & Maccoby, 1954, p. 449). Irving Seidman, a professor of qualitative research, expands on this definition saying how interviews help us understand people's experiences and behaviors (Seidman, 1998). For the purpose of this thesis I described an

interview as a strategic and planned conversation between two or more people for the purpose of obtaining knowledge on a certain subject.

Gorden, a sociology professor, breaks interviewing down into four basic styles. The first, standardized, is used when a researcher is trying to get the same information from everyone, asking the same questions to each person in their study. Non-standardized is used when a researcher is trying to collect different data from each person, resulting in more personalized questions based on the person, position, or other factors (Gorden, 1987). The author also separates interviewing into scheduled and nonscheduled types. For scheduled interviews, the questions and wording follow the same sequence every time. Nonscheduled interviews allow for more flexibility; although they ask each person the same questions, the order or wording for those questions may change depending on the interview.

Arguably the most important skill for an interviewer to learn is how to listen. An interviewer should not only hear what the subject is saying, but also what they are not saying. How should things be interrupted or what someone meant when they say certain things are questions that should be thought of when the interviewee is talking (Seidman, 1998). The researcher should also be aware of how the interview is progressing, what has been covered, and what still needs to be asked. Other skills that are important to have as an interviewer is observing non-verbal behavior, wording questions, taking notes, judging the validity and relevance of what a person is saying, remembering what has already been said, and asking probing questions.

The order of the questions can be very important when planning an interview. Many researchers suggest starting with low risk questions and then building to more high risk as the researcher builds rapport and the interviewee becomes more comfortable (Stage & Manning, 2003). Denzin, a sociology professor at the University of California Berkeley, explains that questions can be grouped into four different categories. The opening questions are supposed to peak the respondent's interest, with less interesting questions following. As the conversation continues the researcher can then try mixing in more emotional questions. The last type of question, the threatening questions, should be saved for the end of the interview. This is because, as Denzin explains, if the subject gets offended, refuses to answer, or cuts the interview short then it is no big loss as most of the data was already collected (Denzin, 1970).

Different types of sampling can be used to find interviewees. Stage & Manning discuss three of these in their book *Research in the College Context*. The first type is purposive sampling or selecting sampling. Purposive sampling allows the researcher to pick the people or groups of people they wish to interview (Stage & Manning, 2003). It allows researchers to get a variation of interviews, showing the diversity of the area. The second type of sampling is called recruitment sampling. This could be done by the interviewer recruiting subjects themselves, sometimes using some form of incentive, or asking groups or businesses for volunteers

(Stage & Manning, 2003). While this can be a great method of finding interviewees that fit the study, researchers have to be careful about who is recruited. If using incentives to recruit subjects, researchers may attract people who might not be participating for the right reasons. Groups, like businesses, may also send interviewers people who will answer the questions in order to benefit certain members of the group and not be a good representation of the group as a whole. The last type of sampling the authors talk about is snowballing sampling. This type of sample involves a subject connecting the interviewer to other participants (Stage & Manning, 2003). While an easy way to make contact with many different people, snowball sample can limit a researcher's variation of people. Subjects tend to suggest people similar to themselves, which can lower the diversity of the sample: Similar jobs, social circles, religions, etc.

As data gets collected it may be hard to know when to stop conducting interviews. Stage and Manning suggest interviews should be continued until the interviewer reaches two points. The first, sufficiency, occurs when the interviews conducted are a reflection of the diversity of experiences in the area, avoiding bias in data collection. The second, saturation, comes about when the data collected by the interviewer begins to repeat itself, with no new information flowing in (Stage & Manning, 2003).

Like all data collection methods there are some drawbacks while using interviews. Interviewing is very time consuming. Researchers must research background information, create questions, reach out to prospective interviewees, conduct the interviews, and transcribe recordings and notes (Seidman, 1998). Depending on travel or location, interviewing can also cost a lot of money. Interviews themselves can also cause issues. While strategic on the interviewer's part, the interviewee also has their own reasons for participating in an interview and may not be completely truthful with the researcher. While doing proper research beforehand and asking probing questions may help detect some untruths, a researcher cannot be one hundred percent certain a subject is not lying (Berry, 2002). Different factors or stimuli could also influence how a person responds to the questions being asked (Dexter, 1970). If a researcher fails to build rapport for instance, the subject may answer questions differently than if a connection was made. People may also just be unwilling to answer questions on certain topics as well, resulting in the interviewer not getting the information they need. The interviewer themselves can also impact the data in different ways. Ted Conover acknowledge this influence when writing *Coyotes*, a piece about Mexican immigrants illegally crossing into the United States:

> "My presence changes things: it changed what happened when we were caught by the Mexican judicial police on the border, it probably changed what the guys said to each other in front of me." (Boynton, 2005, p. 23)

Researcher bias can also influence interviews. This bias can be seen in who has been interviewed or how the data is interrupted. When asking questions, the tone of voice the interviewer uses, their body language, or facial expressions can all affect how a person will answer (Gorden, 1987). It is important, as a researcher to understand and acknowledge these biases and the effect they may have on the final product.

A lot of ethical questions can come up during the interview process. Before going into an interview, it is important for a researcher to know where they stand, where their loyalties lie, their responsibility to society, and what role they are going to play when talking to someone (Gorden, 1987). While some interviewers are careful with what information they tell their subjects, others are more transparent, like William Langewiesche author of *American Ground*: "I'm very careful not to take advantage of the people I talk to. I never lay traps. I try to be very straight forward" (Boynton, 2005, p. 217).

Besides providing the subject with information, providing them with money can also cause ethical issues. Most researchers understand that paying someone to talk to them is not only unethical but can affect the legitimacy of the research. However, others believe there may be some exceptions to this. Jon Krakauer, author of *Into the Wild*, sees the issues with profiting off other people's stories while they get nothing:

> "I make a boat load of money off the books I've written. Don't you think I owe anything to some of my subjects, who got nothing for the crucial assistance they provided except, in some instances, unwanted publicity." (Boynton, 2005, p. 168)

He believes that in some cases, monetary compensation is warranted, and goes on to explain how he paid a poor woman $20,000 for her memoir, even though he already got all the information he needed by interviewing her. Because he paid her, not for an interview but for the rights to her story he was able to walk away clean in the eyes of the industry. He thinks not giving people a fair share for their help says more about the interviewer then the project: "It strikes me as a self-serving stricture, distinction that too often allows journalists to stiff their subjects" (Boynton, 2005, p. 169)

Another ethical choice an interviewer faces concerns confidentiality and whether or not to use the real names of the interviewees. This is important because what is written can have unintended and possible negative consequences for the subject. Jon Krakauer touches on this when warning people about participating in interviews stating, "What I write could turn their lives inside out" (Boynton, 2005, p. 168). Because researchers are expected to bring no harm to the people who agreed to be interviewed, be it physical,

emotional, or socially, it is important to understand these potential consequences (Gorden, 1987). A lot of interviewers will change the names of subjects for their own personal or professional safety, but not all researchers agree with this precaution. Gay Tales, author of *Kingdom of Power* and *Honor Thy Father*, believes real names should always be included in a piece:

> "I'm not only appalled by, I am uninterested in anybody who writes nonfiction without using real names. I don't care whom you are writing about. If I'm reading a magazine and see a name that is not real I put the magazine down." (Boynton, 2005, p.369).

In the end, the choice of using real names or not comes down to the researcher and may depend on the type of research being conducted. Other ethical concerns could include the power dynamics between interviewer and interviewee, the relationship between researcher and subject, and the need to help the interviewee in their personal life.

Interviewing is a practiced skill honed over time. Eventually researchers will develop their own way of researching for and conducting interviews, as well as writing their final piece. Over the course of this project my interviewing skills as a researcher got stronger. Because of this I consider a lot of my later interviews more successful than my earlier ones. For this thesis I focused on two types of interviews in order to collect my data: Elite and semi-structured interviewing.

<u>Elite Interviewing</u>

A lot of people believe elite interviewing is used only when interviewing people of power. These participants are typically in a position of authority, privilege, or a decision-making capacity. Some can also be considered experts on a particular topic, making them elites in their field (Wicker & Connelly, 2014). Due to their important status in society, a power dynamic can form between the interviewer and interviewee. Many "elites" may believe they are above the interviewer and try to control the interview (Empson, 2017). Access to these elites can also cause problems, as it is hard to make direct contact with them without going through a spokesperson or secretary.

However, for this thesis I used Dexter's definition of elite. In his book *Elite and Specialized Interviewing*, Dexter describes elite interviewing as being used for anybody:

> "It is an interview with any interviewee-and stress should be placed on the word "any"-who in terms of current purpose of the interviewer is given special, non-standardized treatment" (Dexter, 1970, p. 5)

Dexter believes the interviewee teaches the interviewer. They do not have to be famous, powerful, or politically connected to be considered an elite. Questions are open ended, allowing the interviewee to explain their answers and talk the interviewer through the process. The subject controls the pace of the interview and, to some extent, the path it takes (Dexter, 1970). If they get too far off subject the interviewer will direct them back to the topic being discussed.

Ten elite interviewees were conducted for this thesis. The interviewees covered a range of professions and locations throughout Cape Cod and were found using purposive and snowball sampling. Interviews ran an average of 45 minutes and were recorded with permission of the interviewee. Interviews were then fully transcribed, taking about 3-4 hours to complete each one.

Semi-structured Interviewing

There are three types of structed interviews: Unstructured, structured, and semi-structured. Unstructured interviews follow a set of topics, but contain no set responses (Baumbusch, 2010). Questions can be asked in any order, and even added or removed from the interview guide as the interview progresses. Structured interviews have a set number and order of questions and the interviewer will not stray off their question guide (Baumbusch, 2010).

The third type, semi-structured, is a mix of the two. It contains open ended questions that allow for in depth and descriptive responses (Baumbusch, 2010). Although an interviewer creates an interview guide beforehand, they are flexible to move off those questions as the interview progresses (Klandermans, & Staggenborg, 2002). This includes adding follow up or probing questions and allowing the interviewee to guide the flow of conversation to an extent. This type of process can lead to a more natural conversation and feel less imposing then a structured interview (Grindsted, 2005).

Thirteen semi-structured interviews were conducted for this thesis, consisting of both locals and tourists. Interviewees were chosen due to having relationships with the beach or ocean, making them more likely be affected by shark interactions. Interviews ran between 5 and 15 minutes, with notes and quotes being recorded in a notebook.

Unobtrusive Observations

Unobtrusive observations are made without the knowledge of the subject, resulting in visual or audial data (Marrelli, 2007). Denzin breaks unobtrusive observation down into three parts: Physical trace analysis, archival record analysis, and simple observation (Denzin, 1970). He then goes on to say that simple observation can further be divided into five different types, two[23] of which were used in this study. The first is expressive movement, which looks at body movement or facial cues. This data can be further categorized by whether it matches to what the participant is verbally saying (embodied posturing), or does not (disembodied posturing) (Denzin, 1970). The second is the observations of language, which looks at not only the language itself but how it is transmitted and verbal utterances, such as "uhm", "uh", or "erm" (Denzin, 1970). This type of observation was used in this study primarily to understand where each participant was from by looking for verbal cues such as regional slang and accents.

In the book *Unobtrusive Measurement Today* phycologists Harper and Wiens also stress the importance of nonverbal behaviors as part of unobtrusive observation measurements. They organize this type of data into five different categories (Harper & Wiens, 1979). The first is facial expressions, typically used to determine the emotion of a person. However, they do state the difficulty in reading these emotions correctly:

> "…expressions of pure emotion are probably rare; affect blends are probably more common forms of expression. For example, what observers might judge as smugness might well be a blend of happiness and anger on the part of the individual." (Harper & Wiens, 1979, p. 61)

Certain emotions can also trigger movements in different parts of the face, with anger effecting the eyes and happiness the mouth and cheeks (Boucher and Ekman, 1975). The second category is kinesics, body motion, which can be classified as four different types: Movements used in place of verbal communication (emblems), movements used to accompany verbal communication (illustrators), movements that change the roles of the speaker and listener (regulators), and the movements that express personal needs and emotion (adaptors) (Ekman & Friesen, 1969). Body language does not only go against or support verbal statements, but also compliment and accent it which makes it a valuable tool for deciphering observations. The third type of nonverbal behavior discussed by the authors is noncontent speech behaviors, which is similar to Denzin's observations of language and looks at sounds like "uhh", laughing, gasps, and crying. The last two types, which

[23] The other three types of simple observation are time sampling analysis, physical location analysis, and exterior body and physical signs (Denzin, 1970).

were not used in this study, are visual behavior like eye contact and proxemics, which is seen by human touching and closeness to one another (Harper & Wiens, 1979).

Unobtrusive measures can often succeed where other qualitative methods, such as interviews and questionnaires, fail. For one thing, other methods can be limiting; researchers must reach out to potential subjects and hope they are willing to participate in their research. These methods themselves could also potentially affect the data. An example of this is called the Guinea Pig Effect, where people change how they act when they know they are being "examined". This effect is described by Selltiz, Jahoda, Deutsch, and Cook in their article *Research Methods in Social Relations*:

> "If people feel like they are 'guinea pigs' being experimented with, or they feel like they are being 'tested' and must make a good impression, or if the method of data collection suggests responses or stimulates an interest the subject did not previously feel, the measuring process may distort the experimental results." (Selltiz et al., 1959, p. 97)

The act of "being watched" can cause many people to change their normal habitats or reactions to certain stimuli. Using unobtrusive observations can limit this sensation and allow people to behave as they normally would.

Role selection is another effect that other more blatant methods, such as interviewing, can create. When a person is individually selected to participate in a study, or answer questions for a research paper, they can be forced to define the role they are playing (Webb, 2000). Participants start thinking about *how* they should answer questions instead of just answering truthfully. They are not exactly lying in their answers, but instead becoming the type of person they believe the researcher wants to see. Sometimes without even realizing they are doing it (Marrelli, 2007). Personality traits could also affect answers. A person who is afraid of conflict, for example, may tend to agree with the interviewer's questions or statements for fear of saying no, or having to defend their answer (Stage, 2003).

Participants may not be the only ones swaying the results. Researchers can also affect the data collection process. Aspects like age, race, eye contact, tone of voice, and sex could lead to biases among interviewees, leading to some people changing how they would normally answer the questions (Stage, 2003). The skill of the interviewer could also affect the data, especially for a project that stretches over a long period of time. Interviewers, especially ones newer to the field, may get better at talking to people and asking

questions over time. This increase of skill could affect the quality of data collected in the beginning of the research verses the end (Stage, 2003).

While a valuable research tool, unobtrusive observation does have its drawbacks. During the course of the data collection, the researcher has no control over what happens. This means they are collecting data on anyone who enters their area of study, allowing for no population restrictions. They are limited by who is around, a variable that could change daily depending on time, weather, day of the week, and whether they observe in more than one spot (Stage, 2003). This also means that the people observed may not fairly represent the population or community as a whole. People may also enter the field of research more than once, unknown to the researcher, and skew the data. Observing can also take its toll on the researcher, causing them to become bored, zone out, or become careless in their observations. What they are seeing on a particular day may not be relevant to their research, or they may be unable to tell if a certain response is common or rare depending on how often they visit the site. These types of studies are also impossible to replicate (Stage, 2003). Observing itself can also cause problems. Due to the need to stay hidden. this research tends to be performed in public areas. This typically means places with crowds or areas the researcher can go unnoticed, thus limiting locations. The information collected is less direct, leaving some of it up to interpretation by the researcher. This can be especially true if the person being observed is further away, restricting what the researcher can see or hear clearly. Without asking, researchers may not know why people do the things they do. Many factors that may be unknown to the researcher could influence how a person behaves, such as social pressure, illness, or other personal issues (Sechrest, 1979).

Along with technical issues, unobtrusive observation also raises ethical ones. Due to the fact that people are unaware they are being studied they are unable to consent to the research. This can cause some moral issues for researchers on where to draw the line. Some researchers keep people unidentified and only study topics that do not impact private lives (Atwell, 1982). Others separate their observing from spying by drawing the line between public and private spaces. However, even that can cause issues and gray areas, such as the case of the public restroom[24] (Webb, 2000). Even with the ethical issues that arise with it, researchers continue to conduct these studies. They argue that the data they are collecting cannot be obtained any other way and that seeking consent would change the results completely (Stage, 2003).

For the purposes of this thesis, I conducted simple observations at beaches in four different towns throughout Cape Cod. Since last year's attack, newly erected shark warning signs were placed at the entrance of every beach on the Cape. In order to view people's reactions to these signs, I sat myself nearby and

[24] Although public bathrooms are considered public domain, people using them expect, "That their behavior will be studiously ignored" (Webb, 2000, p. 147) and not under observation.

watched as they first came upon them. I recorded both verbal and physical reactions in a small notebook: Did they avoid the sign or ignore it, did they spend time reading it, what did they say when they first saw it, etc.

For each period of observation, I strategically place myself as not to seem out of place or allow my presence to affect how someone may view the sign. I wore my swimsuit, or other such beach attire, and sat as close to the sign possible without being separated from the other groups of people enjoying the beach. My notebook was tucked either in a paperback novel I kept on my chair, or within easy reach in my beach bag. This allowed me to make quick notes and record quotes quickly and discretely.

Secondary Source Information

Secondary information contains data not collected by the researcher personally and was originally used for a different purpose. Collecting secondary information can be beneficial to a researcher as it can save time, money, and resources since the data collection is already done (Stage & Manning, 2003). This method also has its limitations though. As this information was not collected for a project designed by the researcher, the information in the data source may not be extremely relevant to the ongoing study. Some sources of information could be restricted and inaccessible to the researcher, such as federal databases. Data could also be missing from the secondary source that is crucial for a researcher to know, such as names, places, and numbers (Stage & Manning, 2003).

For this thesis six sources were used to collect data. Newspaper articles from Massachusetts and surrounding areas were examined including the *Boston Herald*, *Cape Cod Times*, *The Boston Globe*, and *Providence Journal*. Two TV shows, *60 Minutes* and Discovery Channel's Shark Week *Sharks of the Badlands*, which aired in the summer of 2019, were also used. Both of these shows talked about the great whites of Cape Cod, including interviews with local shark experts. Other sources of information included magazine articles, a pamphlet from the National Park service, and Facebook comments.

Appendix III: Autoethnographic Note

During my time conducting this study I kept a second notebook to record my time as a researcher in the field and my experiences throughout the summer of 2019. I was inspired to do this by Porter and Schanzel's book, *Femininities in the Field: Tourism and Transdisciplinary Research*. Below is an autoethnographic note of my experiences.

I have been studying marine biology since declaring it as my major in sophomore year of high school. Since then and the four years of college that followed, I have been learning about the amazing organisms that inhabit the ocean. However, once I graduated from college with a degree in marine, estuary, and freshwater biology I had no clue what I wanted to do with my life. In order to try and find what path I wanted to take I started volunteering at the New England Aquarium for three years. This experience gave me the push I needed to return to school for my masters. It was at the School of Marine and Environmental Affairs, through conversations with my colleagues, that I stumbled upon the field of anthrozoology. This discovery lead to me spending a summer on Cape Cod conducting research for my master's thesis, *Anthrozoology and Public Perception: Humans and Great White Sharks (Carchardon carcharias) on Cape Cod, Massachusetts*.

I was nervous going into this project. I was researching a thesis in a field I had only discovered half a year prior. While I spent those couple of months learning and teaching myself all I could about anthrozoology, I was still worried I was not prepared. I have always thought of myself as a marine biologist. I have been in that field so long that it seemed that is all I would ever be. Now going into my last year as a graduate student I was jumping into a whole new field.

To prepare myself for this project I had to learn about interviewing, as that would be my main form of data collection. This was another field I had no experience in, as I did not have much time to have meaningful conversations with fish in my previous work; well, at least ones where the fish would respond to me with thoughtful quotes. But I studied the masters, like Brady, Bolton, and Dexter, and I took the class "Interviewing Methods and Environmental Topics" to practice my skills. By the time I left to begin my research I felt confident in my knowledge of interviewing and was ready to try it out on the Cape.

Cape Cod has always been a part of my life. I grew up swimming in the warm waters of Cape Cod Bay, learned to boogie board in the waves of the Atlantic Ocean, and have dove for sand dollars and hermit crabs off Mayflower Beach. For the last 27 years, I have spent every summer (and sometimes fall, winter, and spring) playing, swimming, and learning off the sandy beaches of the Cape. This connection was one of the

reasons I was so excited to begin conducting this research, and it felt comfortable to back in a place I was so familiar with.

It took me a while to get use to interviewing people. I had to learn to think on my feet, process the information as people were giving it to me while also planning the next question. I needed to figure out what was important to note down and what was okay to ignore. What I wore made a difference to people, as well as how I talked. I learned interviewing is a strategic game played by both the interviewer and the interviewee. I was there to gather what information on shark reputations that I could, and each person tried to make sure I walked away with what information they deemed appropriate or would help their cause.

Most people I approached seemed happy to talk to me. In the beginning things may have been a little awkward because I was still new to approaching and interviewing people. As time went on things began to go a little smoother and I think who I was and how I presented myself helped with that a bit. My outfits were chosen very deliberately each day I went out into the field. Each piece of clothing was selected based on who I was to meet that day. I took on a professional look, dressing in nice shirts and slacks, when meeting with town officials and wore more causal outfits when walking the beaches. I wore a lot of college gear, both University of Washington (UW) and University of New Hampshire (UNH), my undergraduate school located a couple of hours away from the Cape. I found a lot of people were willing to talk to a student, especially when I mentioned it would be for my master's thesis. The school clothing also helped with initiating small talk, especially the UNH gear as it seemed almost everyone had some connection to that institution. Also to play on my role as an insider, I often sported local sports gear like a Red Sox hat or Tom Brady shirt. While it didn't tell people exactly where I was from, chances are they would assume I was probably from New England at first glance. It didn't hurt to drop a few "r's" and touch up on my use of the word "wicked", two parts of Boston speech I lost a little while on the West Coast.

I think being a young woman also worked in my favor. I probably seemed less intimidating than a guy my age. While both men and women were equally interested in talking to me, I found some men, usually around my age, a lot more eager during the initial conversation then women. These men also tended to talk more, often elaborating on their own thoughts without prodding. However, at times my age and sex seemed to put me at a disadvantage. It seemed like some older men treated me as a young girl, often over-explaining simple concepts repeatedly to make sure I understood. Even after I assured him of my knowledge and familiarity in the area, one man still was not convinced I knew why seals being overpopulated would be a bad thing. There were also times with these old men when it seemed the terms "sweetie" and "honey" turned from an endearment to condescending

Some people looked weary when I would first go up to them, especially parents or older individuals. However, as soon as I said I was doing research for school they often opened up and visibly relaxed. The fact that sharks were a very popular topic in the area at the time helped a lot as well. Everyone was eager to discuss the animals, getting right to their thoughts on them without needing too much prompting. I was also really interested in this topic and it was had trying to become a neutral interviewer when talking to people. With my background in marine biology and work at the aquarium I personally have a strong stance when it comes to animals and marine conservation. In some cases, I did not agree with things people were saying, and had to fight the urge to argue with them or treat them coldly. There were other times I just wanted to drop my questions all together and just start fangirling over this sea turtle or that whale with an interviewee when they discussed their passion for the ocean. I had to learn how to put my biases aside and become an impartial interviewer. Once the tape recorder was turned off, then I could discuss my excitement over Munchkin the loggerhead sea turtle.

By the end of the study I was a lot more comfortable in my role as an anthrozoologist. My interviewing skills got stronger as the summer went on and I learned a lot about myself as an ethnographic researcher. Being in a place I was familiar with definitely helped as I did not have to face any issues of being an outsider: Language barriers, cultural differences, etc. While some people may have treated me a little different due to my age and sex, I do not think it really effected my study too much. Some may have only been so open because I was a woman or student, while others might have talked down to me a little due to my age. However, I feel like I succeed in getting the information I was looking for. With all that being said I look forward to seeing if any of this changes in future research I conduct. What will it be like to work in an area where I am considered an outsider? Or somewhere my age and sex may cause issues for me? As a female researcher I know things will not always be as easy for me as they were in this study and I think it is important to acknowledge that. I think it is also important to acknowledge all the women who came before me that made it possible for me to do this work.