# Public Knowledge, Attitudes, and Behavior towards Sharks and Shark Conservation

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By

Jason O'Bryhim
Bachelor of Science
George Mason University, 2006

Director: Chris Parsons, Professor
Department of Environmental Science and Policy

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Fairfax, VA

# DEDICATION

This is dedicated to my fiancé, Jen, thank you for everything. I couldn't have done it without you.

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ABSTRACT

PUBLIC KNOWLEDGE, ATTITUDES, AND BEHAVIOR TOWARDS SHARKS AND SHARK CONSERVATION

Jason R. O'Bryhim MS

George Mason University, 2009

Thesis Director: Dr. Chris Parsons

Many species of shark are in danger of overexploitation and could possibly be facing extinction. Sharks have been around for over 400 million years but recent declines that threaten their existence can be traced back to the current consumptive uses brought on by humans. If sharks are to be protected, legislation that better regulates their use must be developed. In order to create this legislation support will first be needed from the general public. Currently this could prove difficult because many individuals have negative preconceived notions about sharks, in many cases from the way they are portrayed in the media. It has been stated that the attitudes and behavior of the public have been shown to be able to cause changes in environmental policy. So the variables that can cause both positive attitudes and behaviors towards sharks are important if policies that support their conservation are to be put into place. Previous studies have found that a person's knowledge about a group of species can directly affect their attitude towards them. In this

study it was discovered that knowledge could not only significantly predict a person's attitude but also their behavior towards the conservation if sharks. The higher a person's knowledge the more positive their attitude was and the more likely they were to behave in a way that would support conservation measures. However, it was also shown that in general respondents in the study had a low level of knowledge about sharks. Increasing knowledge about sharks is therefore very important if legislation protecting sharks is to be developed. This study showed that variables significantly effecting knowledge included a person's gender, where they received their information about sharks, whether or not they had viewed programs on "Shark Week" on the Discovery channel, if they were a member of an environmental group, and if they would fear an encounter with sharks. Understanding of how these variables can increase knowledge about sharks and subsequently produce more positive attitudes and behaviors could provide policy makers with the support needed to conserve sharks into the future.

# CHAPTER 1: SHARKS

Sharks[1] have been part of the ocean ecosystem for over 400 million years, they are highly evolved to their environment despite in many cases looking superficially similar to extinct ancestors (Helfman et al., 1997; Hamlett, 1999). At present, there are between 409 and 512 extant species of sharks (Hamlett, 1999). There are discrepancies in the actual number of extant sharks because some species appear in several different places around the world and there is conflict whether or not they should be separated into two or more distinct species or taxonomically grouped together. Shark species can also have a variety common names depending on the location (i.e. The grey nurse shark (*Carcharias taurus*) in Australia is almost identical to the ragged tooth in South Africa and the sand tiger in North America), adding to the confusion. Sharks range in size from the 12 meter whale shark (*Rhincodon typus*) (the largest fish in the sea) to the dwarf lantern shark (*Etmopterus perryi*), pygmy ribbontail catshark (*Eridacnis radcliffei*), and spined pygmy shark (*Squaliolus laticaudus)* which all reach sexual maturity between 15 to 20cm (Helfman et al., 1997; Martin, 1999). They inhabit all the worlds' oceans and some can even be found in rivers, estuaries, and lakes (i.e. bull shark, *Carcharhinus leucas*). The shape of their body can vary immensely among species, allowing for better adaptation to

[1] Refers to species within the Elasmobranchii subclass, as well as the Neoselachii subcohort, that display characteristics such as head, trunk, and tail and that do not have enlarged pectoral fins forming a unified disk for propulsion(rays) (Hamlett, 1999).

specific environments or behaviors (extremes include hammerhead (*Sphyrna spp.*), goblin (*Mitsukurina owstoni*), and thresher (*Alopias spp*.) sharks). They can appear very similar to other fish (teleosts) but have several unique characteristics including a cartilaginous skeleton, five to seven separate gill openings, jaws that are unattached to their skeleton, and dermal denticles (teeth like scales) (Hamlett, 1999). Sharks also have a larger brain size to body weight ratio than other fish; it resembles more the ratios found in higher animals like birds and marsupials (Helfman et al., 1997; Lisney, 2006). This increased brain size could be used as a sign of a higher intelligence over teleost fishes. Sharks are extremely sensitive to environmental stimuli and even have an extra electrical sense, which could be the reason for increased brain size allowing them to more readily process all the information they receive (Helfman et al., 1997). The biggest difference between sharks and other fish however is not what can be seen on the exterior but rather their life history characteristics. Sharks in general mature later in life (average is 6 to 18 years), are longer lived, grow slowly and have a low fecundity in relation to other teleost fish (Helfman et al., 1997; Abercrombie et al., 2005). Their life history characteristics are actually more closely related to those found in mammals than to other fish i.e. they are k-selected species (Shivji et al., 2002). This fact leads to many concerns internationally about the status of shark stocks. Shark fisheries for the most part are unregulated and in some cases fisheries managers use fisheries management models designed for r-selected fish with high fecundities, low age at maturity, and high growth rates (i.e. tuna)(Camhi, 1998). This can be caused by a lack of knowledge on the part of the management body about the limitations of these models with many shark species (Camhi, 1998).

Sharks in general are considered to be apex predators of the oceans. In most cases they have few natural predators besides other sharks. As apex predators sharks are important in keeping the balance within ecosystems (Myers, 2007). The loss of larger sharks will result in their prey species becoming over abundant; this is a result of the prey being released from predation, which then enhances the prey's predation on the next trophic level (Myers, 2007). These are referred to as trophic cascades and can lead to decimation of many of the lower trophic levels (Myers, 2007).

Despite being the top predators of the oceans sharks in general pose little threat to humans. In 2000 there were 264,156,728 people that attended beaches in the US; 53 of them were attacked by sharks, and only one was fatally injured (International Shark Attack File, 2008). That same year on beaches in the US there was 74 fatalities just from drowning (International Shark Attack File, 2008). That still does not count the 70,771 people who had to be rescued from drowning by lifeguards (International Shark Attack File, 2008). The annual risk of death from drowning is 1 in 1,134 in one's lifetime while being attacked and killed by a shark is 1 in 3,748,067 (International Shark Attack File, 2008). This means there is less than a one percent (0.00000003%) chance of being fatally injured by a shark (only 2.2% of shark attacks in the US or Canada resulted in death from 2000-2007) each year (sharks average 0.4 deaths annually) (International Shark Attack File, 2008). People are 30 times more likely to be killed by lightning than they are from sharks (International Shark Attack File, 2008). Sharks are actually at the bottom of a very long list of things that you may not perceive as dangerous but are: dogs, bees, coconuts, grizzly bears, and even ladders pose a greater risk of injury than do sharks (Kellert, 1994;

Mulford, 2001; Langley 2005; International Shark Attack File, 2008). One of the more interesting statistics is that on average there are 1,600 cases of people biting people in New York City, that is compared to an average of 34.5 sharks attacks per year in the US (based on data from 1990-2007) (Mitchinson, 2007; International Shark Attack File, 2008). Since sharks attacks have been recorded (since the year 1580) there have been less than 2,500 cases, comparing that to the 43,687 Americans that were hurt in lavatories in 1996 alone, it rather puts the risk of shark attacks into perspective and makes it seem that we may be worrying about the wrong things (Mitchinson, 2007).

Some sharks do pose a greater threat to humans than other sharks, but for the most part few sharks are ever recorded attacking humans. Of the over 400 species of sharks the International shark attack file has records of only 41 individual species ever attacking humans from 1580-2007 (International Shark Attack File, 2008). Of those 41 species 12 of them have only one recorded attack and 75% (9) of those were provoked attacks (International Shark Attack File, 2008). Of the 1,272 attacks recorded by the International shark attack file from 1580-2007, 702 (55.19%) of them can be attributed to just three species (International Shark Attack File, 2008 The great white (*Carcharodon carcharias*), tiger (*Galeocerdo cuvier*), and bull sharks (*Carcharhinus leucas*) are considered the most dangerous of all sharks (represented in the attack data); these are all rather large sharks that can cause serious injuries and are known to inhabit areas where humans frequent - each of these sharks is known to reach lengths over 10ft. (International Shark Attack File, 2008). It should be noted that the actual numbers for species ever attacking humans as well as the number of attacks attributed to each species should not

be taken as completely accurate In many cases it can be difficult to accurately identify what species of shark attacked a victim because species can look very similar (e.g. requiem sharks, family *Carcharhinidae*) and identifying the species by the victim's bite wounds proves to be very difficult (International Shark Attack File, 2008). There is also the issue that some attacks go unreported because they occur in remote areas or there are no witnesses.

Shark attacks around the world and the US have grown over the past century, but this can be attributed to the fact that the human population has grown exponentially and that more people are now going in the water more than ever before (International Shark Attack File, 2008). Attacks are also more likely to be reported now than ever before. Even with shark attacks on the rise, fatalities from shark attacks have actually decreased worldwide (International Shark Attack File, 2008). In summary, most sharks could cause considerable damage to humans, but attacks are actually infrequent and typically caused by just a few species.

# CHAPTER 2: THREATS TO SHARK POPULATIONS

Many sharks are facing an unknown future, their numbers are declining and there are several factors that can be put to blame. In the past two decades it has become evident that shark fisheries around the world have increased resulting in declines in the stocks of many species (Abercrombie et al., 2005). The catch of elasmobranchs[2] worldwide is now estimated to be nearly 100 million individuals (850,000t) per year (between direct fisheries and bycatch[3]), and can be attributed to an increased demand for elasmobranch products (fins, meat, liver, cartilage) (Hoelzel, 2001; Abercrombie et al., 2005; Lack, 2006). It is also possible that these numbers could be under estimates due to the fact that many shark catches go unreported, in most cases from artisanal fisheries and bycatch (Topelko, 2005). Threats to sharks include loss or degradation of habitat, sport fishing, and eradication programs, but commercial fishing and bycatch by far account for the largest number of takes (Topelko, 2005).

As mentioned earlier the demand for shark products is what is driving the commercial fishery and increasing the number of sharks being caught around the world. Over 150 countries are involved in the trading of shark products with catches from 1950 to 2000 increasing by 220%, showing that it has become a very lucrative business

[2] Dominant living class of chondrichthyes (cartilaginous fishes), are shark like fishes consisting of what we would commonly refer to as sharks and rays (Hamlett, 1999).
[3] Unwanted marine creatures that are caught while fishing for another species, and are usually discarded.

(Hoelzel, 2001; Cunningham-Day, 2001; Lack, 2006). From 1990 to 2003 the number of countries reporting shark catches increased by 25% (20 countries account for 80% of the catch) (Lack, 2006). The majority of sharks are caught in the Pacific Ocean (38% in 2003) but the Atlantic and Indian Oceans are not far behind (32 and 29% ,respectively; Lack, 2006). The US had the fifth largest catch of sharks of any nation (only below Indonesia, Taiwan, India, and Spain, in that order) from 1990 to 2003 (Lack, 2006). For the same time period Japan was ranked tenth on the list (however, for total shark imports from 1950-2003, Japan ranked #1), while the United Kingdom was 14 (Lack, 2006). China, which has one of the largest shark markets, was 27$^{th}$ on the catch list but was number three for importing shark products into the country (Lack, 2006). Interestingly, Spain was the number one importer of shark in 2003 and the number two exporter (fourth in total catch); many would not think of Spain as such a major role in the shark fishery industry (Lack, 2006).

The most valuable of all the items harvested from sharks is by far their fins - most commonly used to make soup and sometimes as ornamental decorations (Topelko, 2005). Prices in Hong Kong, the world's largest fin market, have reached up to US $700 per kg - n.b., some species fins are more greatly valued than others (Abercrombie et al., 2005). Because of these high prices, finning[4] of sharks has become common and as a result much higher catch numbers are possible due to the fact that fins are easier to store because they generally make up a small percentage of the total body mass allowing for

[4] Shark finning refers to the removal and retention of shark fins and the discard at sea of the carcass (IUCN, 2003).

more sharks to be caught in a single trip. Shark meat is also worth a lot less than the fins which prompts many fishermen to cut off the fins and discard the body back into the ocean (Topelko, 2005). Finning also leads to many management problems because it becomes nearly impossible to identify fins down to a species level (Pank et al., 2001). Even if the carcass is kept, it is common practice to remove the head of the shark to save space on the boat, thus receiving accurate catch data on a species is very difficult (Pank et al., 2001). It is vital to have accurate catch data to create effective management plans (n.b., sharks have varying life history characteristics resulting in the need for different management plans) but in many cases either identifying the shark is made difficult by finning and removal of the head, not reporting, or misidentification because many sharks look similar (Pank et al., 2001). The problems associated with finning have led several nations, such as the US to ban the practice. The US requires all fins to be accompanied by the respective carcass (only 4 fins per carcass) for any vessels in US waters (Marine Fisheries Service, 2000).

Sharks are also harvested for other reasons such as the aquaria trade, their teeth and jaws for souvenirs, and as laboratory animals. Shark skin is turned into leather products while their blood is used for the production of anticoagulants (Cunningham-Day, 2001). Before their fins became their main draw sharks livers were collected for oil to provide vitamins (Especially vitamin A) as well as other types of medicines (Cunningham-Day, 2001). Shark cartilage has also become very popular as a burn treatment and to create new bio-chemicals (Cunningham-Day, 2001). The production of pills from cartilage extract is the most common use today because of their believed

cancer curing abilities (Cunningham-Day, 2001). It is believed the cartilage contains factors that protect against cancer by preventing blood vessels from spreading to developing tumor cells (Luer, 2008). However, there is no evidence that the cartilage will allow disease resistance to the sharks or any other animal (Luer, 2008). Contrary to popular myth, sharks do get cancer - it is just occurs at lower rates when compared to other animals (Luer, 2008). Luer (2008) states, that if shark cartilage has factors within it that restricts vascular penetration, it is likely only to keep blood vessels from penetrating cartilage - much like other animal cartilage, and would be unlikely to be able to be released from the cartilage to protect the animal in other areas. Studies using shark cartilage extract to treat cancer showed that it had no effect on tumors and actually could have side effects including gastrointestinal toxicity (Luer, 2008). Obtaining cartilage extract is also very wasteful because it takes 26 lbs. of cartilage to make just 1 lb. of extract (Cunningham-Day, 2001). Shark cartilage however could contain molecular components that have an anti-angiogenic (angiogenesis is the process by which new blood vessels are formed, so these would prevent blood vessel growth) property and could be engineered into drugs to help treat cancer patients, but pure cartilage extract has not been shown to have a beneficial medical effect (Cho, 2002; Luer, 2008).

It is estimated that 50 million sharks are caught unintentionally as bycatch annually (OCEANA, 2007; Bonfil, 2000). Many countries lack regulations on the amount of fish that can be caught as bycatch making conservation of shark species difficult (Stevens, 2000). There are many different fisheries practices that result in bycatch and each has varying levels of impact when it comes to sharks. Trawl nets (pulled behind a

boat) probably account for the highest amount of bycatch with some estimates having the bycatch biomass 10 times higher than that of the target species biomass (Bonfil, 2000). These nets are not discriminatory between species and often leave their bycaught animals dead or dying. Gillnets stay in one place and can have altering mesh sizes so they do not pose as high of a threat, but sharks can become entangled in them and die - n.b., such nets are often used to cordon beaches from shark attacks (Bonfil, 2000). Longlines are used mostly for large predatory fish species that occur in pelagic regions like tuna and swordfish. They can be more selective by the type and size of hooked used as well as the material the gangion[5] is made out of (Burgess et al., 2005). Nonetheless, 20-60% of the fish caught are bycatch (Bonfil, 2000). This type of fishing does, however, allow the sharks a greater chance for survival when by-caught as they can continue to move whilst on the line.

There are 100 species of sharks that are believed to be exploited by fishing or other practices, 20% of those are considered vulnerable, endangered, or critically endangered (Topelko, 2005). Baum et al. (2003) estimated that in the Northwest Atlantic hammerhead shark (*Sphyrna spp*.) populations (mostly scalloped (*Sphyrna lewini*)) had declined by 89%, white sharks (*Carcharodon carcharias*) populations by 79%, thresher sharks dropped by 80% (*Alopias spp.*), while tiger sharks (*Galeocerdo cuvier*) and other coastal species dropped by 60%. They also found that oceanic whitetip (*Carcharhinus longimanus*) and silky sharks (*Carcharhinus falciformis*) have declined by 99% and 90%, respectively (Baum, 2004). Some have argued these findings, stating that the data used to

[5] A short line attached to the main long-line that has a hook attached to the other end (Beerkircher, 2002).

determine these numbers was limited and not appropriate for making inferences about the status of many shark species (Burgess et al., 2005). Burgess et al. (2005) does agree that some shark species in the Northwest Atlantic and Gulf of Mexico have declined, but considers that the decline is not large and Burgess et al. (2005) do not agree with predictions of possible species extinctions in the near future.

# CHAPTER 3: SHARK CONSERVATION

There is an overall lack of conservation measures when it comes to sharks. Few sharks receive the protection they need and, much of this deficiency can be attributed to a lack of information. The conservation and management of sharks can be a difficult task because, as mentioned, they have very different life history characteristics to other fish species. Because of this they do not respond to fish stock management plans like other fish groups, and in many cases they are highly migratory requiring several nations to work together for effective management, which can be very difficult.

In 1990, the United Nations (UN) Food and Agriculture Organization (FAO) adopted the International Plan of Action (IPOA) for sharks (FAO, 1999). The objective of this plan was to ensure the conservation and management of sharks as well as their long term sustainable use (FAO, 1999). Under the "IPOA-Sharks", States are supposed to implement a national program for conservation and management of shark stocks if their vessels conduct directed fisheries for sharks, or they regularly catch sharks in non-directed fisheries (FAO, 1999). Each state is responsible for developing, implementing, and monitoring its shark plan and states are requested to carry out regular assessments of the status of their shark stocks to determine if a shark plan is needed (FAO, 1999). So the IPOA-Sharks does not force states to form a National Plan of Action (NPOA) for sharks - it is completely voluntary. For those countries that do implement a shark plan, the States

should aim to ensure that shark catches from directed and non-directed fisheries are sustainable, assess threat to shark populations, provide special attention to threatened and vulnerable species, minimize incidental catches, encourage full use of dead sharks, and work towards more accurate data collection (i.e. species specific) (FAO sec 22, 1999). With respect to shark stocks that are transboundary, straddling, or highly migratory, it states that international collaboration on data collection, and data sharing for stock assessments, is of particular importance (FAO, 1999). It was recommended that shark plans be developed by February 2001, but by that time only 4 nations had NPOA's (Australia, Japan, United Kingdom, United States), and since then only six other nations have created shark plans (FAO, 1999). Japan's NPOA stated that the Japanese government felt that there was no need for an NPOA, because they considered that no regulatory measures were necessary for their shark catching fisheries (FAO, 2001). The US NPOA builds off of the Magnuson-Stevens Fishery Conservation and Management Act (FAO, 2001; Magnuson-Stevens Act, 2006). The Magnuson-Stevens Act is the main piece of legislation governing the management of marine fisheries in the US exclusive economic zone (Department of Commerce, 2001). The act calls for the conservation and management of resources and the marine environment and includes provisions requiring fishery managers to halt overfishing, rebuild overfished stocks, minimize bycatch and bycatch mortality, and describe, identify, and protect habitat essential to the survival of marine species (Department of Commerce, 2001). The US NPOA builds off these guidelines laid down by the Magnuson-Stevens Act for the further protection of sharks by including provisions to assess directed and incidental catch and bycatch, data collection,

outreach and education of fishermen, exchange of information on shark fisheries and studies, and assess the effectiveness of management measures (Department of Commerce, 2001).

Regional fisheries management organizations (RFMO's) regulate fisheries in international waters outside countries Exclusive Economic Zones (Alliance, 2008). There are no absolute limits set by RFMO's regulating shark catches in waters off Europe (Alliance, 2008). The Inter-American Tropical Tuna Commission (IATTC), which deals with aspects of fisheries management in the Pacific Ocean, resolved that each Party should implement an NPOA, required vessels that catch sharks to have fins that consisted of a total weight no more then 5% of the weight of sharks onboard, and in 2005 introduced ban on shark finning in the Eastern Pacific Ocean (Environment News Service, 2005; IATTC, 2005). The International Commission for the Conservation of Atlantic Tunas (ICCAT) is another RFMO and like most of the others only performs stock assessments on sharks (ICCAT, 2006). This particular RFMO only assesses stocks of blue sharks (*Prionace glauca***)** and shortfin mako (*Isurus oxyrinchus*) (ICCAT Report, 2006). As of 2000, only 25 of 80 nations had reported shark catch data to the ICCAT, and of those many neglected to include species specific data (Marine Fisheries Service, 2000). However, in 2004 the 63 member nations of ICCAT adopted the first International prohibition on shark finning, similar bans have now been adopted by nine RFMO's (Enviroment News Service, 2005; Dulvy et al., 2008).

The Convention on the International Trade of Endangered Species (CITES) provides an international framework for preventing trade in endangered species and

regulating species that may be at risk. In 2002, the first two sharks (whale shark (*Rhincodon typus*) and basking shark (*Cetorhinus maximus*)) were added to CITES Appendix II (which entails limits and regulations on trade in these species), followed by great white sharks (*Carcharodon carcharias*) in 2004 - n.b., some countries took reservations to these listing and as such may be exempt from CITES regulation in such cases (Cunningham-Day, 2001; CITES, 2008). Reservations for the basking shark (*Cetorhinus maximus*) and whale shark (*Rhincodon typus*) were entered by Iceland, Indonesia, Japan, Norway and the Republic of Korea in 2003 (CITES, 2007). In 2004 Palua also entered a reservation on whale sharks (*Rhincodon typus*) as well as one for great white sharks (*Carcharodon carcharias*)(CITES, 2007). Reservations for the great white shark (*Carcharodon carcharias*) were also entered by Iceland, Japan, and Norway in 2005 (CITES, 2007). Similar to this is the Convention on Migratory Species (CMS), which compiles two appendices of threatened species, and has worked to create legally binding or less formal agreements between nations on managing shark species that move between several nations' waters (CMS, 2004). The International Union for Conservation of Nature (IUCN) compiles a "red list" of species, which shows the current status of species based on stock assessments and ranks them in terms of the decree of population decline, fragmentation and extinction risk (IUCN, 2007). This can be used when determining the urgency of conservation-based management that may be needed for a given species. In 1993, the US began regulating shark catches, the Atlantic Coast Shark Fisheries Management Plan put quota regulations on 39 species of shark that occur in US waters including the Gulf of Mexico, Caribbean, and Atlantic (Cunningham-Day, 2001).

At present, this is arguably the leading shark management regime in the world. In 1997 the National Marine Fisheries Service (NMFS) prohibited directed commercial and recreational fishing of five species of shark: whale shark, *Rhincodon typus*; basking shark, *Cetorhinus maximus*; sand tiger, *Carcharias taurus*; bigeye sand tiger, *Odontaspis noronhai*; and great white shark, *Carcharodon carcharias* (Cunningham-Day, 2001; NMFS sec 678.2, 1997). NMFS also prohibited filleting sharks at sea, required species specific identification of landed sharks, and cut the commercial quota by 50% to 1,285 metric tones for large coastal sharks while making a quota of 1,760 metric tones for small coastal sharks (Cunningham-Day, 2001). In 2001, the US government signed into law the "Shark Finning Prohibition Act". Section 3 of this act amended the Magnuson-Stevens Fishery Conservation and Management Act to prohibit persons within US jurisdiction from finning sharks, possessing shark fins without the carcass, and landing shark fins without the corresponding carcass (Marine Fisheries Service, 2000). However, these rules only apply to those vessels flying a US flag while at sea. In 2008, to improve upon the Shark Finning Act the US created Amendment 2 to the Highly Migratory Species Fishery Management Plan, which in part now requires fishermen to land all sharks with fins still attached in the Atlantic Ocean and Gulf of Mexico (NMFS, 2008 ) On July 8, 2008 the House passed the Shark Conservation Act of 2008, which amended the Magnuson-Stevens Fishery Conservation and Management Act to require landed sharks to be brought to port with fins still attached but would be enforced in all US waters (GovTrack, 2008). Costa Rica has also recently banned shark finning (2007) and was the first country to require fins to remain attached naturally to the sharks; several other Central American

countries, and Australia, have pledged to follow suit (Arauz, 2007; Dulvy et al., 2008). Currently shark finning is banned in 19 countries, the European Union (EU), and nine Regional Fisheries Management organizations (Dulvy et al., 2008). The European Union's regulation banning shark finning was created in 2003 to prevent the further development of the practice of shark finning, as well as prohibit the removal of fins, retention on board vessels, and transshipment and landing of sharks or shark fins by vessels in maritime waters under the sovereignty or jurisdiction of Member States or by vessels flying the flag or registered in a Member State in other maritime waters (EU Art. 1, 2003). The regulation also prohibits the purchase, or sale of shark fins which were removed, retained, transferred from one ship to another, or landed in a way that goes against the regulation (EU Art. 3, 2003). This prohibition of finning extends to all species in the *Elasmobranchii* subclass except for the removal of ray wings (EU, 2003). The EU does allow the removal of fins on board vessels only if the fins and rest of the shark are going to be processed separately on board and in order to speed up processing, and the vessels are awarded a special fishing permit from its flag Member State (EU Art. 4, 2003). Those vessels with the permit must keep records in a log book of the amount of shark fins and other remaining parts on board after the shark has been eviscerated and beheaded (EU Art. 5, 2003). To try to ensure that these vessels are keeping the corresponding carcasses authorities use a weight ratio of fins to shark carcass (Hareide et al., 2007). However, the weight ratio used by the EU is nearly double that of other countries and the different ways in which the sharks are cleaned can change ratios thus allowing for some finning to occur (Hareide et al., 2007). Experts have shown that the fin

to carcass weight ratio is flawed and the only way to ensure that sharks are not being finned is to require fins be attached under all circumstances when they are brought to port, like what is required by the new amendment to the Highly Migratory Species Fishery Management Plan (Hareide et al., 2007; NMFS, 2008; Arauz, 2007).

Marine protected areas (MPA's) are another means of conserving sharks that has been implemented by several different countries. These take on more of an "ecosystem approach" to conservation, rather than species-specific, and can be very useful in the conservation of several species in areas with high biodiversity. They can also be created with the intention of primarily protecting a single species, however, the protective measures may also benefit other species. In 2006, the US created, at that time, the largest MPA to date, which encompassed a chain of Hawaiian Islands. The Northwestern Hawaiian Islands National Monument is 140,000 square miles of Pacific Ocean that is larger than all of America's national parks combined (Weiss, 2006). However, a new, larger, MPA was recently established created by the small island nation of Kiribati. In January 2008 Kiribati adopted formal regulations for the Phoenix Islands Protected Area (PIPA), which makes up an area the size of California (158,453 square miles), preserving one of the last intact oceanic coral archipelago ecosystems (International, 2008).

In many cases there are little criteria for where to form such MPAs, which can prove to be counter productive if the area is not host to species that actually need protection (Gerber, 2007). Trying to protect sharks that are highly migratory or show little site fidelity would make it difficult to create a successful MPA specifically for their protection. Pelagic sharks also rarely receive protection from MPA's because they are

found in international waters and MPA's are generally within a single country's territorial waters or EEZ.

It appears that creating new legislation for sharks is a slow-moving process. This can be shown through the relatively few nations that have implemented NPOA's for sharks since the plan's inception. National and international legislation on shark finning is, however, moving forward and starting to provide protection for sharks, although some measures still need a better set of regulations to be productive (Hareide et al., 2007; NMFS, 2008). Some nations, like the US, have started to implement catch limits on sharks, but this is not a common theme around the world (Cunningham-Day, 2001). Limiting the number of sharks being caught is a substantive problem with existing legislation and regulation, especially in international waters. There are relatively no quotas on shark catches in international waters; with fishing in these areas continuing unabated, this is a serious issue (Dulvy et al., 2008). Accurate catch data on sharks is also lacking in all fisheries and, without such data, creating useful quotas that could protect them from overfishing is near impossible (Dulvy et al., 2008). The future of sharks seems to rest on whether or not countries can work together collecting ad sharing data and implementing management plans for shark fisheries, in both coastal and pelagic waters.

# CHAPTER 4: PUBLIC ATTITUDES

Attitudes towards marine conservation can vary greatly depending on what issues are being discussed. The overall public in general does indeed seem concerned about the state of our oceans and how humans may be affecting them, but this concern does not rank as high as other everyday anxieties or other environmental issues (Spruill, 1997). The issues that are of highest concern for Americans are also not necessarily what experts would claim to be the most serious threats to the ocean environment (Spruill, 1997). In 1997, Spruill polled a group of adults about their attitudes towards the ocean and found that respondents felt that oil spills (81%), contamination of seafood (65%), trash and litter on beaches (62%), and dolphins being caught in tuna nets (56%) were the most serious problems facing our oceans. This is compared to destruction of coastal habitat (53%), overfishing by commercial vessels (45%), and deterioration of coral reefs (43%) which were found not to be as serious a problem by the respondents but experts felt were more important issues (Spruill, 1997). Similar results were found in the United Kingdom with respect to marine environmental threats to cetaceans: oil spills and marine litter were perceived as greater threats by the public than they were by individuals considered experts in Scotland (Scott and Parsons 2005; Howard & Parsons, 2006). With respect to sharks, despite Americans in general seeming to be of the opinion that they have a

responsibility to protect the oceans (84%), when it comes to sharks only 30% of the respondents felt that the killing of sharks was a serious problem (Spruill, 1997).

One of the major problems facing shark conservation efforts is their public image (Thompson, 2002). Many members of the public have negative attitudes towards sharks and view them as vicious predators, man-eaters or "mindless eating machines" and media outlets in most cases are exacerbating this stereo type by providing inaccurate knowledge and melodramatic depictions leading to gross misunderstandings about these animals (Thompson, 2002; Barney, 2005; Morey, 2002). By creating this negative image of sharks in the public consciousness we are sabotaging any effort to conserve them, because of the negative information that is being sent out who would support legislation to allow for more sharks. The movie "Jaws" is one example of these negative images. Many people found "Jaws" to be scarier than other horror movies of the time because it was based on realistic events that they felt could actually happen and on an animal that many people do not understand very well (Morey, 2002). The movie was actually based enough in reality to effect people's decisions to enter the water at the beach (Morey, 2002). Despite writing the book that the movie "Jaws" was based on, Peter Benchley was a strong advocate for shark conservation, writing several books about his experiences with sharks in order to help people better understand them (Shark Trouble: True Stories About Sharks and the Sea (2001); Shark!: True Stories and Lessons from the Deep (2002); Shark Life: True Stories About Sharks and the Sea (2005)). The Shark Research Institute also created the Peter Benchley Shark Conservation Award to honor his memory and those who are working to protect sharks internationally.

Public phobia of sharks did not seem to start until after World War II when stories of sailors being attacked by sharks in large numbers began to circulate (the USS Indianapolis is the most recognized incident with books and television specials based on this event), and has grown ever since (Morey, 2002). The summer of 2001, saw several highly publicized attacks in the US (there were 50 recorded attacks in 2001, three were fatal), although the number of attacks was no more than usual, this period was still dubbed the "Summer of the Shark" by Time magazine (there were on average 34.5 shark attacks per year in the US, in 2002 there were 47 attacks and there were 50 attacks in 2007, however publicity was much lower for these years - as previously noted shark attacks have increased over the years due to higher concentrations of swimmers in the water; Morey, 2002; International Shark Attack File, 2008). This was due to over-publicizing the attacks, in combination with a lack of attention- grabbing news stories at the time, but such "media-hype" leads to public panic and more negative feelings towards sharks (Morey, 2002). Dobson (2007) found that all but one participant held negative pre-conceived notions of sharks and that the media played a key role in shaping these negative attitudes. For some members of the public, the evening news and movies are the only way they will receive information about sharks so if they are sent the wrong, or misleading, information, or do not distinguish between fact and fiction, then we could seriously hinder efforts to conserve sharks and create a society with an overall hatred and fear of these animals (Morey, 2002). Even wildlife and nature programming can be biased. Shark week, which appears on the discovery channel each summer and receives many viewers, has programs with titles such as "Anatomy of a Shark Bite", "The 10

Deadliest Sharks", and "Bull Shark: The World's Deadliest Shark". These programs do sometimes mention the low likelihood of actually being attacked by a shark and the peril that sharks as a group are in but such statements usually come at the end, sometimes even only as the credits are rolling. It would seem that these programs are portraying sharks in a negative light even if that is not their original intention.

Many different variables can affect the attitudes people hold towards the natural environment including, age, gender, income, ethnicity, and participation in wildlife activities, however knowledge is the factor found most likely to change peoples attitudes and perceptions (Thompson and Mintzes, 2002; Kellert, 1996). Kellert and Berry (1980) also found a direct link between education level and ones concern, interest and awareness of environmental issues. They found that the higher the education level the more naturalistic[6], ecologistic[7], humanistic[8], and moralistic[9] a person tended to score on a attitudinal typology scale, while those with lower levels of education showed more utilitarian[10], dominionistic[11], and negativistic[12] attitudinal tendencies (Kellert and Berry, 1980). A study by Thompson and Mintzes (2002) looked at the effects of education level and gender on knowledge and attitude towards sharks and the relationships among them.

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[6] Interest in direct experience with animals and the exploration of nature (Thompson and Mintzes, 2002).
[7] Concern for the environment as a system; for inter-relationships between wildlife species and natural habitats (Thompson and Mintzes, 2002).
[8] Interest and strong affection for animals, with strong emotional attachment and 'love' for them (Thompson and Mintzes, 2002).
[9] Concern for the right and wrong treatment of animals, with strong opposition to exploitation or cruelty toward animals (Thompson and Mintzes, 2002).
[10] Concern for the practical and material value of animals; their body parts and/or habitats (Thompson and Mintzes, 2002).
[11] Interest in the mastery and control of animals, as in sporting or other competitive contexts (Thompson and Mintzes, 2002).
[12] Orientation toward an active avoidance of animals as a result of indifference, dislike or fear (Thompson and Mintzes, 2002).

They used concept maps[13] to gauge the level and complexity of knowledge that an individual had regarding sharks and then had subjects respond to a Likert-type attitudinal inventory to show their attitudes towards shark related issues (Thompson and Mintzes, 2002). Respondents for the tests were students ($5^{th}$, $8^{th}$, $11^{th}$ grade, and college level) as well as senior citizens (Thompson and Mintzes, 2002). Thompson and Mintzes (2002) found that knowledge did increase with age (or grade level) and that within the attitudinal scales that college students scored higher in the scientific[14] and naturalistic categories and lowest in the utilitarian/negativistic attitudes (Thompson and Mintzes, 2002). Elementary and middle school students scored the highest in the utilitarian category (Thompson and Mintzes, 2002). Males were found to be more naturalistic and utilitarian, while females exceeded males in the moralistic category, however no gender related differences were found in the knowledge structure (Thompson and Mintzes, 2002). A positive correlation was found between knowledge complexity and scientific and naturalistic attitudes, while it was negatively correlated to utilitarian/ negativistic attitudes (Thompson and Mintzes, 2002). The moralistic category was found to be mostly unrelated to knowledge structure (Thompson and Mintzes, 2002). Thompson and Mintzes (2002) also showed that there was a moderately strong relationship between knowledge and the types of attitudes one possesses when it comes to sharks. Similar findings were made in another study looking at public knowledge, attitude, and behaviors towards cetaceans (Barney, 2005). This study also used concept maps to judge knowledge in a similar subject group of students

[13] "A concept map is a two-dimensional, hierarchical, node-link diagram that depicts the major concepts and propositions within a domain of knowledge (Thompson and Mintzes, 2002)."
[14] Interest in the physical attributes and biological functioning of animals (Thompson and Mintzes, 2002).

and also found as age and educational exposure to dolphins grew so did their knowledge (Barney, 2005). They also found that individuals with a level of dolphin knowledge to be considered experts had the least utilitarian attitudes being more environmentally friendly than any other group and were least likely to participate in harassment behavior towards dolphins (Barney, 2005). It should be noted that in the studies done by Thompson and Mintzes (2002), as well as the one by Barney (2005), the college level students that were participating for the most part were either taking a marine biology class or were a marine biology graduate students and had received information regarding these animals recently, which could cause a bias in the results.

Attitudes can not only be shaped by the amount of knowledge one has regarding a species but also on whether or not they have encountered that species first hand. As mentioned before, Dobson's (2007) study found that most people have negative preconceived notions about sharks but that was only prior to them experiencing these animals in the wild. It is believed that by allowing people to see the animals in their natural environment this will break down the "Jaws" like stereotypes of sharks and create more positive attitudes (Dobson, 2004; Dobson, 2007). In Dobson's (2007) study, it was also found that attitudinal changes seemed to occur despite there being what was considered to be poor educational content provided on the dive trips that the participants were taking part in. So the subjects were receiving little to no extra knowledge about sharks, but being able to experience sharks close up through a shark dive had the ability to change their negative preconceived notions. The participants were perceived to have

gained a great deal of respect for what these animals through this series of shark –focused dives (Dobson, 2007).

The attitude a person holds towards sharks or any other animal seeking protection is important because it can affect their behavior towards those animals (Thompson and Mintzes, 2002). Kraus (1995) stated that attitudes in some fashion can guide, influence, direct, shape, or predict a person's behavior. Individuals with a positive attitude regarding a species are also less likely to have disruptive or harmful behavior towards that particular animal (Barney, 2005). This means that people with positive attitudes may be more likely to support new legislation to protect and conserve sharks, donate money, or just refrain from potentially harmful practices or activities involving sharks. It is possible that understanding what is shaping positive and negative attitudes towards sharks can give a clue into how the different ways in which information being distributed about sharks may need to be changed to allow for a more positive outlook towards these animals. This also holds the possibility of positively affecting the public's behavior as well (Thompson and Mintzes, 2002).

The purpose of this study is to again display the connection between a person's knowledge about sharks and the attitude they hold towards them as was shown in the Thompson and Mintzes study (2002), as well as looking at different variables that may be affecting the public's knowledge and or attitudes about sharks such as gender, education level, age, and where they are receiving their information about sharks. Also, similar to the Dobson (2007) study mentioned earlier the significance of physical encounters with sharks on a participant's attitudes will be reviewed. Within that same idea the effect of

encounters with the aquatic environment in general (e.g., scuba diving, snorkeling), not specifically with sharks, will be studied to see what changes may be associated with it in a persons attitude or knowledge. Finally, it will be determined what effect certain variables may be having on a person's potential or actual behavior towards sharks. Specifically looking to see how attitudes may be shaping behavior. A model based off the variables mentioned was developed in order to determine the relationship between these variables.

It has been shown that greater knowledge leads to a more naturalistic attitude towards different animals, but this study will examine how these attitudes may affect behavior (Thompson and Mintzes, 2002). Having a more naturalistic attitude towards sharks could possibly lead to behaviors that would support the conservation of sharks. These individuals may be more inclined to donate funds supporting research on sharks or legislation that would protect them from the many hazards they face. Understanding what variables may be causing positive behavior towards sharks is important if there are to be successful conservation measures. Kellert (2008) states that, both changes in attitude and behavior can cause major shifts in policy. This study looks to see if it is only attitudes that are shaping behaviors or if other variables such as knowledge and experience with sharks are having direct impacts on behavior besides through there ability to shape attitudes. Without public support of possible legislation protecting sharks the possibility of these laws being enacted is unlikely. It needs to be understood what causes positive behaviors so that they can be used to influence more people in the same way and hopefully they will speak out, whether publicly, or at the ballot box, in support of shark

conservation. A detailed list of the different hypotheses that were tested can be found in Appendix II.

# CHAPTER 5: METHODOLOGY

The survey instrument (Appendix I) used in this study was developed over the course of a year, testing several different versions in order to determine what types of questions most effectively addressed the hypotheses of this study. The original version was created for a graduate course to determine what types of knowledge and attitudes graduate students at George Mason University had toward sharks. This was a biased population but the results were used as pilot study to determine what changes might need to be made to the survey in order to acquire more useful and representative data. After initial revisions were made by the author of this study the survey was peer-reviewed by selected faculty members and graduate students at George Mason University in the Environmental Science and Policy Department. From their critiques of the survey a final draft was created which would then be distributed for the study.

The distribution of the survey instrument was conducted in Chantilly Virginia at an automotive dealership as this venue was considered to have a "captive" audience from a wide cross section of society. Surveys were distributed from November 2007 to April 2008 to customers that were located in the service area waiting room of the dealership. Customers were asked if they would like to participate in the study and signed a release form authorizing the use of they information they provided. No specific individuals were sought out for questioning in this study and surveys were distributed to any customer in

the waiting area wishing to participate. If they declined no further inquiry was undertaken. The survey instrument in this study as well as the procedure for its distribution was in accordance to the requirements and guidelines of the Human Subjects Review Board at George Mason University, and was approved by this body.

The response rate to the survey was 87.7% (n=186 completed surveys) - there were no incentive for taking the survey; it was completely voluntary. Some surveys that were returned to the author of this study were not filled out in their entirety. Despite these surveys not being fully completed the information that was provided was still used in this study. Surveys were then designated numbers that correlate to an excel spreadsheet where the answers to each survey were recorded. The answers that were given by participants were then number coded into another Excel spreadsheet. Following this the inputted answers in both excel spreadsheets were checked by the author of the study to correct for any errors that might have occurred.

After the data from the survey had been coded in the Excel spreadsheet it was transferred to the statistical program StataIC 10. The data in the StataIC 10 program was then checked against the data from the Excel spreadsheet by random comparison of cells from both programs to ensure that no errors were caused during the transfer. Any errors that were found in the StataIC 10 data were then corrected and that entire column of data was then checked against that of the Excel spreadsheet. The program StataIC 10 was then used for all statistical analysis of the data. The survey used in this study can be found in the Appendix I.

Within StataIC 10 the questions in the survey were labeled both numerically from 1 to 61 in the order in which they appeared on the survey and with a letter (K, A, B, D) that corresponded to the type of question being asked. Questions that were labeled with a "K" were questions pertaining to a persons knowledge about sharks, "A" were those regarding attitude towards sharks, questions about a persons behavior towards sharks were labeled with a "B", and "D" was for general demographic questions. These alpha and numeric labels for the survey questions will be used to reference specific questions or groupings (i.e. knowledge) of questions.

The survey questions were partitioned into these categories in order to create indexes that would measure a person's knowledge level, attitude, and behavior towards sharks and shark conservation. An index was not created for the demographic questions; rather they were used separately in the statistical analyses.

The knowledge index consists of 23 questions (K1, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K26, K28, K29, K30, K31, K35, K36, K37, K38, and K39) that were each coded into binary. Participants on many of the knowledge questions within the survey were given the option of answering "I don't know". All questions answered in this manner were given a value of zero on the binary scale because it was established that this answer was identical to answering the question incorrectly and thus should be scored the same. To create the knowledge index these questions were then added together to give a number out of 25. The index is measured out of 25 instead of 23 because K4 asks which three sharks pose the greatest threat to humans and the participant in the survey received one point for each correct answer rather than a base score of one

for having all three correct. A participant's knowledge of sharks could then be judged based on the score they received from these questions with a higher score meaning more knowledge. Not all the knowledge questions presented in the survey were used to create the knowledge index because I was unable to convert them into binary coding. The knowledge index that was created using the sum of the mentioned questions proved to be somewhat internally reliable (Chronbach's alpha= 0.573). Using these questions together created the highest internal reliability. Some knowledge questions were also used independently.

The attitudinal index is made up of five questions (A3, A16, A32, A33, and A34), used to judge a participant's attitudes towards sharks and their conservation. Of these questions only A3 was not coded on a binary scale. Question A3 asked how urgent the participant felt that shark conservation ways from very urgent, urgent, moderately urgent, not at all urgent, or don't know. This question was scored as a three-point likert item (scale using levels of agreement or disagreement) with very urgent being worth three and not at all urgent being worth zero. The answer "I don't know" was coded as such that it received no score and was similar to as if they had answered it with an anti-shark response. No other attitudinal question in the index had the option of an answer of "I don't know". The five questions were then added together to create an attitudinal index scored out of seven, with higher scores representing a more pro-shark attitude. Not all the attitudinal questions presented in the survey were used to create the attitudinal index because the author was unable to convert them into a usable coding system. This shark attitudinal index that was created proved to be internally unreliable (Chronbach's Alpha =

0.238). This index was used in some analyses with the understanding that the results would not be able to definitively support or reject a hypothesis because of the internal reliability. Individual shark attitude questions were used in the study as well.

The last index that was created was used to measure a participant's general behavior towards sharks and consisted of nine questions (B17, B18, B19, B20, B21, B22, B23, B24, and B25) each coded in binary. Questions within this index that were answered "I don't know" were coded as a zero representing anti-shark behavior. The sum of these questions was used to create an index with a scale from nine to zero with higher scores representing a more pro-shark behavior (i.e. individuals more willing to support shark conservation). This index proved to have high internal reliability (Chronbach's Alpha = 0.814).

As previously mentioned the demographic questions (D40, D43, D45, D46, D50, D52, D56, D57, D58, and D60) from the survey were not used to create another index, but rather were used separately for analyses. Binary code was used for the majority of these questions; however, D45, D57, and D58 had to be coded differently (had more than two answers) to be able to run the correct analyses. Question D45 asked where a person receives most of their information regarding sharks. There were seven possible answers and they coded in a way that corresponded to the quality of information that they would be receiving. If the participant provided more than one answer, the answer with the highest value was used and all others were dropped. Question D57 asked what year the participant was born and this number was subtracted from 2008 (year the study was held) to determine their age. The participants' ages were then used in analyses this way to

determine age's effect on different variable regarding sharks and conservation. Question D58 asked the participant what level of education they had achieved with four different answers. Dummy variables were created within StataIC 10 so that this question could be broken down into four separate questions that each used binary code. This made it seem as though the participant was answering a question with the answers "Yes" or "No" to their education level, making it easier to use this question in analysis. This method of using dummy variables was also used for question A55, which asks how someone would feel if they encountered a shark. This question does not appear in the attitudinal index and was used as an individual variable. A code book for how each question was coded and labeled can be found in Appendix III.

The indices as well as several demographic questions were then used to create a model to test the affects of different variables against a participant's behavior towards sharks. It specifically looked at how a person's age (D57), gender (D56), education (D58), where they receive information regarding sharks (D45), whether or not they had viewed the television program "Shark Week" (D46), knowledge, and attitudes about sharks could be affecting their shark behavior. Running the model allowed for each individual variable to be controlled for to determine which, if any, of the variables were having the greatest affect on behavior. Parts of the model were also used to determine which variables could possibly be affecting both knowledge and attitude. A regression analysis was used to run the model to determine if there was a relationship between the variables.

Bi-variate regression analyses were also used to test for relationships between variables. Analysis of variance (ANOVA) tests were used to determine whether or not there was significant difference between how groups were answering a variety of questions. While chi-square tests were run to see if a relation existed between two variables and how strong that relationship might be. A detailed breakdown of the specific tests that were run for each individual hypothesis can be found in Appendix II (including results).

# CHAPTER 6: RESULTS

A total of 51.91% of the participants were male and 48.09% were female (n=183), with a mean age of 37 years (n=169). Tables 1-3 summarize the answers given by the respondents for specific demographic questions that were used in the statistical analyses. Table 1 displays the majority of the demographic questions and is broken up into "Yes" and "No" categories.

Table 1. Responses to the demographic questions with the percentages of respondents.

| **Question** | **Yes** | **No** | **N** |
|---|---|---|---|
| Do you watch animal programs on channels like Discovery, Animal Planet or the BBC? | 74.03 | 25.97 | 181 |
| Do you subscribe to any environmental/scientific/animal magazines? | 14.61 | 85.39 | 178 |
| From the list below, where do you receive most of your information about sharks? | **See Table 2** | | |
| Have you ever watched shark week on the discovery channel? | 58.52 | 41.48 | 176 |
| Have you ever watched any of the Jaws movies? | 87.57 | 12.43 | 177 |
| Have you ever watched the movie Open Water? | 63.64 | 36.36 | 176 |
| Have you ever watched the movie Deep Blue Sea? | 58.62 | 41.38 | 174 |
| Have you ever been scuba diving or snorkeling? | 53.63 | 46.37 | 179 |
| Have you ever been snorkeling or scuba diving with sharks? | 10.06 | 89.94 | 179 |
| In what year were you born? | **See Table 3** | | |
| What level of education have you acquired? | **See Table 4** | | |

| | | | |
|---|---|---|---|
| Are you a member of any type of conservation/environmental group? | 6.18 | 93.82 | 178 |

Table 2. Responses to the question:"From the list below, where do you feel you receive most of your information about sharks?" (N=169)

| | Scientific Journals | Documentaries | Newspapers | Magazines | Television News | Movies or Other People |
|---|---|---|---|---|---|---|
| Percentage of Respondents | 2.96 | 59.76 | 6.51 | 5.33 | 19.53 | 5.92 |

Table 3. Response to the question: "What level of education have you acquired?" (N= 175)

| | High school diploma | College degree | Masters degree | PhD |
|---|---|---|---|---|
| Percentage of Respondents | 24 | 48.57 | 20.57 | 6.86 |

The questions used to gauge respondent's knowledge about sharks and their conservation as well as create the knowledge index are summarized in Table 4. The table displays the percentage of correct and incorrect answer followed by the correct answer that can be found on the survey (Appendix I).

Table 4. Responses to the knowledge questions about sharks and their conservation, displaying the percentage of respondents for correct and incorrect answers and the actual correct answer.

| **Question** | **Correct** | **Incorrect** | **Don't Know** | **Correct Answer** | **N** |
|---|---|---|---|---|---|
| Do you think over the past 100 years shark populations have been… | 68.82 | 9.68 | 21.51 | Declining | 186 |

| | | | | | |
|---|---|---|---|---|---|
| If you chose increasing or decreasing by what percentage do you think they increased or decreased? | 4.96 | 95.04 | 0.00 | ≥70% decline | 121 |
| Please check the three sharks you think pose the greatest threat to humans from the list below. | 75.54 | 24.46 | 0.00 | Bull shark, great white shark. tiger shark[15] | 184 |
| About how many sharks species do you think exist today. | 1.18 | 98.82 | 0.00 | 400-500 species | 169 |
| Which of these sharks listed do you think is the largest? | 52.17 | 47.83 | 0.00 | Whale shark | 184 |
| What percent of reported shark attacks do you think are fatal? | 10.87 | 89.13 | 0.00 | Less than 1% | 184 |
| How many species of sharks do you think are recorded as attacking humans? | 2.84 | 97.16 | 0.00 | 40 to 50 Species | 176 |
| Sharks breed quickly and produce many young. | 57.30 | 4.86 | 37.84 | FALSE | 185 |
| Sharks can be removed from the ecosystem with no adverse effects. | 83.33 | 2.69 | 13.98 | FALSE | 186 |
| Sharks do not get cancer. | 24.19 | 13.44 | 62.37 | FALSE | 186 |
| Sharks may hold the cure for cancer. | 33.33 | 4.30 | 62.37 | TRUE | 186 |
| How long do you think sharks have inhabited the oceans? | 0.00 | 100.00 | 0.00 | ~400 million years | 172 |
| Which do you think are the three most likely to cause death in humans? | 71.27 | 28.73 | 0.00 | Any combination that does not include sharks. | 181 |
| Of the following, which do you think is the single greatest threat to sharks? | 24.85 | 69.23 | 5.92 | Commercial fishing | 169 |
| Do you think shark attacks have… | 30.43 | 49.46 | 20.11 | Increased | 184 |
| Are sharks… | 50.00 | 20.79 | 29.21 | Highly evolved | 178 |
| Compared to other fish are sharks… | 61.67 | 18.89 | 19.44 | More intelligent | 180 |
| Of these countries, which do you think participates most in shark fishing? | 25.00 | 75.00 | 0.00 | Spain, Taiwan, or United States | 136 |
| Of these countries, which do you think participates least in shark fishing? | 19.87 | 80.13 | 0.00 | Galapagos, Philippines, or South Africa | 156 |
| Some sharks have international protection from overfishing. | 10.17 | 26.55 | 63.28 | FALSE | 177 |
| Is shark finning illegal in the United States? | 26.26 | 12.29 | 61.45 | Yes | 179 |
| Is shark finning illegal in International waters? | 5.03 | 23.46 | 71.51 | Yes | 179 |

[15] Those participants who noted two or three of the sharks listed were counted as a correct answer.

| | | | | | |
|---|---|---|---|---|---|
| Is shark finning illegal in foreign countries? | 5.00 | 26.11 | 68.89 | Yes | 180 |
| What do you think shark fins are used for? | 59.87 | 40.13 | 0.00 | Soup, food, delicacy, medicine, or ornament | 152 |

In Table 5 the responses to the six questions from the survey used to judge a respondent's attitude towards sharks and their conservation are summarized. The first five question presented in Table 6 are those used to create the attitudinal index regarding sharks and their conservation. The last question was used to gauge a respondent's perceived fear or curiosity towards a possible shark encounter. The answers on the survey were divided into whether they exhibited a positive or negative attitude towards sharks.

Table 5. Responses to the questions about attitudes towards sharks and their conservation displaying the percentage of respondents who answered with positive or negative attitudes.

| **Question** | **Positive** | **Negative** | **Don't Know** | **N** |
|---|---|---|---|---|
| How urgent do you think shark conservation is? | 22.04[16] | 62.37[17] | 15.59 | 186 |
| Marine protected areas are important to shark conservation? | 85.79 | 2.73 | 11.48 | 183 |
| Which of these animals do you think is most endangered? | 22.09 | 77.91 | 0.00 | 172 |
| Which of these animals do you think is least endangered? | 74.57 | 25.43 | 0.00 | 173 |
| Please out of these animals in order from least to most endangered by numbering them from 1-6. | 11.63 | 88.37 | 0.00 | 172 |

[16] Participant answered that conservation of sharks was either very urgent or urgent.

[17] Participant answered that conservation of sharks was either moderately urgent or not at all urgent.

| | | | | |
|---|---|---|---|---|
| If you haven't encountered a shark before, what do you feel your reaction would be if you did? | 3.65 | 86.13 | 10.22[18] | 137 |

The series of nine questions that represented a respondent's behavior towards shark conservation and used to create the behavior index are summarized in Table 6. Figure 1 shows respondents support for marine protected areas and whether they would still support them if certain activities were prohibited in those areas. Figure 2 shows both respondents support and willingness to donate money towards shark conservation.

Table 6. Responses to the questions regarding a respondent's behavior towards shark conservation, with the percentage of respondents.

| **Question** | **Yes** | **No** | **Don't Know** | **N** |
|---|---|---|---|---|
| Do you support the formation of more marine protected areas? | 83.15 | 2.72 | 14.13 | 184 |
| If you answered yes to the last question, would you still support marine protected areas if any of the following activities were prohibited in them? Commercial fishing | 79.61 | 20.39 | 0.00 | 152 |
| Recreational Fishing/ Angling | 78.95 | 21.05 | 0.00 | 152 |
| Boating | 72.85 | 27.15 | 0.00 | 151 |
| Swimming/Snorkeling | 68.87 | 31.13 | 0.00 | 151 |
| Scuba Diving | 66.01 | 33.99 | 0.00 | 153 |
| Would you support legislation that would protect sharks? | 66.67 | 6.56 | 26.78 | 183 |
| Would you be willing to donate money to support shark conservation? | 19.13 | 35.52 | 45.36 | 183 |
| Would you be more inclined to donate if the funds were only used for sharks that have not been known to harm humans? | 19.02 | 52.72 | 28.26 | 184 |

[18] Participants answered both positively and negatively to an encounter with sharks. They would fear an encounter but also show interest.

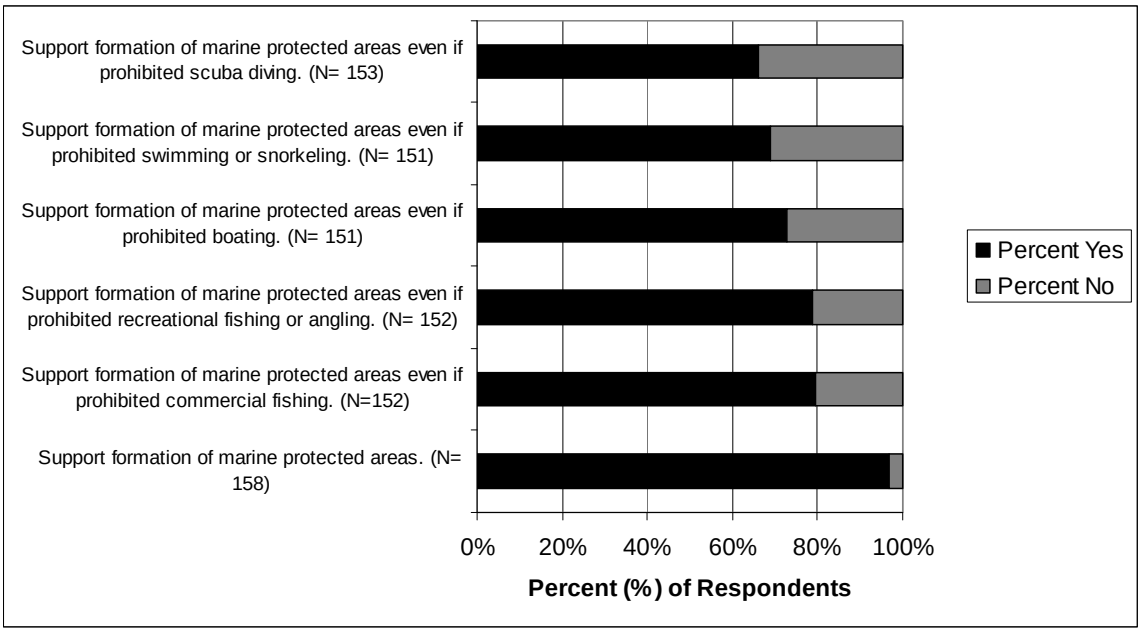


Figure 1. Respondents support for marine protected areas, and whether they would still support them under certain activity restrictions.

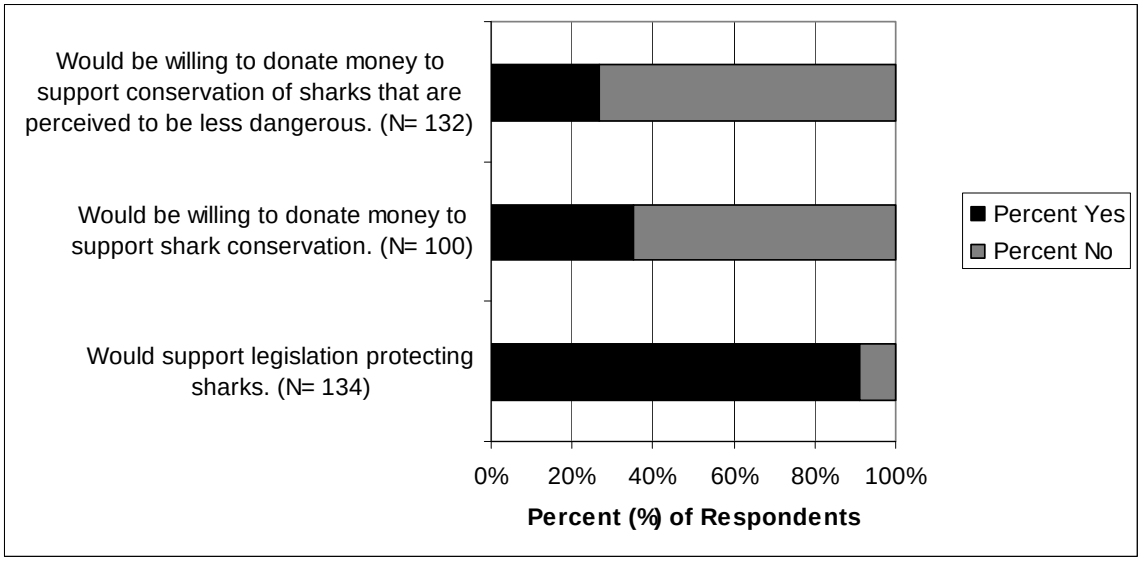


Figure 2. Respondents support and willingness to donate money towards shark conservation.

*Knowledge*

Using the Knowledge index (Chronbach's alpha= 0.573) several hypotheses were tested to see which variables may be affecting a person's knowledge about sharks and their conservation. Figure 3 displays the range and frequency of knowledge levels achieved by respondent's, indicating how much or how little they knew about sharks (higher scores= more knowledge). The index had a mean score of 8.86. An alpha level of 0.05 was used for all analyses.

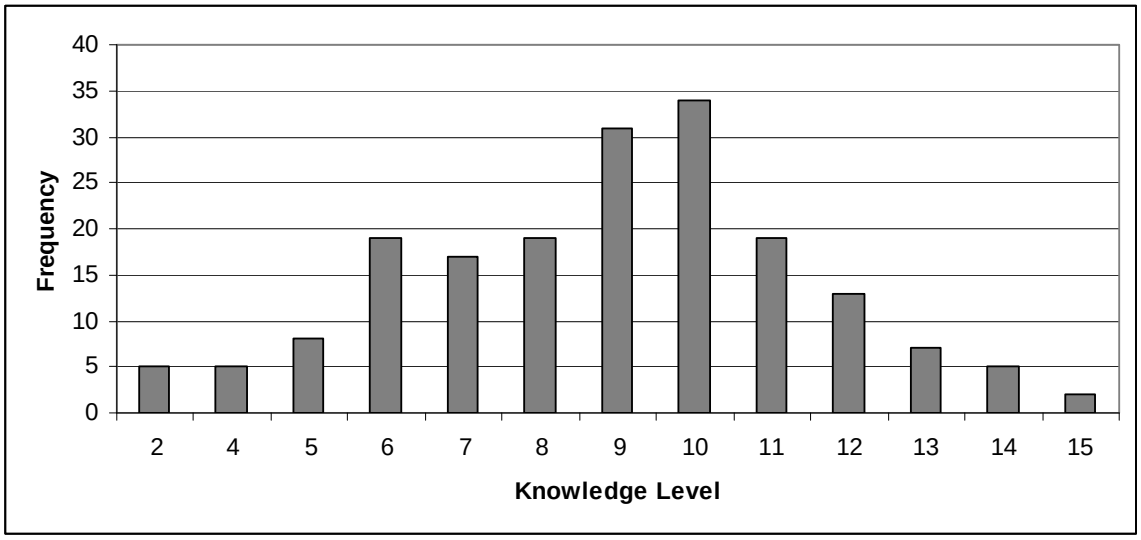


Figure 3. Range of respondents knowledge levels, indicating how much or little they know about sharks. Higher scores indicate more knowledge. (N= 184)

Hypothesis 1 predicted that the knowledge someone has about sharks will be significantly different between genders. To test this hypothesis a standard multiple regression analysis was performed between the dependent variable knowledge and the

independent variable gender. The regression analysis revealed that gender significantly predicted knowledge about sharks ($F(1, 180)= 15.09$, $p<0.001$), with males displaying a higher level of knowledge. The $R^2$ for the model was 0.08. Appendix II shows the unstandardized regression coefficients (B), intercept, and standardized regression coefficient (β) for the variable. The individual relationship between the independent variable gender and knowledge also showed that gender ($t= 3.88$, $p<0.001$) significantly predicted knowledge, i.e., males will likely be more knowledgeable about sharks.

Hypothesis 2 predicted that the knowledge someone has about sharks will be significantly different between different ages. To test this hypothesis a standard multiple regression analysis was performed between the dependent variable – knowledge - and the independent variable - age. The regression analysis revealed that age did not significantly predict knowledge about sharks ($F(1, 167)= 1.30$, $p=0.26$). Appendix II shows the unstandardized regression coefficients (B), intercept, and standardized regression coefficient (β) for the variable. The individual relationship between the independent variable age and knowledge also showed that age ($t= -1.14$, $p= 0.26$) did not significantly predict knowledge.

Hypothesis 3 predicted that the knowledge someone has about sharks will be significantly different between different levels of education (high school degree, college degree, masters degree, PhD). It was shown that education level did not significantly predict knowledge ($F(3, 171)= 0.39$, $p= 0.76$), using a standard multiple regression analysis with knowledge as the dependent variable and the level of education a person has received as the independent variable. Appendix II shows the unstandardized

regression coefficients (B), intercept, and standardized regression coefficient (β) for the variable. The individual relationships between the dependent variable knowledge about sharks and the level of education a person has received also showed that none significantly predicted a person's knowledge regarding sharks (high school, dropped; college degree, $t= 0.17$, $p= 0.864$; masters degree, $t= 0.74$, $p= 0.46$; PhD, $t= 0.83$, $p= 0.407$).

Hypothesis 4 predicted that the knowledge a person has regarding sharks will be significantly different depending on where that person receives their information. A one-way ANOVA indicated that there was a significant difference in the knowledge level a participant had across the different types of information mediums ($F(5, 163)= 3.62$, $p= 0.004$, $\eta^2= 0.10$). A higher level of knowledge was reported in participants who received their information from TV documentaries ($M= 9.65$, $SD= 2.56$), followed by magazines ($M= 8.78$, $SD= 1.79$), science journals ($M= 8.6$, $SD= 1.14$), newspapers ($M= 8.36$, $SD= 2.01$), television news ($M= 7.85$, $SD= 2.49$), and movies or other people[19] ($M= 7.5$, $SD= 3.54$). To further assess the differences between knowledge levels of the six information mediums regarding sharks a Scheffe post-hoc comparison ($p= 0.05$) was performed. The results of this test indicated that the level of knowledge regarding sharks was only significantly different between those who received their information from documentaries ($M=9.65$) and movies or other people ($M= 7.5$). Figure 4 shows the percentages of where

[19] Movies and other people were not separate answers on the survey. Together they were a single answer because it was assumed that both were similar in the type of information they provided.

respondents received their information regarding sharks for each knowledge level that was obtained by respondents, thus displaying the 'educational' effect of different media.

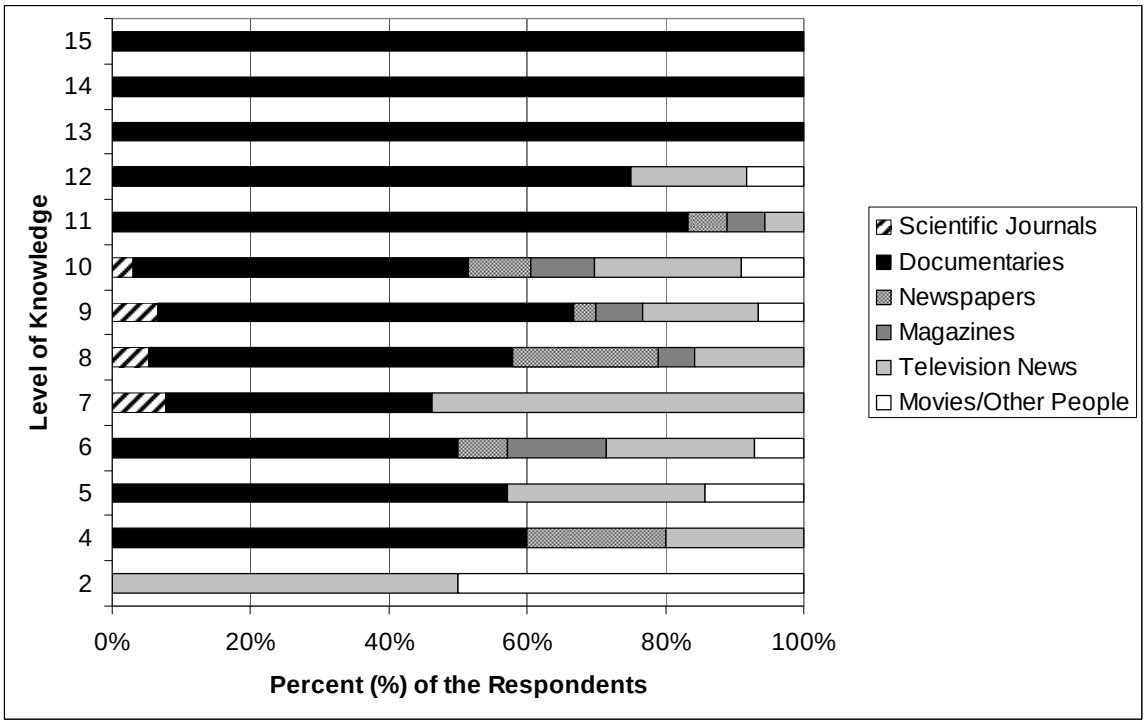


Figure 4. Shows the percentages of where respondents received their information about sharks for each knowledge level that was obtained. Knowledge levels were based on the number of correct answers to the knowledge questions in the survey that a respondent had (N= 169)

Hypothesis 5 predicts that the knowledge level a person has regarding sharks will be significantly different between individuals who have and have not seen the program "Shark Week" on the Discovery channel. A one-way ANOVA indicated that there was a significant difference in the level of knowledge a person had regarding sharks depending on whether they had seen "Shark Week" or not ($F(1, 174)= 17.13$, $p< 0.001$, , $\eta^2= 0.09$), thus supporting the hypothesis. Figure 5 displays the effects of watching "Shark Week" on respondent's knowledge level about sharks. It shows the knowledge levels about

sharks obtained by the respondents and the percentage of respondents at each level that had or had not seen “Shark Week”.

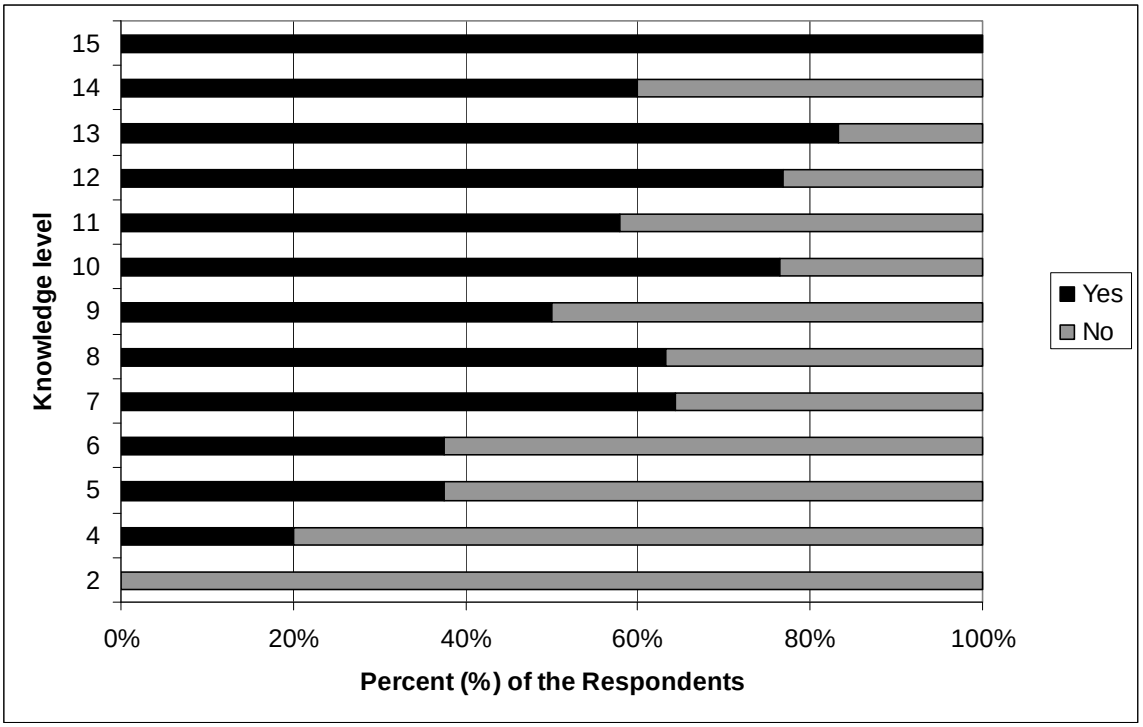


Figure 5. Knowledge levels obtained by the respondents and the percentage of those respondents who “Yes” had seen “Shark Week” before or “No” for those who had never seen “Shark Week”. (N= 176)

Hypothesis 6 predicted that the knowledge someone has about sharks will be significantly different between a person who is a part of an environmental group and someone who is not. To test this hypothesis a standard multiple regression analysis was performed between the dependent variable knowledge and the independent variable environmental group. The regression analysis revealed that environmental group membership did not significantly predict knowledge about sharks ($F(1, 176)= 1.96$, $p=0.16$). Appendix II shows the unstandardized regression coefficients (B), intercept, and

standardized regression coefficient (β) for the variable. The individual relationship between the independent variable environmental group and knowledge was also not significant (t= 1.40, p= 0.16), reaffirming that environmental group membership does not linked to greater knowledge about sharks.

Hypothesis 7 predicted that the knowledge someone has about sharks will be significantly different depending on whether a person would fear a possible encounter with a shark (would show fear, fear and interest, or interest in the shark). This was shown to be significant ($F(2, 181)= 3.37$, $p= 0.04$), at the $\alpha=0.05$ level, using a standard multiple regression analysis with knowledge as the dependent variable and the fear from an encounter as the independent variable, with respondents who showed interest in an encounter having higher levels of knowledge than those who would fear it. The $R^2$ for the model was 0.04. Appendix II shows the unstandardized regression coefficients (B), intercept, and standardized regression coefficient (β) for the variable. Figure 6 shows the effect of fear on knowledge levels about sharks in respondents by displaying different knowledge levels among respondents and the percentage of respondents at each level that would either be fearful, fearful and interested, or interested if they encountered a shark. The individual relationships between the dependent variable knowledge about sharks and a person's fear of an encounter (Fear (t= -1.38, p= 0.17), fear and interest (dropped), Interest (t= 1.24, p= 0.22)) showed that none significantly predicted a person's knowledge regarding sharks.

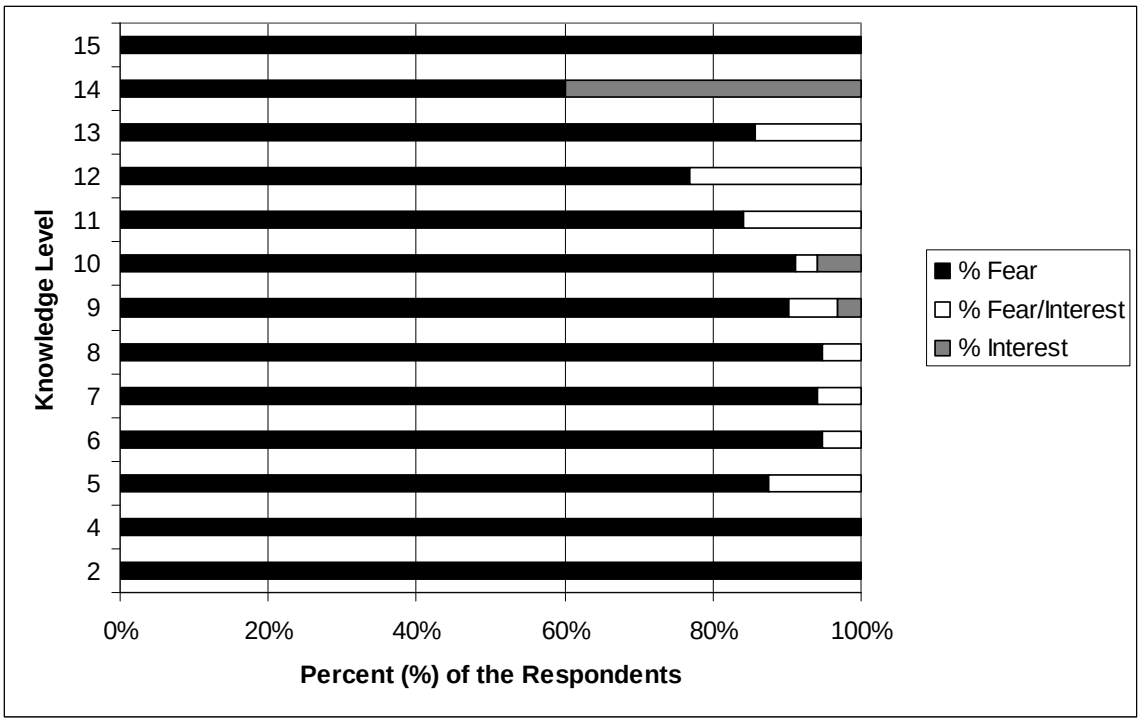


Figure 6. Knowledge levels obtained by the respondents and the percentage of those respondents for each level who would fear, show fear and be interested, or just be interested by an encounter with a shark. (N= 184)

Hypothesis 8 predicts that the knowledge level a person has regarding sharks will be significantly different between individuals who have been snorkeling or scuba diving than those who have not been snorkeling or scuba diving. A one-way ANOVA indicated that there was not a significant difference in the level of shark knowledge and whether or not they had been snorkeling or scuba diving ($F(1, 177)= 2.89$, $p= 0.09$, , $\eta^2= 0.02$), indicating the hypothesis was not supported.

Hypothesis 9 predicts that the knowledge level a person has regarding sharks will be significantly different between individuals who have been snorkeling or scuba diving *with sharks* than those who have not. A one-way ANOVA indicated that there was not a

significant difference in the level of knowledge a person had regarding sharks based on whether or not they had been snorkeling or scuba diving with sharks ($F(1, 177)= 0.47$, $p= 0.50$, $\eta^2= 0.00$), indicating the hypothesis was not supported.

Hypothesis 10 predicts that the knowledge someone has about sharks will be significantly different depending on several variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, and whether or not they are apart of an environmental group). To test this hypothesis a standard multiple regression analysis was performed between the dependent variable knowledge and the independent variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, and whether or not they are apart of an environmental group). This shows if the level of the dependent variable can be significantly predicted using these independent variables together, as well as, how much of the variation in the dependent variable is explained by these variables. It also displays which of the independent variables alone can significantly predict knowledge when each of the other variables is controlled[20] for. The regression analysis revealed that the model significantly predicted knowledge level about sharks ($F(8, 147)= 4.96$, $p<0.001$). The $R^2$ for the model was 0.21. Appendix II shows the unstandardized regression coefficients (B), intercept, and standardized regression coefficient ($\beta$) for the variables. With regards to the individual relationships between the independent variables and knowledge level about sharks, gender ($t= 2.36$, $p=0.02$), whether a person had

[20] Hold the other variables values constant so the relationship between a single independent variable and the dependent variable can be analyzed.

viewed “Shark Week” (t= 2.41, p=0.02), where a person received there information about sharks (t= 2.74, p=0.01), and whether a person was a member of an environmental group (t= 2.56, p= 0.01), each significantly predicted shark knowledge level at the α= 0.05 level.

*Attitude and Behavior*

As with the knowledge level of respondents above, it was hypothesized that the attitudes and behavior of respondents to sharks would be affected by a number of variables. To test this, the potential dependent variables of attitude and behavior were compared against a number of independent variables (see table 8 and table 9) via standard multiple regression and one-way ANOVA tests. Standard multiple regressions were used to determine if the level of attitude or behavior could be significantly predicted using the independent variable, and display how much of the variation in the dependent variable can be explained by the categories or level of the independent variable. The one-way ANOVA tests determined if there was a significant difference in the level of the dependent variable based on the independent variable. It also showed how much of the variation in the dependent variable could be explained by the categories of the independent variable.

The Attitude index (Cronbach’s Alpha= 0.238) was used to test several different hypotheses to determine which of the variables could be affecting a participant’s attitude level towards sharks and their conservation. Figure 7 displays the range and frequency of

the attitude levels towards sharks, with higher scores indicating a positive attitude regarding sharks. A positive attitude indicates that a respondent believes that sharks are in danger of over-exploitation, are in need of more urgent conservation measures, and that theses measures are important for the survival of sharks. The mean score for the index was 3.04. An alpha level of 0.05 was used for all analyses.

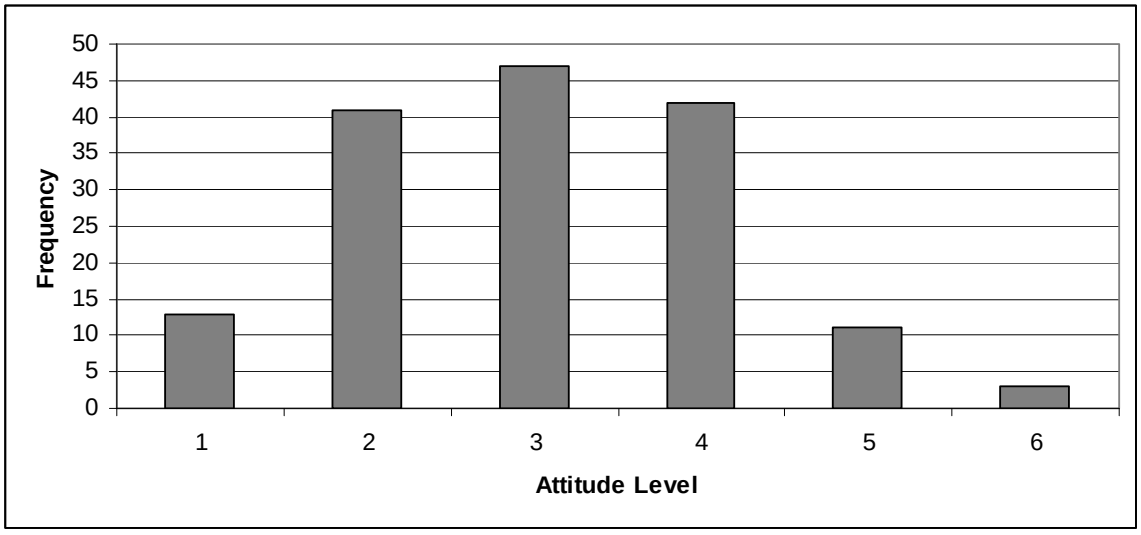


Figure 7. Range of respondents Attitude levels, indicating how pro- or anti-shark they are. Higher scores indicate a more pro-shark attitude (N= 157).

The Behavior index (Chronbach's Alpha = 0.814) which judges whether a person displays positive or negative behavior towards sharks was also used to test several hypotheses in order to determine which of the variables may influence whether or not a person displays behavior that supports sharks and their conservation. Figure 8 displays the range and frequency of the behavior levels towards sharks and their conservation,

with higher scores indicating more positive behavior. As behavior levels rise so does a respondents support for varying types of legislation that would protect sharks. It can also indicate a higher likelihood of a respondent's willingness to donate money in the support of new legislation. The mean score for the index was 4.84.An alpha level of 0.05 was used for all analyses.

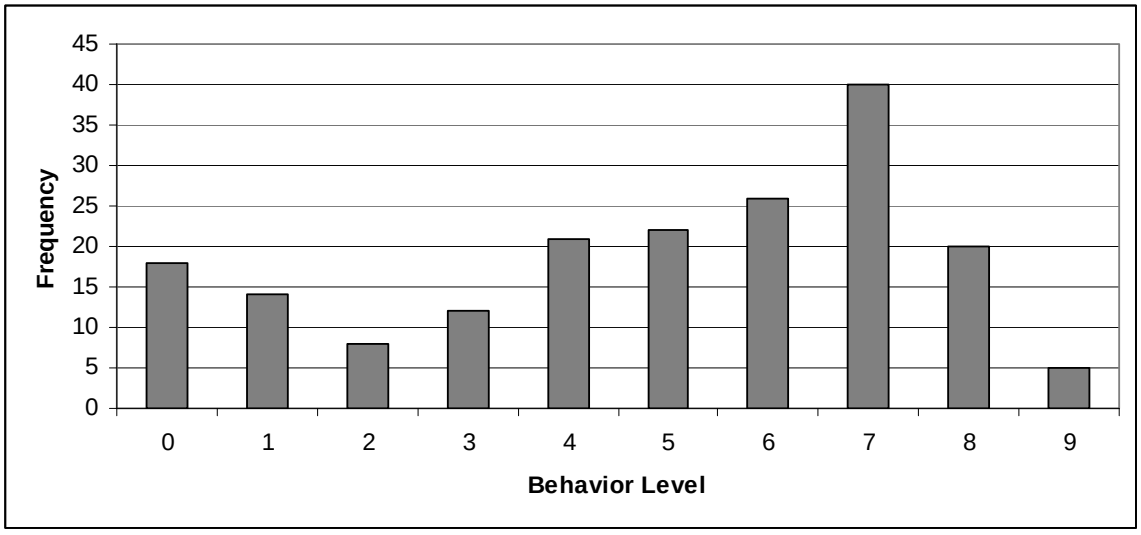


Figure 8. Range of respondents Behavior levels, indicating how pro- or anti-shark they would behave. Higher scores indicate pro-shark behavior. (N= 186)

Several variables were tested against each of the dependent variables (attitude and behavior) to determine what effect they may be causing. A respondent's gender and age, as well as, their education level were each tested using standard multiple regressions. Education level of a respondent was broken into four categories (high school diploma, college degree, masters degree, and PhD), so when using the standard multiple

regressions to analyze it, the high school category was dropped and t and p values were provided for the other three. This displayed how each of the other categories were affecting both attitude and behavior differently than just having a high school degree, as well as, how they affected them individually. It was also tested using the regression analysis to see if respondents who were members of an environmental group had different attitudes and behaviors about sharks than those who were not. By testing how the possible encounter with a shark affected attitude in behavior it was also shown how both fear and interest in such an encounter would directly affect the two dependent variables. A respondent's knowledge of sharks was also run against their attitude and behavior. This would show if having less or more knowledge about sharks would lead to more positive attitudes or behavior towards sharks and their conservation. A respondent's attitude towards sharks was then tested against their behavior to see what positive or negative affects it may be having.

Where a respondent receives information regarding sharks was tested against the dependent variables (attitude and behavior) using the one-way ANOVA test. This would show if different information mediums were causing changes in attitude or behavior. The same test was also used for whether a respondent had viewed programming on the Discovery channels "Shark Week", or if they had ever been snorkeling or scuba diving with or without sharks.

Finally, using a standard multiple regression several of the previous independent variables were tested against attitude and behavior simultaneously. This again shows if the level of the dependent variable can be significantly predicted using these independent

variables together, as well as, how much of the variation in the dependent variable is explained by these variables. It also displays which of the independent variables alone can significantly predict attitude or behavior when each of the other variables is controlled for.

Tables 8 and 9 display each of the discussed independent variables and how they were tested against the two dependent variables (attitude and behavior). Table 7 represents all standard multiple regression analyses, while table 8 shows the results of the one-way ANOVA tests for both dependent variables. In Appendix II can be found the unstandardized regression coefficients (B), intercept, and standardized regression coefficient (β) for each of the variables that underwent a standard multiple regression. Appendix II also displays the original null hypotheses for each of the independent variables affects on the dependent variables, along with the results for each test.

Table 7. Results for the standard multiple regression analyses run against the dependent variables attitude and behavior towards sharks. Results displayed in bold indicate that they were significant.

| Independent Variable | Attitude | Attitude b (SE) | Behavior | Behavior b (SE) |
|---|---|---|---|---|
| Attitude | | | **$F(1, 155)= 8.61$, $p=0.004$, $R^2= 0.053$** | **$b= 0.512$, $SE= 0.175$** |
| Knowledge | **$F(1, 154)= 14.31$, $p<0.001$, $R^2= 0.09$** | **$b= 0.135$, $SE= 0.036$** | **$F(1, 182)= 9.81$, $p=0.002$, $R^2= 0.051$** | **$b= 0.219$, $SE= 0.07$** |
| Gender | $F(1, 153)= 0.58$, $p=0.448$, $R^2= 0.004$ | $b= -0.142$, $SE= 0.187$ | $F(1,181)= 1.58$, $p=0.21$, $R^2= 0.009$ | $b= -0.483$, $SE= 0.384$ |
| Age | $F(1, 141)= 0.05$, $p=0.816$, $R^2= 0$ | $b= -0.002$, $SE= 0.007$ | $F(1, 167)= 0.00$, $p=0.988$, $R^2= 0$ | $b= -0.000$, $SE= 0.014$ |

| | | | | |
|---|---|---|---|---|
| Education Level | F(3, 144)= 1.50, p=0.216, $R^2$= 0.03 | | **F(3, 171)= 2.94, p=0.035, $R^2$= 0.049** | |
| College Degree | t= -1.63, p= 0.106 | b= -0.392, SE= 0.241 | **t= -2.13, p= 0.034** | **b= -1.028, SE= 0.482** |
| Masters Degree | t= -1.12, p= 0.265 | b= -0.308, SE= 0.275 | t= -0.71, p=0.478 | b= -0.413, SE= 0.58 |
| PhD | t= -1.88, p=0.062 | b= -0.808, SE= 0.429 | t= 1.07, p=0.287 | b= 0.893, SE= 0.836 |
| Member of Environmental Group | **F(1, 149)= 6.16, p=0.014, $R^2$= 0.04** | **b= 0.914, SE= 0.368** | **F(1, 176)= 4.54, p=0.035, $R^2$= 0.025** | **b= 1.70, SE= 0.798** |
| Fear Sharks | F(2, 154)= 2.70, p=0.07, $R^2$= 0.034 | | F(2, 183)= 2.46, p=0.088, $R^2$= 0.026 | |
| Would Fear an Encounter with a Shark | t= 2.32, p=0.022 | b= -1.2, SE= 0.517 | t= 1.6, p=0.111 | b= -1.15, SE= 0.719 |
| Would be Interested in Encounter with a Shark | t= 2.01, p=0.046 | b= -1.2, SE= 0.597 | t= 0.55, p=0.582 | b= 0.743, SE= 1.347 |
| Multivariate regression using all previous variable | **F(9, 126)= 3.22, p=0.002, $R^2$= 0.187** | | **F(10, 125)= 2.89, p=0.003, $R^2$= 0.188** | |
| Attitude | N/A | | t= 1.82, p=0.071 | b= 0.354, SE= 0.194 |
| Knowledge | **t= 3.4, p=0.001** | **b= 0.144, SE= 0.042** | t= 1.17, p=0.243 | b= 0.113, SE= 0.097 |
| Gender | t= -1.45, p=0.15 | b= -0.304, SE= 0.209 | **t= -2.48, p=0.015** | **b= -1.142, SE= 0.461** |
| Age | t= -0.22, p=0.826 | b= -0.002, SE= 0.009 | t= 0.65, p=0.514 | b= 0.012, SE= 0.019 |
| College Degree | t= -1.45, p=0.149 | b= -0.38, SE= 0.262 | **t= -1.98, p=0.049** | **b= -1.142, SE= 0.461** |
| Masters Degree | t= -0.76, p=0.45 | b= -0.233, SE= 0.307 | t= -0.56, p=0.575 | b= -0.378, SE= 0.672 |
| PhD | **t= -2.1, p=0.037** | **b= -0.939, SE= 0.446** | t= 1.14, p=0.258 | b= 1.125, SE= 0.991 |
| Viewed Shark Week | t= 0.36, p=0.723 | b= 0.078, SE= 0.22 | t= 0.44, p=0.661 | b= 0.211, SE= 0.480 |
| Where Receive Shark Information | t= 0.56, p=0.578 | b= 0.039, SE= 0.07 | t= 0.87, p=0.388 | b= 0.133, SE= 0.153 |
| Member of Environmental Group | t= 1.93, p=0.056 | b= 0.817, SE= 0.424 | t= 0.88, p=0.383 | b= 0.822, SE= 0.937 |

Table 8. Results for the one-way ANOVA analyses run against the dependent variables attitude and behavior towards sharks. Results displayed in bold indicate that they were significant.

| Independent Variable | Attitude | Behavior |
|---|---|---|
| Where Receive Shark Information | $F(5, 142)= 0.92$, $p=0.47$, $\eta^2= 0.031$ | $F(5, 163)= 1.26$, $p=0.282$, $\eta^2= 0.037$ |
| Viewed Shark Week | $F(1, 147)= 1.28$, $p=0.26$, $\eta^2= 0.009$ | $F(1, 174)= 2.27$, $p=0.134$, $\eta^2= 0.013$ |
| Been Snorkeling or Scuba Diving | $F(1, 150)= 0.00$, $p=0.984$, $\eta^2= 0$ | $F(1, 177)= 0.06$, $p=0.809$, $\eta^2= 0$ |
| Been Snorkeling or Scuba Diving with Sharks | $F(1, 150)= 0.03$,$p=0.86$, $\eta^2= 0$ | $F(1, 177)= 0.07$, $p=0.79$, $\eta^2= 0$ |

Highlighted below are the independent variables which were found to have a significant effect on the dependent variables of attitude and behavior. They are discussed based on the subsequent hypotheses which they relate to in Appendix II.

Hypothesis 11 predicted that the attitude someone held towards sharks would be significantly different depending on the level of knowledge they had about sharks. The standard multiple regression analysis revealed that the level of knowledge a person had about sharks did significantly effect their attitude towards sharks ($F(1, 154)= 14.31$, $p<0.001$), specifically that someone with a higher knowledge level about sharks displayed a more positive attitude towards them. The $R^2$ for the model was 0.09. The individual relationship between the independent variable knowledge level about sharks and a person's attitude towards sharks also showed that knowledge ($t= 3.78$, $p<0.001$) significantly predicted -a positive- attitude.

Hypothesis 17 predicted that the attitude an individual has towards sharks will be significantly different between a person who is apart of an environmental group and someone who is not. The standard multiple regression analysis revealed that environmental group membership did significantly predict a person's attitude towards sharks $F(1, 149)= 6.16$, $p=0.01$. Members of environmental groups displayed a more positive attitude towards sharks. The $R^2$ for the model was 0.04. The individual relationship between the independent variable environmental group and attitude also showed that whether or not a person was a member of an environmental group ($t= 2.48$, $p= 0.01$) did significantly predict a person's attitude.

Hypothesis 21 predicts that the attitude a person displays towards sharks and their conservation will be significantly different depending on several variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, whether or not they are apart of an environmental group, and knowledge about sharks). The standard multiple regression analysis used to perform this analysis between the dependent variable attitude and the independent variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, whether or not they are apart of an environmental group, and knowledge about sharks) revealed that the model significantly predicted attitudes towards sharks, $F(9, 126)= 4.96$, $p=0.002$. The $R^2$ for the model was 0.19. With regards to the individual relationships between the independent variables and attitudes towards sharks, only knowledge ($t= 3.40$, $p=0.001$) and individuals with the education level of PhD ($t= -2.10$, $p=0.04$) significantly predicted attitudes towards sharks at the $\alpha= 0.05$ level. Higher

levels of knowledge predict a more positive attitude, while having a PhD was shown to result in more negative attitudes.

Hypothesis 22 predicted that the behavior someone displays towards sharks and their conservation would be significantly different depending on whether they exhibited a more positive attitude regarding sharks. The standard multiple regression analysis revealed that the attitude level a person had towards sharks did significantly effect their behavior regarding sharks and their conservation ($F(1, 155)= 8.61$, $p= 0.003$). A person who displayed a more positive attitude was more likely to support sharks and their conservation. The $R^2$ for the model was 0.05. The individual relationship between the independent variable attitude level and a person's behavior towards sharks and their conservation also showed that attitude ($t= 2.93$, $p= 0.004$) significantly predicted behavior.

Hypothesis 23 predicted that the behavior someone exhibited towards sharks and their conservation would be significantly different depending on the level of knowledge they had about sharks. The standard multiple regression analysis revealed that the level of knowledge a person had about sharks did significantly effect the manner in which they behaved toward them ($F(1, 182)= 9.81$, $p= 0.002$). Someone with a higher knowledge level exhibited a higher likelihood to support sharks and their conservation. The $R^2$ for the model was 0.05. The individual relationship between the independent variable knowledge level about sharks and a person's behavior towards them also showed that knowledge ($t= 2.93$, $p= 0.002$) significantly predicted behavior.

In Hypothesis 26 it was predicted that someone's behavior towards sharks and their conservation will be significantly different between differing levels of education (high school diploma, college degree, masters degree, PhD). It was shown that education level did significantly predict behavior ($F(3, 171)= 2.94$, $p= 0.04$; the $R^2$ for the model was 0.05), using a standard multiple regression analysis with behavior as the dependent variable and the level of education a person has received as the independent variable. The individual relationships between the dependent variable behavior towards sharks and the level of education (high school diploma, dropped, college degree ($t= -2.44$, $p= 0.02$), masters degree ($t= -1.53$, $p= 0.13$); PhD ($t= 1.07$, $p= 0.287$) a person has received showed that only if a person had a college degree would it significantly predicted a person's behavior regarding sharks, with those individuals having more negative behavior compared to individuals with a high school diploma.

Hypothesis 29 predicted that a person's behavior towards sharks and their conservation will be significantly different between a person who is apart of an environmental group and someone who is not. The standard multiple regression analysis revealed that whether or not a person was apart of an environmental group did significantly predict a person's behavior towards sharks ($F(1, 176)= 4.54$, $p=0.04$; the $R^2$ for the model was 0.03), with members displaying positive behavior supporting sharks. The individual relationship between the independent variable environmental group and behavior also showed that environmental group membership did significantly predict their behavior towards sharks and their conservation ($t= 2.13$, $p= 0.03$).

The last significant result in this section is Hypothesis 33, which predicts that the behavior a person exhibits towards sharks and their conservation will be significantly different depending on several variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, whether or not they are apart of an environmental group, knowledge about sharks, and their attitude towards sharks). The standard multiple regression analysis revealed that the model significantly predicted behavior towards sharks ($F(10, 125)= 2.89$, $p=0.003$; the $R^2$ for the model was 0.19). With regards to the individual relationships between the independent variables and a person's behavior towards sharks, only gender ($t= 2.48$, $p=0.02$) and individuals with a college level of education ($t= -1.98$, $p=0.049$) significantly predicted behavior towards sharks at the $\alpha= 0.05$ level. Both male respondents and those with college degrees displayed more negative behavior towards sharks and their conservation (individuals with college degrees displayed more negative behavior compared to those who only had a high school diploma).

*Shark Attacks*

In Hypothesis 34 it was predicted that where a person receives their information regarding sharks will determine whether they think sharks attacks have increased, decreased, or stayed the same. A chi-square test indicated that the relationship between where someone receives their information about sharks and if they think shark attacks are

increasing, decreasing, or staying the same was found to be not significant (at the $\alpha = 0.05$ level, $\chi^2(10, N = 169) = 12.27$, $p = 0.27$, $V = 0.19$).

*Willingness to Donate Money*

It was hypothesized that (hypothesis 35) the willingness of a person to donate money to shark conservation will be significantly different between individuals who view animal programming (i.e. Discovery Channel), than those who do not. A chi-square test indicated that the relationship between a person willingness to donate money to shark conservation and whether or not they view animal programming was significant (at the $\alpha = 0.05$ level, $\chi^2(1, N = 181) = 4.77$, $p = 0.03$, $V = 0.16$).

*Shark Week and Conservation*

Another hypothesis (hypothesis 36) was that urgency at which a person perceives the need for shark conservation will be significantly different depending on whether they had viewed programs on "Shark Week" on the Discovery channel. A one-way ANOVA indicated that there was a significant difference in how urgent someone though shark conservation was based on whether or not they had viewed "Shark Week" programming ($F(1, 147) = 4.01$, $p = 0.05$, $\eta^2 = 0.03$), indicating the hypothesis was supported at the $\alpha = 0.05$ level.

*Threats to Sharks*

In Hypothesis 37 it was predicted that public perception as to the greatest threats towards sharks does not match what is actually threatening them the most. Table 5 shows that only 24.85% of respondents could identify commercial fishing as the greatest threat to sharks. In Figure 9 it can be seen that majority of respondents felt that habitat degradation (31.36%) was the main threat facing sharks. Only 8.87% identified shark finning as the greatest threat.

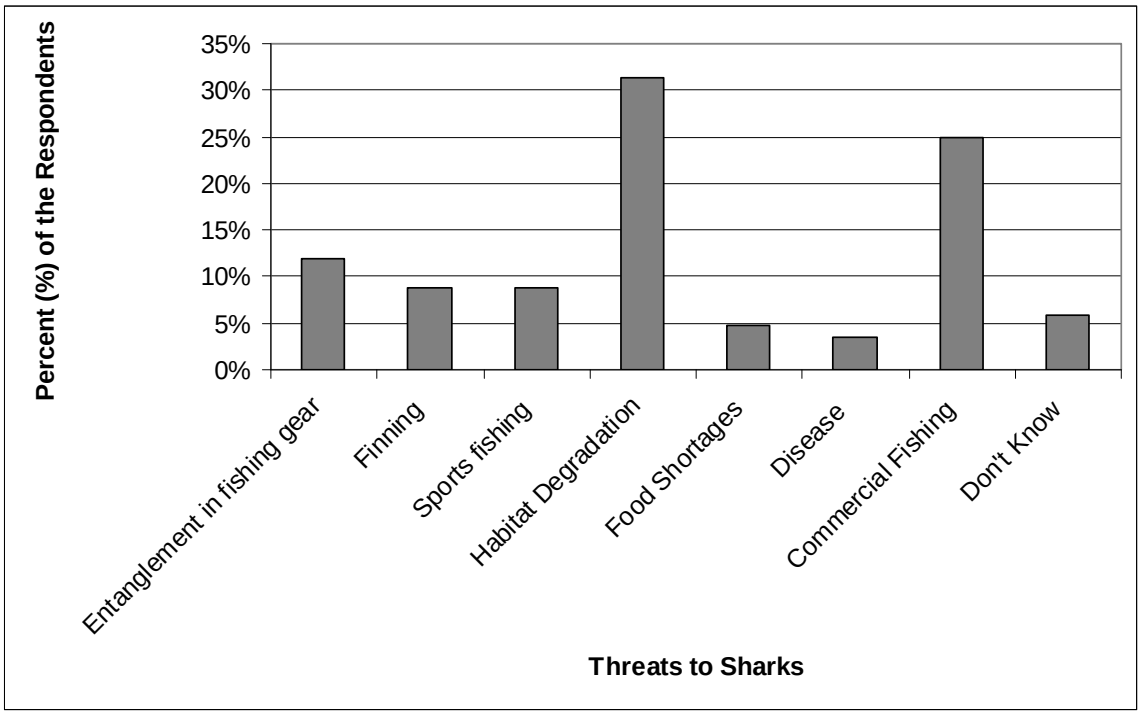


Figure 9. Shows possible threats towards sharks and the percentage of respondents for each answer who thought it was the biggest threat facing sharks. (N= 169)

*Shark Conservation*

It was predicted that the majority of the public does not feel that shark conservation is very urgent at this time. Figure 10 displays that the majority of respondents (60.51%) felt that shark conservation was only moderately urgent. While only 6.37% of respondents felt that shark conservation was very urgent.

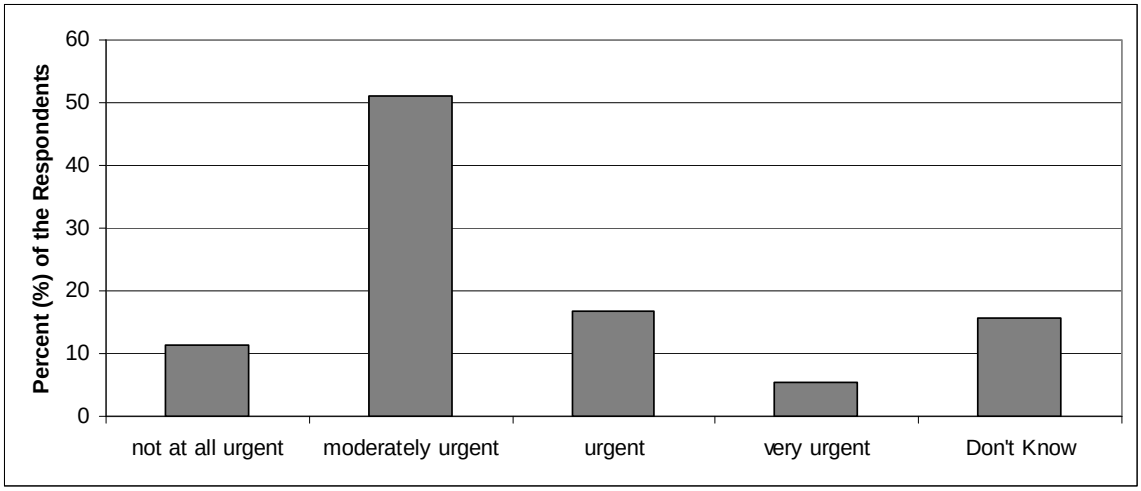


Figure10. Displays how urgent respondents felt shark conservation was at the time. (N= 186)

*Shark Information*

It was predicted that the majority of people receive their information regarding sharks from non-scientific sources. Of the options that were provided to respondents, scientific journals was the answer that would have provided the most accurate information regarding sharks but only 2.96% of respondents used these. The majority of respondents (59.76%) claimed to receive their shark information from documentaries. Figure 11 displays the different possibilities of where people could be receiving information about sharks and where respondents were receiving their information.

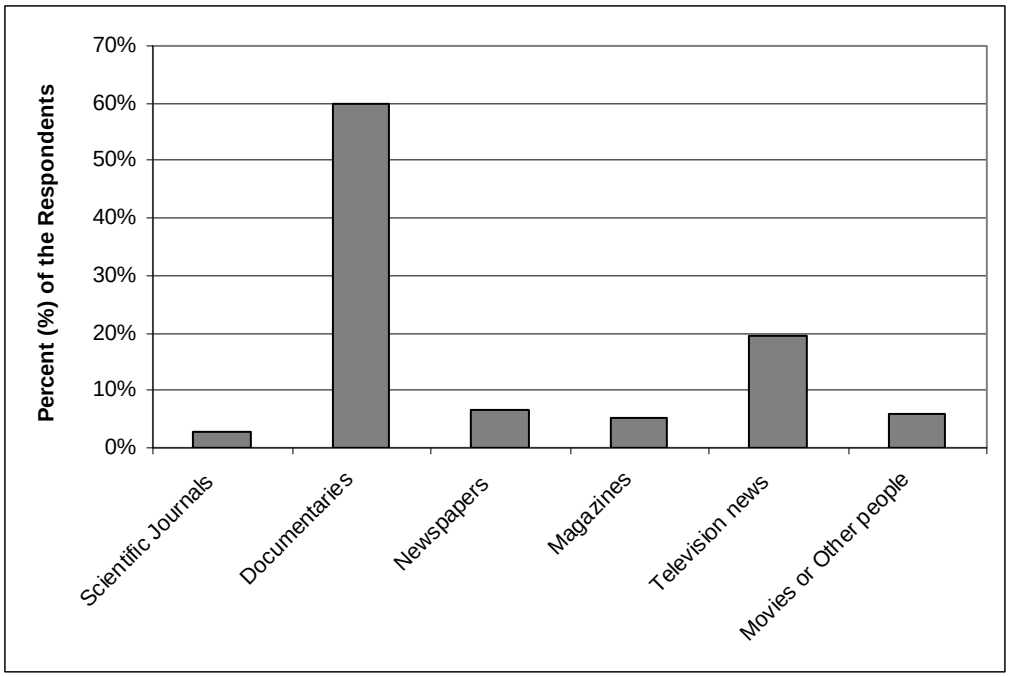

Figure 11.Shows where respondents received their information regarding sharks. (N= 169)

*Shark Populations*

It was predicted that if a person believes that shark populations are declining they will generally think that they are declining at a rate below 70%. Figure 12 represents all the respondents who felt that shark population were declining. It shows by what percent those respondents felt that shark populations could be declining. Only 5.26% of the respondents felt that shark populations were declining by 70% or more.

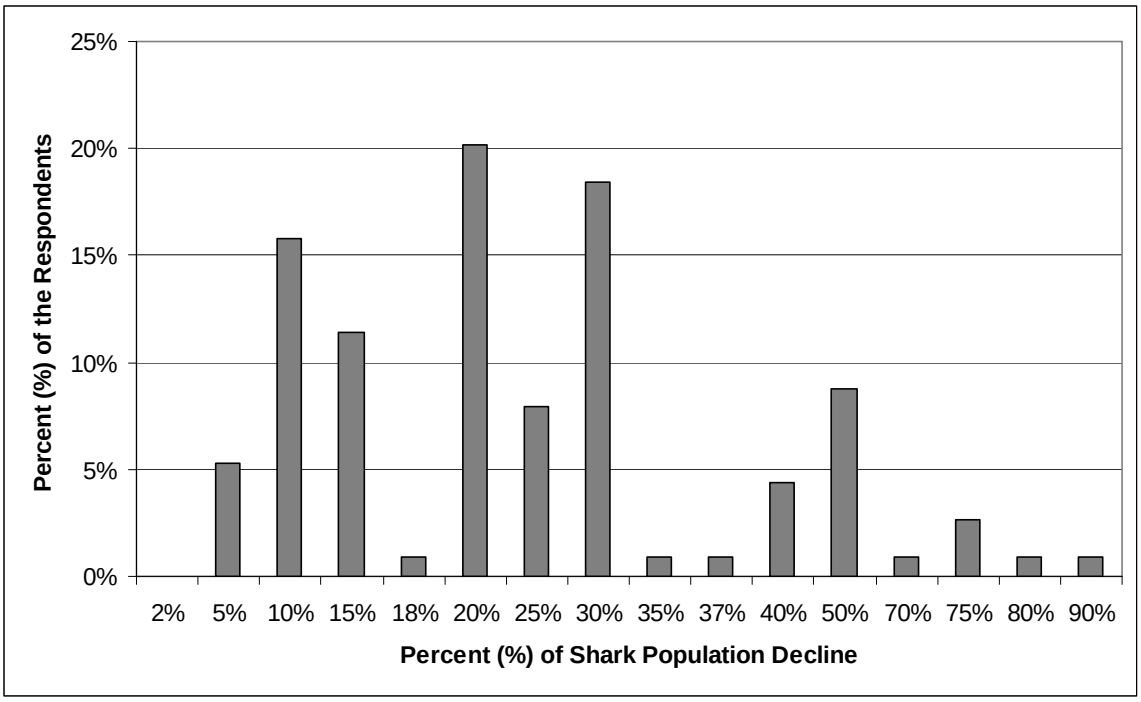


Figure12. Displays respondent who thought shark populations were declining, and by what percentage that thought they were declining by. (N= 114)

*Shark Existence*

It was predicted that the majority of people do not realize how long sharks have inhabited the earth (~400 million years). Figure 13 shows that the majority of respondents (45.68%) thought that sharks had existed for thousands of years.

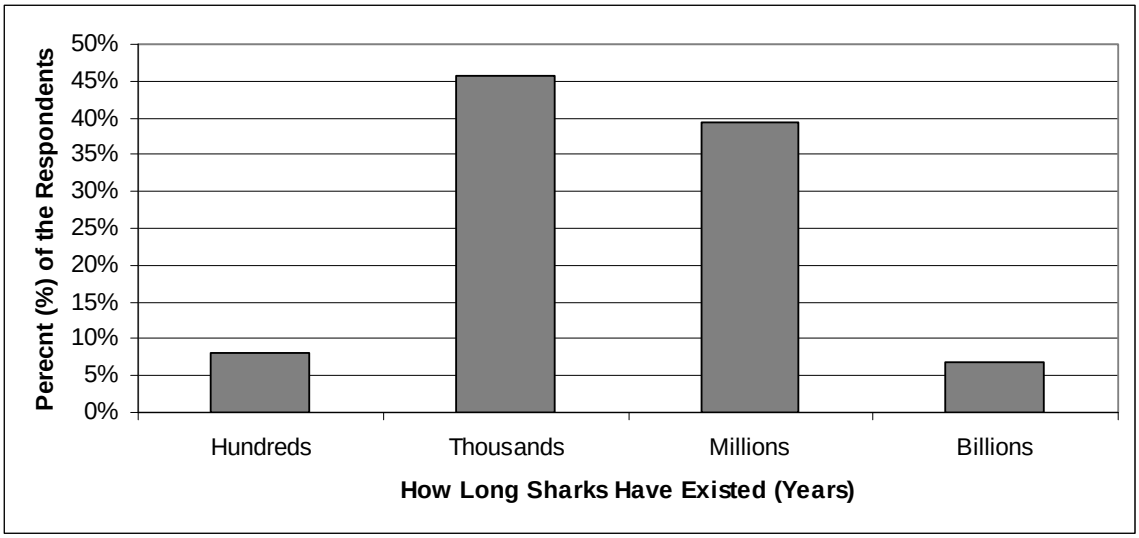

Figure13. Shows how long respondents thought sharks have existed on this planet. (N= 162)

# CHAPTER 7: DISCUSSION

## *Knowledge*

Thompson and Mintzes (2002) found that there was a positive correlation between knowledge about sharks and displaying scientific and naturalistic attitudes. So from this it can be deduced that individuals who display a higher level of knowledge about a species or group of species should have a more positive attitude towards them. Dobson (2007) found that people generally have negative preconceived notions about sharks so increasing a person's knowledge about them could help to create more positive shark attitudes. These attitudes have also been shown to shape behavior in individuals (Kraus, 1995; Thompson and Mintzes, 2002; Barney, 2005). So the understanding of what variables may be affecting a person's knowledge about sharks could help conservationist in receiving support for their protection.

Previously Thompson and Mintzes (2002) found that gender played no role in the amount of knowledge a person had about sharks. However, in this study a weak relationship between gender and knowledge was shown with males displaying higher levels of knowledge than females. This variance in knowledge between males and females could be the result of the ways in which the information about sharks is portrayed. Examples of this are the programs that are presented on "Shark Week" on the Discovery channel, which in general can be more male-oriented. Of the respondents who

stated that they received their information about sharks from documentaries, 61.4% were male. It was also found that of the respondents who received their information about sharks from documentaries, 70% of them had viewed “Shark Week”. So there is a good possibility that these individuals are considering this programming a documentary. This indicates that a majority of the knowledge regarding sharks could be coming from programs that are being presented on “Shark Week”. Based on the programs and their titles that appear on “Shark Week” it was originally assumed that many of the viewers were not receiving information that would allow for their knowledge about sharks to be significantly higher than people who had not viewed these programs. However, a weak relationship was found between “Shark Week” and knowledge, with respondents who had viewed programs from “Shark Week” displaying a significantly higher level of knowledge about sharks. This not only highlights the importance of these programs to not be gender biased, but also shows that these programs need to provide accurate information about sharks and their conservation. It is possible that these programs are not just being used for entertainment but also as the basis for people’s knowledge about sharks. These programs may peak people’s interest and get them to view materials on sharks and because of this it is important that they do not contribute to negative stereotypes that may already exist about sharks.

Age was shown to have no effect on the knowledge a person had about sharks, which is contradictory to what was reported by Barney (2005), and Thompson and Mintzes (2002). Both of these studies found that as age increased so did their knowledge about a species. It is easy to understand why knowledge would grow with age because

one would think as someone gets older they learn more either through schooling or life experience. However, knowledge about sharks is very different because it can be assumed that the majority of people are not exposed to information about sharks throughout their lives. The information more likely has to be deliberately obtained by an individual. In both the Barney (2005) and Thompson and Mintzes (2002) studies the oldest respondents came from individuals either taking a college level marine biology class or marine biology graduate students. So it would make sense that they would have more knowledge than younger respondents because they have had more direct exposure to information about sharks in the Thompson and Mintzes (2002) study, and dolphins in the Barney (2005) study. Since knowledge about sharks is not age specific several different mediums in which to present important information about sharks and their conservation would have to be created, with each targeting a different age group.

A similar result was found in the effect of education on knowledge about sharks, with this study finding the two had no relationship. Thompson and Mintzes (2002) found knowledge to increase with education level but as stated before their was a bias in their data with the highest education level being those respondents with direct access through marine biology classes to information about sharks. Barney (2005) found a relationship between knowledge and education but that study stated that knowledge about dolphins increased as exposure to dolphin education increased. Both of those studies are not taking into account the lack of exposure to these subjects within the general public. Information about sharks is not a common occurrence in most education programs, whether it is elementary school, high school, or college. It is unlikely that information regarding

sharks specifically will ever be implemented into all the different education levels but it is important to understand that even though a person may have a college education does not mean they have the knowledge about sharks necessary to change opinions to help support conservation. It reaffirms what was previously stated that several types of media to educate the public need to be developed because as a whole the general public are at similar levels regarding knowledge about sharks.

It was found that the source in which a respondent received information about sharks had a weak relationship with their level of knowledge. There was a significant difference in the level of knowledge between respondents who received information from television news and those who received it from documentaries, with documentaries producing a higher knowledge level. Nearly 20% of the respondents claimed they receive all there information about sharks from television news which was only second to documentaries at 60%. Typically when information about sharks appears on television news it is usually in the context of reporting the occurrence of an attack. This provides no useful information to educate people about sharks and can actually cause a negative perception of them even though attacks are fairly uncommon. People are left with the images and ideas that sharks are killers and gain no understanding of these animals. It is important that these different types of information media understand the impact they are having on peoples knowledge about sharks and what this may be doing to the conservation status of these animals. If people lack accurate knowledge about sharks and believe they are only unintelligent man-eaters that will attack them any chance they get it makes it very difficult to convince people to protect them.

The thought of encountering a shark in the wild brings up different feelings depending on the individual. It was found that whether a respondent would fear or be interested in such an encounter significantly affected their level of knowledge about sharks. A weak relationship was shown between fearing such an encounter and displaying a lower level of knowledge about sharks. It is possible that the fear these individuals hold towards sharks could be caused by a lack of understanding about them. It is important that the people who fear sharks are not receiving information that would reinforce these fears and possibly cause more negative feelings that could lead to less support for the existence of sharks. An example of this was previously mentioned with stories of sharks on television news centering mainly on recent attacks.

Over 50% of respondents stated that they had been either snorkeling or scuba diving in the past. It could be assumed that individuals who had participated in these activities would have a higher knowledge about the aquatic environment and possibly sharks. It was found, however, that whether or not a person participated in such activities had no bearing on their knowledge about sharks. Even those respondents who had participated in snorkeling or scuba diving excursions with sharks present (10%) did not display a higher level of knowledge about sharks than those who had not. This supports the Dobson (2007) study in which it was found that participants of dive trips were provided poor educational content before, or during, the trips. It is possible that not all the respondents in this study that had stated they had been snorkeling or scuba diving with or without sharks were on an actual guided dive trip where there was the possibility to receive information about the aquatic environment or sharks. Despite this it is still

important that these types of trips provide some sort of educational content regarding the oceans and the species that inhabit them so people can have a better understanding and appreciation for them.

All previous results discussed were based on analyses done between only a single independent variable and knowledge. When several variables (gender, age, education, viewing of "Shark Week", where they receive information about sharks, and whether they are part of an environmental group) were put into a model testing each ones relationship to knowledge while controlling for the other variables some of the previous results differed. It was found that there is a moderate relationship between all the variables and the knowledge a respondent had about sharks. Gender once again showed a relationship with knowledge about sharks with males displaying a higher level. Both, where a respondent received information about sharks and whether or not they had viewed programs on "Shark Week" showed the same relationships as seen previously in the bivariate analyses. Whether or not a person was a member of an environmental group was shown to have no relationship to their level of shark knowledge when just those two variables were tested against each other. However, within the model it was found that members of environmental groups had a higher level of knowledge than those who were not. It seems logical that members of environmental groups would, in general, possess a higher level of knowledge about different aspects of the environment, which could include sharks. It is unclear why a relationship was found between knowledge and being apart of an environmental group within the model but not when using the bivariate analysis. If being apart of one of these groups is uniquely predictive of knowledge level

within the model it would be assumed it would also predict knowledge in a bivariate analysis. It could be caused by the fact that only 6% of the respondents were actually apart of an environmental group, which could have resulted in a bias within the sample. If there is truly a relationship between being apart of an environmental group and a persons level of knowledge about sharks then these groups could be helpful in educating others about sharks. However, more respondents who are members of an environmental group would need to be surveyed to eliminate bias and determine if it actually has an effect on the respondent's level of knowledge about sharks.

*Attitude*

The attitudes that someone possesses about an animal can directly effect how they might behave towards that animal (Thompson and Mintzes, 2002). As mentioned previously, Kraus (1995) stated that a person's attitude can guide, influence, direct, shape, or predict a person's behavior. Barney (2005) also found that an individual with a positive attitude about a species is less likely to display disruptive or harmful behavior towards that species. It was shown by Dobson (2007) that most people have negative preconceived notions about sharks, and these attitudes could therefore lead to negative behavior against them. This illustrates the importance of understanding what variables cause a person to either have a more positive or negative attitude towards sharks. Support for conservation, the donation of money to protect sharks, and even the willingness to not participate in activities that would be detrimental to sharks (i.e. shark fishing, support of

shark products) could all be based off a person's attitude. It should be noted that the index used to determine a respondent's attitude towards sharks and their conservation had a very low Cronbach's alpha (0.238) making it unreliable, so any conclusions made using this index are merely speculation based on what was found in the analyses. Further studies would be needed to accurately determine if the variables presented are indeed affecting attitudes.

The attitude a person holds towards the natural environment can be influenced by many different variables (age, gender, income, ethnicity, participation in wildlife activities), however knowledge is the variable most likely to change their attitudes (Thompson and Mintzes, 2002; Kellert, 1996). Thompson and Mintzes (2002) found that there was a moderately strong relationship between knowledge and the attitudes a person has about sharks, with a positive correlation between knowledge complexity and scientific or naturalistic attitudes. A study done by Barney (2005) displayed similar results with individuals who were considered experts about dolphins showing the least utilitarian attitudes. This study also found that a respondent's knowledge about sharks could significantly predict their attitude towards them. Respondents who scored higher on the knowledge index had a more positive attitude about sharks. All of these studies show the importance of making sure the entire public is properly educated about sharks and the threats that they face. That knowledge is needed in order to garner more positive attitudes, which in turn could have a positive effect on behavior. They also reaffirm the need to understand variables that may be affecting knowledge in order to determine what groups may need to be focused on for providing information about sharks, which was

previously discussed. If the negative opinions about sharks are to be changed in the general public, accurate, unbiased information has to be provided that will help people to understand sharks beyond what is distributed by the main stream media.

In this study gender was found to have no effect on level of attitude that a respondent had towards sharks. This is not congruent with previous findings of men displaying naturalistic and utilitarian attitudes, while women had moralistic attitudes towards sharks (Thompson and Mintzes, 2002). In that study females were more concerned about the welfare of the animals than being able to either exploit them for profit or there own personal enjoyment. The fact that gender had no effect in this study also goes against the previous findings that the level of knowledge a person has about sharks does affect their attitude. This is because it was previously stated that in this study males displayed a higher level of knowledge. Therefore, males based off those findings should have a more positive attitude towards sharks. This is completely opposite to what was found in the Thompson and Mintzes (2002) study and does not agree with what was found here either.

A respondent's age and education level were also found to not significantly predict attitudes, which would be expected based on the fact that neither had an effect on knowledge. Kellert and Berry (1980) originally found people with lower education levels to display utilitarian, dominionistic and negativistic attitudinal tendencies, while those with higher education levels being more naturalistic, ecologistic, humanistic, and moralistic. A study later done by Thompson and Mintzes (2002) found that college students showed greater scientific and naturalistic attitudes towards sharks than

individuals with a lower education levels, they also had lower utilitarian and negativistic attitudes. It should again be noted that the college students in Thompson and Mintzes (2002) were either marine biology majors or taking a marine biology class. Since the attitudinal index for this study is not very reliable it is hard to determine whether or not age and education can significantly predict attitudes in this study. Both previously were shown to not significantly predict knowledge using a more reliable knowledge index and it was found in this study and others that knowledge level can predict attitudes. Further studies would be needed to accurately determine these two variables effects on attitudes.

Where a respondent was receiving information about sharks did not effect whether they had a positive or negative attitude towards them. Previously it was shown that where information about sharks was being obtained did significantly affect a respondent's knowledge level but it does not directly affect their attitudes. It seems a person first has to gain a certain level of knowledge about sharks before they develop a final opinion. These results were also found with the variable of whether respondents had viewed "Shark Week", with it not being able to significantly predict a respondent's attitude. This again highlights the need for accurate unbiased information being presented in these different information mediums so that they create higher levels of knowledge and more positive attitudes are formed. These variables appear to be working through knowledge, which then has the possibility to change attitudes. It is also possible in the case of "Shark Week" that it merely causes as many negative attitudes as it does positive.

Respondent's who were members of an environmental group displayed a more positive attitude towards sharks than those who were not. This would be expected based

on the fact that in general members of these groups have a positive attitude towards the environment and its conservation. This group of respondent's attitudes towards sharks could simply be based on their opinion of the environment as a whole and they do not need specific knowledge about sharks as an intermediary like some of the other variables did. Previously conflicting information was found on whether being apart of one of these groups could predict knowledge levels because the multivariate and bivariate regressions displayed different results but it does seem possible that it could be directly affecting attitudes in a positive way. It should again be noted that only 6% of respondents were members of one of these groups so further testing would be needed to alleviate this bias as well as the fixing the reliability of the attitudinal index.

Whether or not a person would fear or show interest in an encounter with a shark also seemed to working through knowledge. Those who showed interest in an encounter had higher levels of knowledge and thus positive attitudes towards sharks. No matter if the person feared the encounter or not it could not significantly predict a respondent's attitude. It would be expected that those who would fear the encounter would have a less positive attitude. Knowledge again seems to be the key factor in changing attitudes.

Respondents who had been snorkeling or scuba diving, either with or without sharks showed no difference in their attitudes about sharks than those who had not participated in these activities. This is contrary to a study conducted by Dobson (2007) that found attitudes about sharks changed from being negative to more positive when participants in the study encountered sharks in the wild. This is despite the fact that there was little educational content being supplied directly before, after or during the trip

(Dobson, 2007). In the Dobson (2007) study knowledge was not needed in order to change attitudes about sharks. This has not been the case for the majority of variables in this study. This could explain why these activities did not display differences in attitudes, because the respondents were not supplied the required information about sharks that would provide higher levels of knowledge to change attitudes. This survey failed to determine exactly what other activities the respondents may have been participating in while snorkeling or scuba diving. Someone that is going spear fishing could have a very different attitude about the aquatic environment than someone who is merely going for the experience of being around nature. Also it would need to be determined for those respondents who had encountered sharks how they had done so. If they had taken part in shark feeding to attract the animals that could leave the impression that sharks are more aggressive than if they had just happen to see one by chance resting on the bottom or slowly cruise by. It would appear that simply encountering these animals in their natural environment should have some effect on attitudes as was seen by Dobson (2007) directly. However, this could cause positive or negative reactions depending on the type of encounter. As Dobson (2007) mentioned most participants in his study were provided little educational content about sharks. If someone is going out of there way to participate in one of these activities it seems to be a prime opportunity to try and educate them about these animals. They are already showing interest in at least the aquatic environment and what it holds, if not a direct interest in sharks. Providing this information can be important to make sure participants in these activities have an understanding of sharks before entering the water. Someone who already fears sharks and holds a negative

attitude towards them may only have those feelings reinforced by a chance encounter with one if they have not been properly prepared. This type of information could obviously only be provided on guided trips. It is important that good educational content is provided during these guided trips because whether it is this information, the encounter with the sharks in the natural environment, or both, there is a chance that any of these could change negative attitudes towards sharks and that may go a long way in helping get support for their protection.

Until this point all results involving attitudes towards sharks were based on bivariate analyses between an independent variable and the attitude index. Here, like before with the knowledge index, the respondents attitudes are tested against several of the independent variables (knowledge, gender, age, education, viewing of "Shark Week", where they receive information about sharks, and whether they are apart of an environmental group) simultaneously within a regression model to determine what effect each may be having on respondent's attitudes about sharks while controlling for the other variables. The model showed that all the independent variables together had a weak to moderate relationship with attitudinal levels and the model could significantly predict these levels. When each independent variable was tested separately against the attitudinal index it was found that only knowledge and whether or not the respondent had a PhD could significantly predict their attitude levels. Having increasing levels of knowledge once again was shown to cause more positive attitudes towards sharks. Interestingly the model showed that respondents who had a PhD level of education actually had a more negative attitude than those who had a high school diploma. This again shows that having

a higher level of education does not necessarily mean you have a higher level of knowledge about sharks. Unlike the Thompson and Mintzes (2002) and Barney (2005) studies it was previously found that education did not significantly predict knowledge levels. If higher education did result in higher knowledge levels about sharks like these other cases suggest then we should have seen more positive attitudes in respondents with PhD's compared to those with high school diplomas rather than the negative attitudes that were found. This is because it was shown by this study and the ones conducted by Barney (2005) and Thompson and Mintzes (2002) that higher levels of knowledge about sharks should result in more positive attitudes towards them. Specific information about sharks has to be obtained to change knowledge levels which can then bring about more positive attitudes.

In a previous bivariate analysis from this current study it was found that being a member of an environmental group resulted in more positive attitudes towards sharks. However, within the model this variable was found to not be able to significantly predict attitudes. This could be caused by the fact that the variance in attitudes that is predicted between members and non-members in the bivariate analysis overlaps with the prediction power of another variable. So being a member of an environmental group would no longer be uniquely predictive and would be found to be not significant.

Few of the variables were found to directly affect attitudes towards sharks. Knowledge about sharks appears to play the biggest role in shaping peoples attitudes towards them. Some of the other variables work through knowledge by increasing its levels, which in turn should create more positive attitudes. From this study, as well as

those conducted by Barney (2005) and Thompson and Mintzes (2002), it can be concluded that to dissolve negative preconceived notions about sharks the public must first receive appropriate education about them.

*Behavior*

Supporting conservation, the willingness to donate money, refraining from potentially harmful activities: these are all types of behaviors that are desired to help the preservation of sharks. In order to try and instill these behaviors in others we must first understand what makes people act in these ways. What can be done to make others behaviors more like these? This is the ultimate goal of this study. Someone can have all the knowledge in the world about sharks and the greatest attitude about them, but if they sit back and are not willing to act for their conservation what does having those qualities do for those species? This study only shows respondents willingness to display these behaviors, not if they have actually done so; but it at least gives some insight into how someone might actually behave. If enough people are willing to support the protection of sharks in some way (speak out publicly or at the ballot box) it makes it much easier to convince governments that something needs to be done to conserve them.

The majority of respondents (83.15%) supported the formation of marine protected areas. Even with the possible implementation of restrictions on activities in this areas support did not drop below 66.01%, and support was only this low on activities that could for the most part be considered non-detrimental to shark species. Meaning in most

cases the restrictions of those activities would not be needed to protect species in the marine protected areas. Support for MPAs with commercial and recreational fishing being restricted was considerably higher at 79.61% and 78.95%, respectively. A majority of the respondents (66.67%) also indicated that they would support legislation that would protect sharks, but few (19.13%) were willing to donate money to support shark conservation. Respondents were shown to support the overall protection of sharks through legislation even with possible restrictions on activities they may personally enjoy. They showed to be especially supportive of protection that would restrict activities that could be directly harmful to sharks and other marine animals. This support should demonstrate that new legislation protecting sharks could be created. The US is a leader in shark fisheries and these results show that a majority of people would rather protect these animals than use them for consumptive purposes. The support is there, now the legislation just needs to be developed and set in place.

Now even though most respondents supported the conservation of sharks it seems they still may not be the charismatic animals that can actually draw funds through donations. It is one thing to support the use of government funds but it could be that only someone who is truly fascinated and intrigued by these animals would actually be willing to donate their own money. This does not mean that people want to continue to exploit them though. A confounding factor might be that this survey was also conducted at the beginning of an economic down turn in the United States, which could also cause lower willingness to donate money.

Kraus (1995) stated that behaviors can be guided, influenced, directed, shaped, or predicted by a person's attitude. Someone with a more positive attitude is less likely to display negative or harmful behavior (Barney, 2005). This study too found that respondents with more positive attitudes towards sharks also displayed positive behaviors in support of shark conservation. It was a weak relationship but attitudes could significantly predict behavior. Since respondents with more positive attitudes were willing to support positive behavior towards sharks it is important to go back and look at what creates positive attitudes. It all seems to come back to having adequate and unbiased information about sharks. Again it should be note that the attitudinal index had a low cronbach's alpha showing that it is not very reliable, but the results found here are congruent with those from other studies.

Those respondents with higher levels of knowledge about sharks were also found to have more supportive behavior towards sharks and their conservation. It too was a weak relationship but knowledge level could significantly predict behavior. This is similar to findings by Barney (2005), in which individuals with higher levels of knowledge about dolphins (i.e. experts) were the least likely to participate in harassing behavior. This bivariate analysis shows that knowledge can directly affect behaviors without having to first change attitudes. So someone with good knowledge of sharks doesn't necessarily have to have a good opinion of them to support their protection. The knowledge and behavior indices were both found to be reliable. Knowledge appears to be able to shape both attitudes and behaviors towards sharks so the variables that are affecting it show great importance (discussed previously).

Both gender and age showed to have no direct impact on a respondent's behavior. In this study age was found to play no role in predicting knowledge, attitudes, or behavior. Despite the fact that males displayed more knowledge than females and knowledge was shown to predict more positive behaviors, gender still had no affect. Males not displaying more positive behavior could be due to the questions involved in the index's construction. Many of the questions asked were whether or not a respondent would support marine protected areas if certain activities (commercial fishing, recreational fishing, and boating, swimming, snorkeling, scuba diving) were prohibited. Even though males have more knowledge they may not be inclined to support legislation that would prohibit activities which they feel they have the right to participate in inside those areas. Some of these activities could also be considered 'male-oriented' resulting in a lack of support from them.

It was found that there was a weak relationship between the level of education a respondent had and how they would behave towards sharks. Respondents with a college degree had more negative behavior towards sharks than those with a high school diploma. Previously in this study a respondent's education level was found to have no effect on knowledge or attitudes about sharks in the bivariate analyses so the chance of it having an effect on behavior did not seem likely. Also, Thompson and Mintzes (2002) found college students to have more positive attitudes towards sharks which should lead to positive behavior, but none of this was demonstrated here. Perhaps other outside factors that were not tested for were effecting how these college graduates indicated they would behave towards sharks and their conservation.

Where a respondent receives information about sharks and whether they had viewed "Shark Week" both had no effect on the behavior a respondent displayed towards sharks. Both of these were previously shown to change the level of knowledge so could be indirectly working through knowledge to change behaviors.

It was found that respondents who were members of an environmental group exhibited a weak relationship with having more positive behavior towards sharks. This is an expected outcome because most members of these groups would be expected to show support for the protection and preservation of animals. Their membership in these groups displays this support. If these respondents have positive behavior towards one aspect of nature they are more likely to have those same behaviors towards others. They were also found to have a more positive attitude about sharks and it was shown that these attitudes can cause positive behavior.

Respondents who would fear an encounter with a shark showed no difference in their behavior than those who would be interested in such an encounter. Someone who fears sharks would not be expected to support their conservation or be willing to donate money, and thus so have less a positive behavior than other respondents. Perhaps there is no difference between the two because even though some respondents might be interested in the encounter they still don't think that there needs to be more sharks which might occur by them donating money or supporting their protection.

Participation in the activities of snorkeling or scuba diving by respondents, whether it was with or without sharks, were previously shown to have no effect on a

respondent's knowledge or attitude. The same was discovered with behavior. It seems that the interaction between respondents and the aquatic environment had little to no effect on anything. It seems hard to believe that encounters such as these would not at least shape attitudes respondents held towards sharks. Not receiving adequate information during these activities seems plausible, but to witness these areas and these animals and not have attitudes or behavior change seems unlikely. It doesn't necessarily have to be a positive change either, an encounter with a shark could leave someone terrified of sharks and that should show up in their attitudes or behaviors. Few respondents (10.1%) had actually encountered sharks in the wild during one of these activities and this could be the reason for no changes in knowledge, attitude, and behavior. Perhaps there has to be an actual encounter with a shark and not just with the aquatic environment to change these. Dobson (2007) found attitudes about sharks changed when individuals encountered sharks specifically, so there could be little effect on those respondents who had not actually been in the presence of a shark. With so few respondents indicating they had encountered a shark in these activities, there is also a possibility of a sampling bias.

All the previous results discussed using the behavior index were based of bivariate analyses that did not take into account the effect of each variable on the others. To overcome this problem a final multivariate regression tests was used, like the ones discussed with the knowledge and attitude indices, to test each of the previous independent variables (attitude, knowledge, gender, age, education, viewing of "Shark Week", where receive shark information, and whether apart of environmental group) affect on a respondent's behavior towards sharks while controlling for the other variables.

A weak to moderate relationship was found between the combined predictive power of all the variables and a respondent's behavior.

When observing the affect of each variable independently (controlling for other variables) on a respondent's behavior towards sharks it was found that only gender and having acquired a college education showed a significant change in a respondent's behavior. More positive behavior towards sharks was found in females than in males. This is despite the fact that females had displayed less knowledge about sharks. However, based on the study done by Thompson and Mintzes (2002) where it was found that females displayed moralistic attitudes while males were naturalistic or utilitarian, it makes sense that females would have more positive behavior. Females were more concerned with the ethical treatment of sharks, while males worried about the value of them commercially (Thompson and Mintzes, 2002). Using the attitudes found in the Thompson and Mintzes (2002) study, females displaying a more positive behavior towards the conservation and non-exploitation of sharks is founded. Unfortunately this study found gender to play no role in attitudes.

Respondents who had obtained a college degree again displayed more negative behavior towards sharks than those who had high school diplomas. This reiterates the fact that a higher level of education does not mean a person has more knowledge, better attitudes or behavior about specific subjects. Just because they have a higher education doesn't mean they ever learned specific information about sharks or the problems they face. Now each respondent is equally likely to receive information about sharks because it is not linked to education level it would also be expected that each educational level

would not predict behavior. So there could be other factors affecting the behavior of college graduates specifically, which would need to be studied further.

In the bivariate analyses that were run with behavior as the dependent variable it was found that a respondent's knowledge and attitude about sharks, as well as, whether they were a part of an environmental group could significantly predict behavior towards sharks and their conservation. When the multivariate model was run however, each of these variables was shown to no longer be able to significantly predict behavior. The variances in behavior that these variables previously predicted in the bivariate analyses may overlap with each other. Since each of these variables would no longer be uniquely predictive they would show up as being not significant within the model, which is what is found here. So it is not that they have no effect on a respondent's behavior towards sharks, but that they are affecting it in similar ways.

From this study it appears that knowledge about sharks has a direct link to behavior. The more a respondent knew regarding sharks the more inclined they were to support their conservation. Knowledge was also shown to change attitudes so it could be working both directly and indirectly on behavior. Because the attitude index is unreliable it is hard to determine if a relationship between it and knowledge or behavior truly exists. However, the knowledge and behavior indexes were much more reliable providing support for the results.

*Shark Attacks*

No relationship was found between where a respondent received their information about sharks and whether they believed shark attacks had increased, decreased, or stayed the same. Previously it was found that respondents who received their information about sharks from television news had a lower knowledge level than those who had received it from documentaries. This lower knowledge could be attributed to the fact that many news reports about sharks are conducted to report recent attacks. If this is the case it would be believed that respondents receiving their information from television news should think that shark attacks have increased. However, no link was found between the two. This could mean that either the respondents were not connecting reporting of attacks with their increased occurrence or that respondents watching documentaries thought they were happening just as much. This again goes back to the fact that 70% of respondents who indicated they got their information from documentaries had viewed "Shark Week". Many of the programs on "Shark Week" have titles and themes about shark attacks so people could think attacks are just as frequent based on this information as they if they had just been watching the news. It was shown that respondents were gaining knowledge from "Shark Week" but they could also be receiving misconceived notions about the actual number of attacks. There is also the possibility of an issue with the data. When respondents indicated where they received information about sharks only the highest graded source was recorded. So a respondent could have indicated that they received it from documentaries and television news but only documentaries were recorded. So respondents could be getting information about shark attacks from several sources causing their overall view of attacks to be similar.

*Willingness to Donate Money*

A weak relationship was found between respondent's who had watched animal programs on television and their willingness to donate money to protect sharks. Of the respondents who indicated that they watched animal programming 23% stated that they would be willing to donate money to support the conservation of sharks. This is compared to the 8.5% of respondents willing to donate from those who do not watch animal programming. It would appear that the viewing of these programs encourages people to be more willing to donate than if they had not viewed them. If more funds are needed for the conservation of sharks through donations, perhaps changing the information that is distributed by other forms of media about sharks to more resemble these programs would elicit this behavior. Further studies would be needed to determine what exactly it is about these programs that make donating money more agreeable to people.

*Shark Week and Conservation*

A significant difference was found in the urgency at which a respondent felt shark conservation was, between those who had and had not viewed programs on "Shark Week". There was a weak relationship between viewing these programs and believing that shark conservation was more urgent. Of those who had viewed programs on "Shark Week" 31.2% felt that shark conservation was either urgent or very urgent compared to 19.6% in those who had not. From this it appears "Shark Week" is actually helping

people realize the need to protect sharks. This is what should be occurring from these programs, not them just providing mindless entertainment but also educating about the importance of sharks and the need for their conservation. It is still only a small difference between the two groups, so programs on "Shark Week" need to continue to be more oriented in this way.

*Threats to Sharks*

Spruill (1997) found that most people do not know what the major threats to the ocean are when compared to expert opinion. Similar findings were present in this study as well, with most respondents (77.42%) unable to identify commercial fishing as the main threat to shark populations. Habitat degradation (31.36%) was seen as the biggest threat to the survival of sharks by respondents, when in actuality it plays a lesser role in the current issues revolving around their conservation. Commercial fishing along with the act of finning sharks are much more serious problems but only 33.73% of respondents felt this way. It would seem that people are not receiving accurate information regarding threats to sharks. If the public is unable to identify the major causes of declines in shark populations how is support supposed to be garnered to curb these practices. Public support of the reduction of critical habitat for sharks that is being taken is important but it does not answer the main problem. It is hard to gain support against commercial fishing and finning if people do not know it is even occurring and at what levels, and in the case of finning, they might not even know what this actually means. Not understanding the

threats facing shark populations could also affect how people view conservation urgency. Habitat degradation is caused by man but in many cases it is a byproduct of other activities that are not directly targeting and killing sharks. It is a threat but it is less quantifiable so could garner less support for conservation. Commercial fishing and finning are quantifiable and these numbers can be presented to show how many sharks are being caught and what is happening to those populations. If this information is not being delivered to the public it could seriously affect conservation efforts. The public needs to be provided the information necessary to realize what are the most pressing issues facing sharks so that support is directed at proper legislation and conservation.

*Shark Conservation*

Only 26% of respondents thought that shark conservation was either very urgent or urgent. The majority (60.51%) thought it was of moderate concern. This is similar to the findings in a study by Spruill (1997) in which only 30% of participants felt that killing sharks was a serious problem. If killing them isn't an issue why would conserving them be? As mentioned in the section before, a reason for the lack of urgency among respondents could be due to the fact that they do not even know what is actually threatening sharks. Perhaps if they knew that some sharks were caught only for their fins to be removed and the rest of their carcass thrown back in the water to die they would think conservation was more urgent. Even those respondents who indicated that they thought shark populations were declining did not realize by how much. Only about 5% of

respondents thought that some shark species could be declining by 70% or more. Nearly 30% of those who thought shark populations were declining believed it was by 30% or less. This is much less than some of the declines that have been projected in certain shark species. Perhaps gaining support for conservation would be easier if people only realized by how much some shark populations have declined. Perhaps some people do not think shark populations are declining since there has seemed to be a rise in attacks. Educating people on the importance of sharks in the ecosystem and their declining numbers is also important to gain support for their conservation. It comes back to having knowledge about sharks so that proper attitudes and behaviors can be established that reflect what is actually happening to these species.

*Shark Existence*

Sharks have existed on this planet for over 400 million years (Helfman et al., 1997; Hamlett, 1999). Most people do not even know this. More than 53% of the respondents felt they had only been around for a couple thousand years or less. This lineage has survived mass extinctions and major global changes but humans are their greatest adversary. Maybe if people realized how long sharks have been around they could recognize their importance to the ecosystem and the need for conservation. The fact that most respondents didn't even realize that sharks had been around for at least a million years shows the lack of knowledge that is present within the public about sharks.

It was shown increasing this knowledge through proper education could greatly contribute to the conservation effort.

# CHAPTER 8: CONCLUSION

Within the general public knowledge about sharks is fairly low. Most people could not tell you how many species of shark there were or even a rough estimate of how long they have existed. Unless someone is a marine science major or is purposefully going looking for information about sharks they would be very unlikely to come across anything that would significantly increase their knowledge about them. Sharks are just not common subject matter in everyday life or even educational systems (i.e. college, high school). Perhaps they appear on the news every once and awhile in terms of a scientific discovery, or because of a shark attack, but such coverage is still uncommon. With so little information about sharks being distributed it seems important that what is distributed is correct and does not have negative effects.

This study showed that understanding a person's knowledge level about sharks is very important in determining their attitudes and possible behavior towards them. As a person's knowledge about sharks increased their attitudes and behavior towards sharks were affected in a positive manner. Their attitudes became more accepting of sharks and their behavior changed to be more supportive of legislation and other acts that would encourage the conservation of sharks. Some other variables were shown to also have effects but it appeared knowledge was the main contributor to differences in both. Due to the significant affect of knowledge on attitudes and behaviors it is also essential to

understand what factors are contributing to one's knowledge about sharks. Of the variables that could significantly predict knowledge levels, a person's gender, where they receive their information about sharks, and whether or not they had viewed programs on "Shark Week" appeared the most important. Males, individuals who used documentaries as the basis for their shark knowledge, and those who watched "Shark Week" displayed increased knowledge levels. Many of the "Shark Week" programs, as well as, other documentaries about sharks can be male-biased, which may be creating this knowledge gap. So developing programs that are not gender-biased may be important. It is also imperative that the information being provided by all different types of media be accurate and unbiased. Those who do not view documentaries about sharks need to be getting better information. Even if everyone was receiving information about sharks from documentaries or 'Shark Week" (apparent some respondents believed "Shark Week" programs were documentaries) these mediums need to continue to strive to provide the best information possible.

It also seems that there is a need for the development of educational programs on dive and snorkeling trips. Respondents in this study who had encountered sharks in the wild or had been snorkeling or scuba diving showed no significant increase in knowledge. This points out that there is little educational content to these trips. Some information on these trips would have to be specific to sharks in order to affect knowledge about them and thus attitudes and behavior.

Behaviors among respondents were mostly supportive of shark conservation through either legislation or the possible establishment of marine protected areas.

However, few were willing to donate money to support this cause. Using what was found in this study these supportive behaviors towards shark conservation hopefully can continue to be established and increased.

Being able to predict what may shape a person's attitudes and behaviors towards sharks is important because they have the ability to cause changes in policy (Kellert, 2008). That is the whole purpose, to find a way to achieve support for policy that will protect sharks into the future.

This study found that several variables were able to predict or show significant differences in knowledge, attitudes, and behavior towards sharks, yet there are still improvements which could be made to increase the reliability of the results. There are several changes to the survey itself that could be made. For starters, having each question answered in the same manner will make coding easier and allow for more reliable indexes that can be tested against each other. For example, each question could have yes or no answers, and could then be coded using binary. This allows for each question to be weighted equally and again provide for more reliable indices. Having each index contain an equal number of questions can also increase reliability. All indices should also contain a minimum number of questions to make sure that the variable (i.e. knowledge) is being adequately described. More questions equal greater likelihood of accurately describing a respondent's knowledge, attitude, or behavior. In this study the attitude index only consisted of a few questions, which could be the cause of its low Cronbach's alpha, making it an unreliable scale of the respondent's attitudes.

A larger sample size could also increase the reliability of the study. Significance was found but further studies with larger sample sizes could verify these results. A variety of areas could also be used. This study was conducted in the Fairfax Virginia area, which is very multicultural, reducing some sampling bias. However, this is area a coastal area, so knowledge, attitudes, and behaviors here could be very different than those found in non-coastal areas. It is possible that individuals on the interior of the United States have a far different knowledge and attitude about sharks and other aspects of the ocean. It would be interesting to see how their knowledge, attitudes, and behavior towards sharks and their conservation differ from those who are in coastal areas. If so, different methods for increasing supportive shark conservation behavior may be needed between coastal and non-coastal areas.

APPENDIX I
Survey

# Public Knowledge, Attitudes, and Behavior of Sharks and Shark Conservation

## George Mason University Department of Environmental Science and Policy

Do you think over the past 100 years shark populations have been ☐ Declining
☐ Increasing
☐ The same
☐ I don't know

If you chose increasing or decreasing by what percentage do you think they increased or decreased? _____

How urgent do you think shark conservation is? ☐ Very urgent
☐ Urgent
☐ Moderately urgent
☐ Not at all urgent
☐ I don't know

Please check the three sharks you think pose the greatest threat to humans from the list below.

☐ Blue shark ☐ Bull shark ☐ Great white shark ☐ Nurse shark
☐ Oceanic whitetip shark ☐ Tiger shark ☐ Whitetip reef shark

About how many shark species do you think exist today?

_____ Species

Which of these sharks listed do you think is the largest?

☐ Basking shark ☐ Deep sea colossal shark ☐ Great white shark
☐ Megamouth ☐ Tiger shark ☐ Whale shark

What percent of reported shark attacks do you think are fatal?

_____ Percent

How many species of sharks do you think are recorded as attacking humans?

_____ Species

Sharks breed quickly and produce many young. ☐ True ☐ False ☐ I don't know

Sharks can be removed from ecosystems with no adverse effects. ☐ True ☐ False ☐ I don't know

Sharks do not get cancer. ☐ True ☐ False ☐ I don't know

Sharks may hold the cure for cancer. ☐ True ☐ False ☐ I don't know

How long do you think sharks have inhabited the oceans?

_____ Years

Which do you think are the *three most* likely to cause death in humans?

☐ Bees ☐ Coconut ☐ Dog ☐ Grizzly bear ☐ Ladder

☐ Lightning ☐ Pig ☐ Hippo ☐ Shark

Of the following, which do you think is the single greatest threat to sharks?

☐ Entanglement in fishing gear ☐ Finning ☐ Sports fishing ☐ Habitat degradation

☐ Food shortages ☐ Disease ☐ Commercial fishing ☐ I Don't Know

Marine protected areas are important to shark conservation? ☐ True ☐ False ☐ I Don't Know

Do you support the formation of more marine protected areas? ☐ Yes ☐ No ☐ I Don't Know

If you answered yes to the last question, would you still support marine protected areas if any of the following activities were prohibited in them?

| | | |
|---|---|---|
| Commercial fishing | ☐ Yes | ☐ No |
| Recreational fishing/angling | ☐ Yes | ☐ No |
| Boating | ☐ Yes | ☐ No |
| Swimming/Snorkeling | ☐ Yes | ☐ No |
| Scuba Diving | ☐ Yes | ☐ No |

Would you support legislation that would protect sharks? ☐ Yes ☐ No ☐ I don't know

Would you be willing to donate money to support shark conservation? ☐ Yes ☐ No ☐ I don't know

Would you be more inclined to donate if the funds were only used for sharks that have not been known to harm humans? (i.e. not to man-eaters) ☐ Yes ☐ No ☐ I don't know

Do you think shark attacks have ☐ Increased

☐ Decreased

☐ Stayed the same

☐ I don't know

Please explain why you chose your previous answer.

_____

_____

_____

Are sharks ☐ Primitive

☐ Highly evolved

☐ I don't know

Compared to other fish are sharks ☐ More intelligent

☐ Less intelligent

☐ Same

☐ I don't know.

Of these countries, which do you think participates *most* in shark fishing?

☐ Costa Rica ☐ Galapagos ☐ Japan ☐ Philippines ☐ Scotland

☐ South Africa ☐ Spain ☐ Taiwan ☐ United States

Of these countries, which do you think participates *least* in shark fishing?

☐ Costa Rica ☐ Galapagos ☐ Japan ☐ Philippines ☐ Scotland

☐ South Africa ☐ Spain ☐ Taiwan ☐ United States

Which of these animals do you think is *most* endangered?

☐ Great white shark ☐ Siberian tiger ☐ Panda ☐ Polar bear ☐ White rhino

Which of these animals do you think is *least* endangered?

☐ Great white shark ☐ Siberian tiger ☐ Panda ☐ Polar bear ☐ White rhino

Please put these animals in order from least to most endangered by numbering them from 1-6?

____Cheetah ____ Great white shark

____ Humpback whale ____ North american manatee

____ Northern fur seal ____ Oceanic whitetip shark

Some sharks have international protection from overfishing. ☐ True ☐ False ☐I don't know

Is shark finning illegal in the United States? ☐ Yes ☐ No ☐ I don't know

In International waters? ☐ Yes ☐ No ☐ I don't know

In foreign countries? ☐ Yes ☐ No ☐ I don't know

What do you think shark fins are used for? _____

Do you watch animal programs on channels like Discovery, Animal Planet or the BBC? ☐ Yes ☐ No
If so, which programs? _____

Which channel (Animal Planet, BBC, Discovery, or others) do you watch animal programs on most frequently? _____

Do you subscribe to any environmental/scientific/animal magazines? ☐ Yes ☐ No
If Yes, then which one(s)?
_____

From the list below, where do you feel you receive most of your information about sharks?

☐ Documentaries ☐ Magazines ☐ Movies ☐ Newspapers
☐ Science journals ☐ TV news ☐ Other people ☐ N/A

Have you ever watched Shark Week on the discovery channel? ☐ Yes ☐ No
any of the Jaws movies? ☐ Yes ☐ No
the movie Open Water ? ☐ Yes ☐ No
or Deep Blue Sea? ☐ Yes ☐ No

Have you ever been scuba diving or snorkeling? ☐ Yes ☐ No

About how many have you been? _____

Have you ever been snorkeling or scuba diving with sharks? ☐ Yes ☐ No

If so, do you feel your scuba or snorkeling experience changed your perception of these animals in any way? ☐ Yes ☐ No
Please describe how.

If you haven't encountered a shark, before what do you feel your reaction would be if you did?

_____

_____

What is your gender? ☐ Male ☐ Female

In what year were you born? _____

What level of education have you acquired?

☐ High school diploma ☐ College degree or equivalent ☐ Masters degree

☐ PhD ☐ Other_____

What is your occupation?

_____

Are you a member of any type of conservation/environmental group? ☐ Yes ☐ No

If yes, which one(s)? _____

APPENDIX II
Hypotheses

**$H_1$: A person's gender will affect the level of knowledge they have about sharks.**

Regression F(1, 180)= 15.09, p= 0.0001, R-squared= 0.0773

| knowledge | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D56 | 1.474531 | .3795956 | 3.88 | 0.000 | .2781097 |
| _cons | 8.114943 | .2742504 | 29.59 | 0.000 | . |

**$H_2$: A person's age will affect the level of knowledge they have about sharks.**

Regression F(1, 167)= 1.30, p= 0.2552, R-squared= 0.0077

| knowledge | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D57 | -.0167019 | .014629 | -1.14 | 0.255 | -.0880043 |
| _cons | 9.505741 | .5791837 | 16.41 | 0.000 | . |

**$H_3$: A person level of education will have an affect on their knowledge about sharks.**

Regression F(3, 171)= 0.39 , p=0.7618, R-squared= 0.0068

| knowledge | Coef. | Std. Err. | t | P>t | Beta |
|---|---|---|---|---|---|
| High School | dropped | | | | |
| College | .0859944 | .5031602 | 0.17 | 0.864 | .0162432 |
| Masters | .4484127 | .6059126 | 0.74 | 0.460 | .0685027 |
| PhD | .7261905 | .8732129 | 0.83 | 0.407 | .0693596 |
| cons | 8.690476 | .4116365 | 21.11 | 0.000 | .. |

**$H_4$: Where a person receives information regarding sharks will affect their level of knowledge about sharks.**

Anova F(5, 163)= 3.62, p= 0.004, $\eta^2$= 0.0999

oneway knowledge D45, tab scheffe

| D45 | Summary of knowledge Mean | Std. Dev. | Freq. |
|---|---|---|---|
| Movies/ot | 7.5 | 3.5355339 | 10 |
| TV news | 7.8484848 | 2.4889909 | 33 |
| Magazines | 8.7777778 | 1.7873009 | 9 |
| Newspaper | 8.3636364 | 2.0135902 | 11 |
| Documenta | 9.6534653 | 2.5590453 | 101 |
| Science j | 8.6 | 1.1401754 | 5 |
| Total | 9.0118343 | 2.6185878 | 169 |

Analysis of Variance

| Source | SS | df | MS | F | Prob > F |
|---|---|---|---|---|---|
| Between groups | 115.06161 | 5 | 23.012322 | 3.62 | 0.0040 |
| Within groups | 1036.91472 | 163 | 6.36144001 | | |
| Total | 1151.97633 | 168 | 6.85700197 | | |

Bartlett's test for equal variances: chi2(5) = 7.9064 Prob>chi2 = 0.161

Comparison of knowledge by D45
(Scheffe)

| Row Mean-<br>Col Mean | Movies/o | TV news | Magazine | Newspape | Document |
|---|---|---|---|---|---|
| TV news | .348485 | | | | |
| | 1.000 | | | | |
| Magazine | 1.27778 | .929293 | | | |
| | 0.943 | 0.965 | | | |
| Newspape | .863636 | .515152 | -.414141 | | |
| | 0.987 | 0.997 | 1.000 | | |
| Document | 2.15347 | 1.80498 | .875688 | 1.28983 | |
| | 0.255 | 0.030 | 0.962 | 0.762 | |
| Science | 1.1 | .751515 | -.177778 | .236364 | -1.05347 |
| | 0.986 | 0.996 | 1.000 | 1.000 | 0.975 |

**$H_5$: Whether or not a person has viewed programs presented on "Shark Week" on the Discovery channel will affect the level of knowledge they have about sharks.**

Anova F(1, 174)= 17.13, p= 0.0001, $\eta^2$= 0.0896

**$H_6$: Whether or not a person is a member of an environmental group will affect their knowledge about sharks.**

Regression F(1, 176)= 1.96, p= 0.1633, R-squared= 0.0110

| knowledge | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D60 | 1.155689 | .8255645 | 1.40 | 0.163 | .1049371 |
| _cons | 8.844311 | .2052283 | 43.09 | 0.000 | . |

**$H_7$: Whether or not a person is fearful of sharks will have an affect on their knowledge about them.**

Regression F(2,181)= 3.37, p= 0.0366, R-squared= 0.0359

| knowledge | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| fear | -1.005195 | .7292197 | -1.38 | 0.170 | -.1155972 |
| fear/Interest | (dropped) | | | | |
| Interest | 1.685714 | 1.364789 | 1.24 | 0.218 | .1035795 |
| _cons | 9.714286 | .7001222 | 13.88 | 0.000 | . |

**$H_8$: Whether or not a person has been snorkeling or scuba diving will affect their knowledge about sharks.**

Anova F(1, 177)= 2.89, p= 0.0909, $\eta^2$= 0.0161

**$H_9$: Whether or not a person has gone snorkeling or scuba diving with sharks will affect their knowledge about sharks.**

Anova F(1, 177)= 0.47, p= 0.4957, $\eta^2$= 0.0026

**$H_{10}$: A person's knowledge regarding sharks will be affected by several different variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, and whether or not they are apart of an environmental group).**

regress knowledge D56 D57 e1-e4 D46 D45 D60, beta

```
      Source |       SS       df       MS              Number of obs =     156
-------------+------------------------------           F(  8,   147) =    4.96
       Model |  229.032537     8  28.6290671           Prob > F      =  0.0000
    Residual |   848.88413   147  5.77472197           R-squared     =  0.2125
-------------+------------------------------           Adj R-squared =  0.1696
       Total |  1077.91667   155  6.95430108           Root MSE      =  2.4031

------------------------------------------------------------------------------
   knowledge |      Coef.   Std. Err.      t    P>|t|                 Beta
-------------+----------------------------------------------------------------
         D56 |   .9930161   .4211258     2.36   0.020              .1884959
         D57 |  -.0253449   .0166486    -1.52   0.130             -.1338793
          e2 |   .0186243   .5213582     0.04   0.972             .0035321
          e3 |   .0092181   .6308706     0.01   0.988              .001416
          e4 |   .6209523   .8956158     0.69   0.489             .0604761
         D46 |   1.034516   .4288191     2.41   0.017              .1935826
         D45 |   .3876413   .1414293     2.74   0.007              .2167281
         D60 |   2.276027   .8888652     2.56   0.011              .2018842
       _cons |   6.979664   .7834661     8.91   0.000                     .
```

**$H_{11}$: The level of knowledge a person has about sharks will affect their attitude towards sharks.**

Regression F(1, 154)= 14.31, p= 0.0002, R-squared= 0.085

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| knowledge | .1345779 | .0355785 | 3.78 | 0.000 | .2915638 |
| _cons | 1.800889 | .3405195 | 5.29 | 0.000 | . |

**$H_{12}$: A person's gender will affect their attitude towards sharks.**

Regression F(1, 153)= 0.58, p= 0.4478, R-squared= 0.0038

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D56 | -.1421303 | .1867621 | -0.76 | 0.448 | -.061409 |
| _cons | 3.119403 | .1407227 | 22.17 | 0.000 | . |

**$H_{13}$: A person's age will affect their attitude towards sharks.**

Regression F(1, 141)= 0.05, p= 0.8157, R-squared= 0.0004

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D57 | -.0016689 | .0071472 | -0.23 | 0.816 | -.0196612 |
| _cons | 3.130654 | .2775074 | 11.28 | 0.000 | . |

**$H_{14}$: A person's education level will affect their attitude towards sharks.**

Regression F(3, 144)= 1.50, p= 0.2163, R-squared= 0.0304

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| High School | dropped | | | | |
| College | -.3922078 | .2410751 | -1.63 | 0.106 | -.1712243 |
| Masters | -.3080808 | .2751415 | -1.12 | 0.265 | -.1155787 |
| PhD | -.8080808 | .4293249 | -1.88 | 0.062 | -.1688637 |
| cons | 3.363636 | .1987388 | 16.92 | 0.000 | .. |

**$H_{15}$: Where a person receives information regarding sharks will affect the attitude towards sharks.**

Anova F(5, 142)= 0.92, p= 0.4698, $\eta^2$= 0.0314

**$H_{16}$: Whether or not a person has viewed programs presented on "Shark Week" on the Discovery channel will affect their attitude towards sharks.**

Anova F(1, 147)= 1.28, p= 0.2595, $\eta^2$= 0.0086

**$H_{17}$: Whether or not a person is a member of an environmental group will affect their attitude towards sharks.**

Regression F(1, 149)= 6.16, p= 0.0142, R-squared= 0.0397

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D60 | .9141844 | .368442 | 2.48 | 0.014 | .1991956 |
| _cons | 2.985816 | .0948158 | 31.49 | 0.000 | . |

**$H_{18}$: Whether or not a person is fearful of sharks will have an affect on their attitude towards them.**

Regression F(2, 154)= 2.70, p= 0.0704, R-squared= 0.0339

| attitude | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| fear | -1.2 | .517174 | -2.32 | 0.022 | -.3339514 |
| fear/Interest | -1.2 | .5978984 | -2.01 | 0.046 | -.2888634 |
| Interest | (dropped) | | | | |
| _cons | 4.2 | .5081159 | 8.27 | 0.000 | . |

**$H_{19}$: Whether or not a person has been snorkeling or scuba diving will affect their attitude towards sharks.**

Anova F(1, 150)= 0.00, p= 0.9838, $\eta^2$= 0.0000

**$H_{20}$: Whether or not a person has gone snorkeling or scuba diving with sharks will affect their attitudes towards them.**

Anova(A) F(1,150)= 0.03, p= 0.8602, $\eta^2$= 0.0002

**$H_{21}$: A person's attitude towards sharks will be affected by several different variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, whether or not they are apart of an environmental group, and knowledge).**

regress attitude knowledge D56 D57 e1-e4 D46 D45 D60, beta

```
Source |       SS       df       MS              Number of obs =     136
-------------+------------------------------   F(  9,   126) =    3.22
       Model |   34.777263     9  3.86414034     Prob > F      =  0.0015
    Residual |  151.333031   126   1.2010558     R-squared     =  0.1869
-------------+------------------------------   Adj R-squared =  0.1288
       Total |  186.110294   135  1.37859477     Root MSE      =  1.0959

------------------------------------------------------------------------------
    attitude |      Coef.   Std. Err.      t    P>|t|                 Beta
-------------+----------------------------------------------------------------
   knowledge |   .1439406   .0423559     3.40   0.001             .3079116
         D56 |   -.303614    .209416    -1.45   0.150            -.1286289
         D57 |  -.0019024   .0086137    -0.22   0.826            -.0221423
          e2 |  -.3799143   .2616787    -1.45   0.149            -.1617494
          e3 |  -.2328507   .3072925    -0.76   0.450            -.0844335
          e4 |  -.9385765   .4461925    -2.10   0.037            -.1994519
         D46 |   .0782008   .2200468     0.36   0.723             .0324861
         D45 |   .0390707   .0701355     0.56   0.578             .0493559
         D60 |   .8168671   .4239469     1.93   0.056             .1735881
       _cons |   2.028786    .474181     4.28   0.000                    .
```

**$H_{22}$: A person's attitude towards sharks will affect their behavior towards them.**

Regression F(1, 155)= 8.61, p= 0.0039, R-squared= 0.0526

```
behavior |      Coef.   Std. Err.      t    P>|t|                 Beta
-------------+----------------------------------------------------------------
    attitude |   .5125054   .1746653     2.93   0.004             .2293969
       _cons |   3.366464   .5670949     5.94   0.000                    .
```

**$H_{23}$: A person's knowledge about sharks will affect their behavior towards them.**

Regression F(1, 182)= 9.81, p= 0.002, R-squared= 0.0512

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| knowledge | .2191334 | .0699465 | 3.13 | 0.002 | .2262046 |
| _cons | 2.955503 | .6466865 | 4.57 | 0.000 | . |

**$H_{24}$: A person's gender will affect their behavior towards sharks.**

Regression F(1, 181)= 1.58, p= 0.2098, R-squared= 0.0087

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D56 | -.4828947 | .383716 | -1.26 | 0.210 | -.0931347 |
| _cons | 5.125 | .2764688 | 18.54 | 0.000 | . |

**$H_{25}$: A person's age will affect their behavior towards sharks.**

Regression F(1, 167)= 0.00, p= 0.9879, R-squared= 0.0000

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D57 | .0002185 | .0143678 | 0.02 | 0.988 | .0011766 |
| _cons | 4.843985 | .5688408 | 8.52 | 0.000 | . |

**$H_{26}$: A person's education level will affect their behavior towards sharks.**

Regression F(3, 171)= 2.94, p= 0.0346, R-squared= 0.0491

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| High School | dropped | | | | |
| College | -1.027731 | .4819593 | -2.13 | 0.034 | -.1982993 |
| Masters | -.4126984 | .5803821 | -0.71 | 0.478 | -.0644025 |
| PhD | .8928571 | .8364197 | 1.07 | 0.287 | .0871119 |
| cons | 5.357143 | .394292 | 13.59 | 0.000 | . |

**$H_{27}$: Where a person receives information about sharks will affect their behavior towards them.**

Anova F(5, 163)= 1.26, p= 0.282, $\eta^2$= 0.0373

**$H_{28}$: Whether or not a person has viewed programs presented on "Shark Week" on the Discovery channel will affect their behavior towards sharks.**

Anova F(1, 174)= 2.27, p= 0.1337, $\eta^2$= 0.0129

**$H_{29}$: Whether or not a person is a member of an environmental group will affect their behavior towards sharks.**

Regression F(1, 176)= 4.54, p= 0.0345, R-squared= 0.0252

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| D60 | 1.700054 | .7976537 | 2.13 | 0.034 | .1586203 |
| _cons | 4.754491 | .19829 | 23.98 | 0.000 | . |

**$H_{30}$: Whether or not a person is fearful of sharks will have an affect on their behavior towards them.**

Regression F(2, 183)= 2.46, p= 0.0880, R-squared= 0.0262

| behavior | Coef. | Std. Err. | t | P>\|t\| | Beta |
|---|---|---|---|---|---|
| fear | -1.150556 | .7194491 | -1.60 | 0.111 | -.134063 |
| fear/Interest | (dropped) | | | | |
| Interest | .7428571 | 1.347134 | 0.55 | 0.582 | .046227 |
| _cons | 5.857143 | .6910652 | 8.48 | 0.000 | . |

**$H_{31}$: Whether or not a person has been snorkeling or scuba diving will affect their behavior towards sharks.**

Anova F(1, 177)= 0.06, p= 0.8088, $\eta^2$= 0.0003

**$H_{32}$: Whether or not a person has gone snorkeling or scuba diving with sharks will affect their behavior towards them.**

Anova F(1, 177)= 0.07, p= 0.79, $\eta^2$= 0.0004

**$H_{33}$: A person's behavior towards sharks and their conservation will be affected by several different variables (gender, age, education level, viewing of "Shark Week", where a person receives their information about sharks, whether or not they are apart of an environmental group, knowledge about sharks, and attitude towards them).**

regress behavior attitude knowledge D56(gender) D57(age) e1-e4(education) D46(shark week) D45(where receive information) D60 (environmental group), beta

```
Source |       SS       df       MS              Number of obs =     136
-------------+------------------------------   F( 10,   125) =    2.89
       Model |  165.181349    10  16.5181349   Prob > F      =  0.0028
    Residual |  714.936298   125  5.71949039   R-squared     =  0.1877
-------------+------------------------------   Adj R-squared =  0.1227
       Total |  880.117647   135  6.51938998   Root MSE      =  2.3915

------------------------------------------------------------------------------
    behavior |      Coef.   Std. Err.      t    P>|t|                 Beta
-------------+----------------------------------------------------------------
    attitude |   .3537668    .194407     1.82   0.071             .1626792
   knowledge |   .1133084   .0965726     1.17   0.243             .1114601
         D56 |  -1.141553   .4607863    -2.48   0.015            -.2223963
         D57 |   .0123109   .0188006     0.65   0.514             .0658906
          e2 |  -1.142293   .5757952    -1.98   0.049             -.22364
          e3 |   -.377811   .6721037    -0.56   0.575            -.062998
          e4 |    1.12533   .9906361     1.14   0.258             .1099672
         D46 |   .2112902   .4804296     0.44   0.661             .0403628
         D45 |   .1326104   .1532389     0.87   0.388             .0770336
         D60 |    .821765    .938673     0.88   0.383             .0803028
       _cons |    2.76964   1.107382     2.50   0.014                    .
```

**$H_{34}$: Where a person receives their information regarding sharks will affect their perception on whether shark attacks have increased, decreased, or stayed the same.**

Chi-square chi2(10, N=169)= 12.2734, p= 0.267, V= 0.1906

**$H_{35}$: Whether or not a person watches animal programming will affect their willingness to donate money to protect sharks.**

Chi-square chi2(1, N=181)= 4.7706, p= 0.029, V=0.1623

**$H_{36}$: Whether or not a person has viewed programs presented on "Shark Week" on the Discovery channel will affect how urgent they believe shark conservation is.**

Anova F(1, 147)= 4.01, p= 0.0471, $\eta^2$= 0.0265

**$H_{37}$: What a person perceives as the greatest threat towards sharks will not be the same as what actually threatens them the most.**

| | | | |
|---|---|---|---|
| wrong \| | 144 | 77.42 | 77.42 |
| commercial fishing \| | 42 | 22.58 | 100.00 |

**$H_{38}$: People feel that shark conservation is not very urgent.**

| | | | |
|---|---|---|---|
| not at all urgent \| | 21 | 13.38 | 13.38 |
| moderately urgent \| | 95 | 60.51 | 73.89 |
| urgent \| | 31 | 19.75 | 93.63 |
| very urgent \| | 10 | 6.37 | 100.00 |

**$H_{39}$: People receive information about sharks from non-scientific sources.**

| | | | |
|---|---|---|---|
| Movies/other people \| | 10 | 5.92 | 5.92 |
| TV news \| | 33 | 19.53 | 25.44 |
| Magazines \| | 9 | 5.33 | 30.77 |
| Newspapers \| | 11 | 6.51 | 37.28 |
| Documentaries \| | 101 | 59.76 | 97.04 |
| Science journals \| | 5 | 2.96 | 100.00 |

70% of those who said got information from documentaries also watched shark week.

**$H_{40}$: A person who believes shark populations are declining will generally believe they are declining below 70%.**

Figure 10

**$H_{41}$: People do not realize how long sharks have existed.**

Figure 11

APPENDIX III
Code Book

# Public Knowledge, Attitudes, and Behavior Towards Sharks and Shark Conservation

## George Mason University Department of Environmental Science and Policy

**K1** Do you think over the past 100 years shark populations have been 1 Declining
0 Increasing
0 The same
0 I don't know

**K2** If you chose increasing or decreasing by what percentage do you think they increased or decreased?
_____

**A3** How urgent do you think shark conservation is? 3 Very urgent
2 Urgent
1 Moderately urgent
0 Not at all urgent
. I don't know

**K4** Please check the three sharks you think pose the greatest threat to humans from the list below.
0 Blue shark 1 Bull shark 1 Great white shark 0 Nurse shark
0 Oceanic whitetip shark 1 Tiger shark 0 Whitetip reef shark
**Add them up.**

**K5** About how many shark species do you think exist today?

_____ Species **400-500 = 1 everything else =0**

**K6** Which of these sharks listed do you think is the largest?
0 Basking shark 0 Deep sea colossal shark 0 Great white shark
0 Megamouth 0 Tiger shark 1 Whale shark

**K7** What percent of reported shark attacks do you think are fatal?

_____ Percent **1% or less= 1 everything else = 0**

**K8** How many species of sharks do you think are recorded as attacking humans?

_____ Species **40-50 = 1 everything else = 0**

**K9** Sharks breed quickly and produce many young. 1 True 0 False 0 I don't know

**K10** Sharks can be removed from ecosystems with no adverse effects. 1 True 0 False 0 I don't know

**K11** Sharks do not get cancer. 1 True 0 False 0 I don't know

**K12** Sharks may hold the cure for cancer. 1 True 0 False 0 I don't know

**K13** How long do you think sharks have inhabited the oceans?

_____ Years **~400 million = 1** **everything else = 0**

**K14** Which do you think are the *three most* likely to cause death in humans?

1 Bees 1 Coconut 1 Dog 1 Grizzly bear 1 Ladder
1 Lightning 1 Pig 1 Hippo 0 Shark

**If shark mentioned at all get 0, not added together no shark mentioned =1**

**K15** Of the following, which do you think is the single greatest threat to sharks?

0Entanglement in fishing gear 0Finning 0Sports fishing 0Habitat degradation
0Food shortages 0Disease 1Commercial fishing 0 I Don't Know

**If provided more than one answer, those answers for that person were omitted.**

**A16** Marine protected areas are important to shark conservation? 1 True 0 False 0 I Don't Know

**B17** Do you support the formation of more marine protected areas? 1 Yes 0 No 0 I Don't Know

If you answered yes to the last question, would you still support marine protected areas if any of the following activities were prohibited in them?

**B18** Commercial fishing 1 Yes 0 No
**B19** Recreational fishing/angling 1 Yes 0 No
**B20** Boating 1 Yes 0 No
**B21** Swimming/Snorkeling 1 Yes 0 No
**B22** Scuba Diving 1 Yes 0 No

**B23** Would you support legislation that would protect sharks? 1 Yes 0 No 0 I don't know

**B24** Would you be willing to donate money to support shark conservation? 1 Yes 0 No 0 I don't know

**B25** Would you be more inclined to donate if the funds were only used for sharks that have not been known to harm humans? (i.e. not to man-eaters) 1 Yes 0 No 0 I don't know

**K26** Do you think shark attacks have 1 Increased

0 Decreased
0 Stayed the same
0 I don't know

**K27** Please explain why you chose your previous answer.

_____

_____

**Increasing population, more people in the water = 1 everything else = 0**

**K28** Are sharks 0 Primitive
1 Highly evolved
0 I don't know

**K29** Compared to other fish are sharks 1 More intelligent
0 Less intelligent
0 Same
0 I don't know.

**K30** Of these countries, which do you think participates *most* in shark fishing?
0 Costa Rica 0 Galapagos 0 Japan 0 Philippines 0 Scotland
0 South Africa 1 Spain 1 Taiwan 1 United States
**One of top three = 1 If gave more than one answer was omitted.**

**K31** Of these countries, which do you think participates *least* in shark fishing?
0 Costa Rica 1 Galapagos 0 Japan 1 Philippines 0 Scotland
1 South Africa 0 Spain 0 Taiwan 0 United States
**One of last three = 1 If gave more than one answer was omitted.**

**A32** Which of these animals do you think is *most* endangered?
1 Great white shark 0 Siberian tiger 0 Panda 0 Polar bear 0 White rhino
**All are the same, attitude question If gave more than one answer was omitted.**

**A33** Which of these animals do you think is *least* endangered?
0 Great white shark 1 Siberian tiger 1 Panda 1 Polar bear 1 White rhino
**If gave more than one answer was omitted.**

**A34** Please put these animals in order from least to most endangered by numbering them from 1-6?

____Cheetah ____ Great white shark
____ Humpback whale ____ North american manatee
____ Northern fur seal ____ Oceanic whitetip shark

**If two sharks are 5 and 6 = 1, attitude question**

**K35** Some sharks have international protection from overfishing. 1 True 0 False 0I don't know

**K36** Is shark finning illegal in the United States? 1 Yes 0 No 0I don't know

**K37** In International waters? 1 Yes 0 No 0I don't know

**K38** In foreign countries? 1Yes 0 No 0I don't know

**K39** What do you think shark fins are used for? _____
**soup/food/delicacy/medicine/ornament(decoration) =1**

**D40** Do you watch animal programs on channels like Discovery, Animal Planet or the BBC? 1 Yes 0 No
**D41** If so, which programs? _____

**D42** Which channel (Animal Planet, BBC, Discovery, or others) do you watch animal programs on most frequently? _____

**D43** Do you subscribe to any environmental/scientific/animal magazines? 1 Yes 0 No
**D44** If Yes, then which one(s)?
_____

**D45** From the list below, where do you feel you receive most of your information about sharks?
5 Documentaries 3 Magazines 1 Movies 4 Newspapers
6 Science journals 2 TV news 1 Other people . N/A
**Used highest number because it assumes they are receiving best information from that source.**
**Deleted wikipedia**

**D46** Have you ever watched Shark Week on the discovery channel? 1 Yes 0 No

**D47** any of the Jaws movies? 1 Yes 0 No

**D48** the movie Open Water ? 1 Yes 0 No

**D49** or Deep Blue Sea? 1 Yes 0 No

**D50** Have you ever been scuba diving or snorkeling? 1 Yes 0 No

**D51** About how many have you been? _____ **20+ = 20, many= blank**

**D52** Have you ever been snorkeling or scuba diving with sharks? 1 Yes 0 No

**A53** If so, do you feel your scuba or snorkeling experience changed your perception of these animals in any way? 1 Yes 0 No
**A54** Please describe how.

**Positive Experience = 1, Negative = 0**

**A55** If you haven't encountered a shark, before what do you feel your reaction would be if you did?

**Fear/Scared/Afraid = 0, Interest/Excitement/ Curiosity = 2, Both = 1**

---

**D56** What is your gender? 1 Male 0 Female

**D57** In what year were you born? _____ **2008-year = age**

**D58** What level of education have you acquired?

e1 High school diploma e2 College degree or equivalent e3 Masters degree

e4 PhD 0 Other__dropped from education_____

**D59** What is your occupation?

_____

**D60** Are you a member of any type of conservation/environmental group? 1 Yes 0 No

**D61** If yes, which one(s)? _____

**If a participant answered a question with more than one answer and one answer was right and the other was wrong that answer was left entirely out of the data.**

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# CURRICULUM VITAE

Jason O'Bryhim received his B.S. from George Mason University in Biology in 2006. He is currently enrolled in George Mason University's PhD programin Environmental Science and Policy