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Informal Education Builds Deeper Knowledge And Connections With Elasmobranchs To Develop An Understanding For Environmental Conservation

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INFORMAL EDUCATION BUILDS DEEPER KNOWLEDGE
AND CONNECTIONS WITH ELASMOBRANCHS
TO DEVELOP AN UNDERSTANDING
FOR ENVIRONMENTAL CONSERVATION

By

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A capstone submitted in partial fulfillment of the requirements
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“If we can teach people about wildlife, they will be touched. Share my wildlife with me. Because humans want to save the things they love.”

- Steve Irwin, *The Crocodile Hunter Diaries*

DEDICATION

This Capstone Project is dedicated to my amazing large family, my friends, my colleagues, and the many teachers who have supported and guided me over the years. Through love, persistence, and endurance, this Capstone was made possible because of them. A special acknowledgement to my parents, sister, husband, and my daughters; Emma and Kenzie. Thank you.

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CHAPTER ONE

Introduction

Background

As a young girl growing up in Greenfield, Indiana, I always had a love and admiration for the ocean. I can remember watching iconic conservation enthusiasts like Steve Irwin, Jacques Cousteau, and David Attenborough on Discovery Channel and Animal Planet. Their passion and excitement seemed to jump off the screen at me. When I was just three years old, I won my first goldfish at the Hancock County fair and I asked my mother if I could swim with my fish in the bathtub. My mother smiled and said, “You can’t swim with your goldfish in a bathtub. If you want to swim with fish, you need to be a marine biologist.” At just three years old, I knew what I wanted to be when I grew up.

Throughout my elementary school years, I can remember visiting the Indianapolis Zoo often. There was an incredible Oceans Building that helped me connect with our oceans that always seemed so far away. Every year I would look forward to a week in the summer dedicated to sharks on Discovery Channel: Shark Week. Their power, grace, skill, evolution, anatomy, everything amazed me about these incredible animals. In 5th grade, we were learning how to write a persuasive essay. While other students wrote essays to persuade their parents on why they should have a puppy, the topic I chose was “Why we should ban shark-finning.” I then became known as the nerdy shark girl. My drive and determination kept me going throughout my education career as I pursued my dream to become a marine biologist.

Chapter Overview

The purpose of this Capstone Project is to connect my love for elasmobranchs (the family name for sharks and rays) with informal education. I will interpret the benefits of informal education and how it positively affects environmental conservation to our oceans. I will also examine educational programs in zoos and aquariums and the benefits that formal education centers find in utilizing these resources, even though zoos and aquariums have had mixed reviews in terms of inadequate maintenance in several areas. I plan to do this by investigating *how informal educators can build a deeper knowledge and connection to animals that are non-charismatic, such as elasmobranchs, to develop an understanding and need for environmental conservation*. In this chapter I will describe my personal experiences, explain my professional journey, and interpret the layout of my project.

Personal Journey

Growing up in a traditional, Midwest, middle class, Christian family, I remember our frequent trips to the Indianapolis Zoo. My mother and father worked hard to make it financially possible to travel, just a few times in my youth. I always had a love, passion, and admiration for our world and all the creatures in it. I can remember my first trip to Florida and seeing the ocean for the first time. I felt so small against this never-ending body of water. One thing I often tell myself is that God made so much more than Greenfield, Indiana. There is an entire world out there with all things from His creation and I wanted to see and experience as much as I can. I believe in rescue, rehabilitation, and release, as well as conservation and preservation.

My hope is that animals such as polar bears, great white sharks, penguins, orangutans, and elephants are around for our future generations. As an adult, I then worked to be financially capable to travel and see more of the world. As a female in the science field, I feel I have always had to work harder, have more experience, and be better than others in this highly competitive field. Even though I have only seen a small percent of our planet, by contributing as an environmental educator, I believe I can make a difference by inspiring others to become environmentally literate to help preserve our planet.

Path to my passion

It was the Spring of 2010, just before I was to graduate high school from Irvington Community High School in Indianapolis, Indiana. I had mailed out all of my college applications, had been accepted to one Indiana college, and had been denied admission to all three colleges across California I had applied to. I was feeling very defeated. I was in the gymnasium of my high school picking out my senior class ring when I began explaining to the gentleman selling the rings about what I wanted to do after graduation. He asked if I had looked at Florida. He could not remember the name of the college, but there was a school right on the water that specialized in marine biology. When I got home that same day, I did a general Google search for “Florida Colleges on the Water.” Eckerd College in St. Petersburg, Florida was the first search result. It was love at first click. The school’s website was incredible, and they had a rolling enrollment so I had not missed the deadline. I applied immediately.

My mother had been incessantly reminding me to send in my “I accept” letter to the Indiana school, but I was waiting to hear back from Eckerd. Two weeks went by and I

had still not heard. I told my mother I would mail my letter for the college in Indiana the next day since the deadline was fast approaching. I forgot to mail in my letter and received my acceptance letter from Eckerd that day. My mom was apprehensive to send me to Florida without having seen the school in person. She booked us a red eye flight for that weekend so we could visit the school. We were both enamored with Eckerd's beauty, reputation, and marine science program and I was able to confirm my acceptance in person. My dream of becoming a marine biologist was officially beginning.

Just two months into starting school, I met Captain Bill Hardman of the Aquatic Obsessions Dive Shop in St. Petersburg, Florida at the club fair on campus. I called my mom and begged her to help me (and allow me) to become Scuba certified; that this would be necessary if I want to be a marine biologist. I explained that so many marine biologists use scuba diving as a tool for their research. One example of this is how Ciaran Hyde (2022) used scuba as one of her tools to determine Important Shark and Ray Areas (ISRAs) to create protected areas for sharks. As always, my mom (and the rest of my extended family) pulled through to help me go through the program.

In just three years, I had completed four certifications: Open Water, Advanced Open Water, Nitrox, and Limited Wreck Penetration diving. I had been diving in the Florida Keys, Rainbow River, Crystal River, off of Venice Beach, Fort Lauderdale, and in Roatan, Honduras. By my senior year at Eckerd, I decided to pursue the rigorous course to become a Divemaster. I aided in the instruction of Open Water classes for new divers by teaching the students emergency ascents, how to clear their masks, how to enter the water, and how to assemble their gear. I remember teaching a freshman named Serena specifically. We were in the shallow end of the pool where she could stand up if she

needed, but on our knees we were under water practicing how to clear her mask. She probably tried at least fifty times. The rest of the group had moved on and I was working one-on-one with her until she got it. Just when she started to feel completely discouraged, I calmed her down and taught her my trick. We went back under water and she finally cleared her mask and gave me the “OK” sign and her eyes got so wide. We stood up and she exclaimed, “I did it! I did it! Thank you!” She was beaming and so was I. That was my first exposure to the “A-Ha Moment.” The moment that something clicks in a person’s brain where they completely understand something and have a sense of achievement and accomplishment.

The marine science program at Eckerd was extremely difficult. It is such a demanding program because the student obtains a Bachelor’s of Science degree, which has several more requirements than a Bachelor’s of Arts. It entailed long days and evenings in classrooms and labs along with hours outside in the Florida sun collecting data and doing research. But I loved every minute of it. My grades throughout all four years stayed steady with B’s and C’s. I felt very average in these classes. I felt like I never stood out and I needed something that would set me apart from the rest of the class. I was not excelling enough to become a tutor or teacher’s aid, I did have the dive shop, but I wanted to start volunteering somewhere as well.

The Clearwater Marine Aquarium was about forty-five minutes north of Eckerd College. Nothing in particular drew me there, let alone to their education department. I applied to volunteer and I was accepted and placed on their Sea Life Safari adventures offered to guests. I was on the boats as a deck-hand. There was also a captain, an educator, and one other volunteer, along with the boat full of guests. We would take a

tour of the Intercoastal Waterway observing various sites along the way, and do a brief stop at Shell Key where guests could get off and explore a small island on their own. My role was to set a seine net in the water. We would catch an array of fish and invertebrates, all of which would be used as data for the Florida Fish and Wildlife Conservation Commission (FWC) for their biodiversity database. I later went on to volunteer with the FWC as well. Once the organisms were on board, we would divide them by species, do a quick tally, keep one of each species in a small water-filled container on board, and release the rest. We would then bring each species we caught around to the guests as a Show-and-Tell where we would talk about each species and its role in the ecosystem. I would be the one passing around the animal, and the educator would be on a microphone talking about the animals we caught, our procedure with the seine net, the estuary ecosystem we are in, conservation messages, and so on.

This program was so much fun and an incredible experience. Yes, it was very hard work, I would be tired and dirty, but this was the second place to which I experienced the “A-Ha Moment,” the “wow” look on the guests face when we would pass a pod of dolphins or caught a really neat fish. This was the moment that I knew what I wanted to do with my marine biology degree. I had not yet heard the term “informal education,” but I knew I wanted to be the educator on the microphone, inspiring the masses about our amazing planet, the ecosystems, and the incredible organisms that inhabit it. However, these kinds of marine wildlife tours have been a benefit to marine conservation for years. In 2008, Heather Zepple found that visitors who took one of these tours had more emotional empathy and higher learning with a greater intention to contribute to marine conservation.

Professional Journey

Looking back at my career in the marine biology field, there have been trials and triumphs. Marine science is a competitive field, and knowing I didn't have outstanding grades in my undergraduate program once I graduated, I used all of my volunteering and working experience to help obtain my first job as a marine biologist. An Eckerd College professor would send out emails throughout the year of various job openings, internships, and volunteer opportunities within the marine science community. Among these emails was a job posting with the National Oceanic and Atmospheric Association (NOAA) as an Alaskan Observer. This was a field job and since I was fresh out of college, I wanted the opportunity to see the world. I was accepted in October of 2014 and left Christmas Day for training in Seattle, Washington.

The role as an Alaskan Observer is “to help the government obtain the data necessary to achieve a sound management plan for the protection and benefit of future fisheries resources in the Bering Sea, North Pacific, and on the West Coast” (Alaskan Observers, N.D., <https://www.alaskanobservers.com>). This was a very dangerous career. According to OSHA, fishing and hunting workers are the number one most dangerous jobs in the world, with logging being the second. “These often hazardous conditions make this profession the most dangerous in the nation. Drowning is often the reason cited behind fatalities, but injury using heavy machinery can also contribute to deaths on the job” (Invictus Law, 2022, <https://www.invictuslawpc.com/most-dangerous-jobs-osha/>). However, I felt like an actual marine biologist making a difference in the world.

During my one year contract with Alaskan Observers Inc. I was stationed at a home base in Seattle and completed three deployments to Dutch Harbor, Alaska. I

boarded dozens of vessels and would complete trips with them that would last anywhere from three days to one month. I worked alongside the fishermen both on deck and below deck collecting samples of their catch in nets that were as long as two football fields. I counted and weighed millions of pounds of fish. What made the danger and the intense training all worth it was the absolute beauty of Alaska. While I was in town, not on a boat, we would whale watch from the beach, hike a small mountain named Ballyhoo eating salmon berries along the way, and watch the sea otters playing along the shore. I made life-long friends from all over the country and truly discovered myself as both an individual and as a scientist. I also felt valued.

The data I collected from these commercial fishing vessels was vital to the fishing industry. One of the most important aspects was logging the data of high priority species such as halibut and salmon. Each vessel had an allotted allowance it was permitted to catch of these species. If a vessel exceeds their limit, by law they must terminate their fishing trip, even if they had not reached their quota for the target species. In a very real sense, my data could close down a fishery. This is why it was so important. My data maintained a healthy fishery.

Being so young in the field, I did not fully grasp the bigger picture of my data. I understood the data was necessary, but did not think about the environmental impacts it had as well. A healthy fishery is necessary for a healthy ecosystem. Since working with Alaskan Observers Inc, I have learned the severity of the problem of overfishing along with debris waste of discarded fishing gear in our oceans. From this knowledge my passion for conservation and the notion of environmental education really grew.

Reconnecting with Marine Biology

I continued with Alaskan Observers for 3 years in both Alaska, and the Pacific Northwest in California and Oregon. In 2017, I put my career temporarily on hold as I got married and started a family. When the global pandemic happened in March of 2020, I was laid off from a temporary job and found myself evaluating where I was at in life. I tried to think back to what I was doing when I was happiest and I remembered those days on the Sea Life Safari vessel teaching guests about the Florida ecosystems at the Clearwater Marine Aquarium. The word “education” kept floating around in my head and I just couldn’t shake it. I went down a path on the internet trying to understand what it was I wanted to do. I wanted to teach, but not be a teacher.

Countless hours were spent during quarantine researching programs and trying to understand informal versus formal education, when I learned about environmental education. Once I started searching this term, I found a program at Hamline University. A program that was a Masters in Education: Natural Science and Environmental Education. The program was perfect, everything I wanted and needed in order to get back to my true love and passion in life. I love being a mom and a wife, but I wanted to get back to being an advocate for marine science conservation as well. I applied to the Hamline Graduate program and was accepted in April of 2020, and then found out I was expecting my second child the following month. I knew it was going to be hard, challenging, and exhausting; but this made me want to complete graduate school even more, to set the example for my daughters that you can do anything. To keep pushing and to keep trying to achieve your goals and make your dreams a reality.

In August of 2022, I applied to my dream job at the Indianapolis Zoo. They had an opening in their education department as a Programs Educator. I had learned so much about informal education, environmental education, and how to be an effective educator over my courses at Hamline, that when I got the interview, I just let myself shine through the computer screen. I was my genuine self; bubbly, energetic, and just let my enthusiasm and passion for marine environmental education take front stage. I truly believe that it was because of this program that I got the job.

Conclusion

At this point not just in my career, but in my life, I have found how necessary it is to do what makes you happy, what gives you that sense of fulfillment and personal achievement. At the Indianapolis Zoo, I have the privilege to connect with guests that range from three years old to eighty years old in our many incredible programs that the education department offers. At thirty-one years old, I have a deeper understanding of “What do I want to be when I grow up?”

I want to combine my current position as a Programs Educator at the Indianapolis Zoo, with my passion for marine ecosystems and organisms. I am obtaining my Master’s Degree to be an Environmental Educator for Marine Biology. I have created a two day camp that will be offered at the Indianapolis Zoo to children ages 11-14, a Shark Researcher Camp. In Chapter 2, I will review literature on the importance and benefits of getting children involved in education centers outside of the classroom by means of informal education. I will also review literature on shark evolution, biology, and management by means of conservation that will be presented during my camp. Finally, I will review why informal education is vital in zoos and aquariums despite a negative

connotation usually associated with these types of facilities. In Chapter 3, I will explain the project that I will present to the Indianapolis Zoo, including a powerpoint, curriculum, and program outline. Finally, in Chapter 4, I will contemplate how this program at Hamline and this Capstone Project has not only made me a better educator, but a better learner as well.

Rationale

During the first months of training at the Indianapolis Zoo, I shadowed a variety of animal encounters, classrooms, camps, and adventures. In October 2022, I was assisting with a Dolphin Trainer Camp with middle schoolers as the audience. I remember sitting in that camp thinking, ‘This would also be fun if it were about sharks.’ Thus, my Capstone Project was created. Creating the Shark Researcher Camp will highlight a group of animals that I consider to be a non-charismatic megafauna. In other words, a group of animals that are not usually considered a favorite animal, but ones that are so vital to our oceanic ecosystems. This program will teach kids how to be a scientist, about elasmobranch biology, how to be environmental conservationists, and will be a space where they can develop a love and passion for our oceans. I remember being the kid from Indiana dreaming about the ocean, and I want to provide the opportunity for other kids to find their passion as well.

Chapter Two

Literature Review

Introduction

The benefits of informal education can be measured in a number of ways. Formal education can utilize institutions that have informal/non-formal programs as resources in their arsenal of teaching techniques. As I have embarked on my journey as a Programs Educator at the Indianapolis Zoo, these resources are being underutilized because of the lack of knowledge that they are available. When educators, parents, tutors, supervisors, counselors, and leaders become environmentally literate, they can make educated decisions in their own lives and in the lives of the children in their care in order to protect and conserve our planet.

On a daily basis, I have the privilege to see guests of the Indianapolis Zoo making personal connections with animals they love. One Sunday, a woman and her family drove to Indiana from Ohio to experience an encounter with a sloth. They specifically chose our program because it is an ethical tourism experience, meaning we provide the utmost care for our animals by not allowing guests to touch our sloths. When sloths feel threatened, they will stop breathing as a defense mechanism, and that includes being touched because they are naturally a prey species. Sloths in facilities that allow guests to hold them have shown higher blood pressure rates as well as shorter life spans. This woman and her family were so elated to be inches from the sloth and learn even more about her favorite animal, even without holding the animal. From guests giving an elephant a bath, to teaching a preschool class, to a middle school spring break camp, informal education can take on a variety of appearances.

Through a review of literature, I will explore a guiding question: *How can informal educators build deeper knowledge and connections to animals that are non-charismatic, such as elasmobranchs, to develop an understanding and need for environmental conservation?* In this chapter, I will look further into defining the phrase “informal education” and answering the following questions; Where can informal education centers be found? What are the benefits of getting kids outside of the classroom? What is environmental and ocean literacy? What conservation messages can be found in informal education? Utilizing my passion for the marine environment and for sharks and rays (elasmobranchs), I will explain why pursuing education outside of a classroom is vital to species’ survival and our planet’s conservation.

A Definition of Informal Education

Defining Education

Informal and non formal education can be found in any discipline across any field. When the term “education” is used, the default definition or connection relates to schools, or a formal classroom whether it be elementary education or higher education in a college or university. Most do not realize that even as adults, both formal and informal education is continuous. In a study by Raimonda Alonderienė (2017), he looks at both formal and informal education in an adult workplace. He conducted this study with the perception that “lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence” (Alonderienė & Sabaliauskaitė, 2017, p. 16). He concludes that informal learning is not necessarily intentional and that the person

who is learning may not even realize that they are contributing to their skills and knowledge.

In this study, Alonderienė looked at two companies within the aviation sector in Lithuania. This place of work was chosen because of the high level of intensity that goes into the employee's formal training. He measured informal education as extra training that had incentive, whether it was greater responsibilities, superior feedback, or monetary rewards. In the results, his thesis was supported in that the employees did not perceive that they were learning, just that they were continuing to fulfill their duties and responsibilities in their place of employment.

Infed is a not for profit organization that provides the opportunity to explore education further as well as pedagogies, change, and building community. In an article on their website, Tony Jeffs and Mark Smith (2019) have a very different perspective on the definition of informal education than Alonderienė's definition. While Jeffs and Mark acknowledge that learning goes on in daily life, they believe that it is a "spontaneous process through conversation and exploration and enlargement of experience. The purpose is to cultivate communities, associations, and relationships for human flourishing" (Jeffs & Smith, 2019, <https://infed.org/mobi/what-is-informal-education/>). Learning can be anything that happens in our daily lives such as talking with friends, teaching our children, or even learning a new skill or hobby such as scuba diving. Tony Jeffs and Mark Smith also point out that informal education can be found when involved with a youth or community organization where informal educators are a necessity to help stimulate such conversations. Jeffs believes that conversations can provoke us to change our habits based on the thoughts and exchanges that occur; not necessarily a

predetermined curriculum or plan. But is there a way formal and informal educators can work together to provide the deepest learning to make connections through mutual goals? Formal and informal education are respectively important when evaluating youth and our future generations.

Informal Education: Benefits to Students and Teachers

When investigating further into the relationship between formal education in schools with informal education, a balance has been found that students benefit greatly from being outside of a classroom. It is a connection that is mutually beneficial to educators and students alike. Haim Esach (2007) wanted to understand how the learning of science affected students. The time spent in school is only a fraction of the total time a child is awake, approximately 85% of their awake time is spent outside of a classroom. How can the time be maximized for learning in a classroom and how can we utilize the time outside of a classroom for learning purposes?

In his introduction, Esach distinctly separates and defines both informal and non-formal education by stating,

Non-formal learning occurs in a planned but highly adaptable manner in institutions, organizations, and situations beyond the spheres of formal or informal education. It shares the characteristic of being mediated with formal education, but the motivation for learning may be wholly intrinsic to the learner.

Informal Learning applies to situations in life that come about spontaneously.

(Esach, 2007, p.173)

The term “edutainment” was used while describing informal learning; when education is paired with entertainment, the education aspect will generally be the loser. However, kids

need that sense of purpose and fulfillment while having fun. By combining learning into a game such as a scavenger hunt through a museum exhibit, it is possible to achieve both.

Through the perspective of Haim Esach, it seems there is still a disconnect between schools and informal educators. He argues the amount of challenges and difficulties that go into planning for taking students out of the classroom to alternative learning facilities, is not the most effective way to induce science learning. He proposes bringing those learning facilities into the classroom itself in order to bridge the impact and benefits non-formal education has on teachers and students alike; this ideology would also maximize the little time students spend in a formal science classroom.

The benefits of informal education to both students and teachers have been documented in numerous ways across various studies. In a Capstone Thesis for Hamline University by Colin Johnson in 2017, he looked at multiple studies of how science subjects can be delivered in an engaging way to inspire higher science careers. He believes that “making connections comes from using outside resources from partnerships w/ informal learning institutions” (Johnson, 2017, p. 17). For his research question, Johnson wanted to look at the actual impact that informal education had on formal education by means of a series of questions conducted in a survey. Johnson wanted to know if informal education helped teachers feel more prepared in their science teaching methods. After collecting fifteen responses from formal science educators, the consensus was that they felt more prepared to teach science after attending an informal education workshop. The teachers learned something new that they would be able to implement into their classroom.

Both Esach and Johnson agree on the importance of informal education, but there are a variety of ways it can be included and incorporated with formal education. Is there a better way, or a more effective way to utilize informal education? There are a lot of questions and opinions that can be included in this topic, and it may vary from school to school. Some schools may have access to more resources that can include informal education more often. Other schools may not have access to any resources that could help utilize external learning centers. However, the first step is understanding the advantages of these learning centers.

Pros and Cons of Field Trips

The second step for teachers to successfully utilize informal education is to understand what facilities and resources are available. In Esach's study from 2007, he highlights learning centers that are found in museums and science centers. A science center can be anything from a local nature center to a public library. They can also be found in larger institutions such as zoos and aquariums. If a facility offers resources for schools, typically an "Education" tab can be found on their website. During the global Covid-19 Pandemic of 2020, these resources became even more accessible to teachers. Online resources became the only source of informal education as these large facilities were closed. These sources continue to remain a popular option for schools with limited resources. An example of this can be found on the Georgia Aquarium website. At <https://www.georgiaaquarium.org>, the "Programs" tab is found at the top of the page which produces a drop down menu. There are so many options available for field trips, education programs offered in person at the aquarium, home-school resources, and virtual programs.

Field trips are an important part of a learning experience on any topic or in any curriculum. They put words into action by bringing something you are reading about in a book to life and provide the students a way to see and experience the world. However, there are many difficulties and challenges that go along with organizing and executing a successful field trip. I conducted an interview in 2021 in order to investigate these challenges by interviewing two teachers in formal schools and the Lead Naturalist at Brown County State Park Nature Center in Nashville, Indiana. The teachers were Ronda Hallquist, a high school chemistry teacher at Irvington Preparatory Academy in Indianapolis, Indiana, and Deborah Ownbey, a 3rd grade teacher at Blue Lake Elementary School from McKinleyville, California. The conversations with these individuals surprised me in that their answers were so similar. The two teachers agreed that field trips are overall beneficial to both the students and the facility in which they visit. When asked “Do you notice a change in interest from the students when a topic includes a field trip?” Mrs. Hallquist responded, “Absolutely. When we are studying something they can pull the relevance and they can connect different ideas together based on those experiences.” When comparing how a high school student would benefit from a field trip to an elementary student, it is understandable there will be a maturity difference. But Mrs. Ownbey responded, “There is an interest, but there is also a build up of excitement... (the field trip) can inspire them to want to learn more or find a passion.” Even with the age differences, both teachers felt that field trips inspire students to think about their futures. (Ronda Hallquist. Deb Ownbey. Personal Communication. 2021).

Field trips are equally important for the facilities as well. Brown County State Park is located in central/southern Indiana. The Nature Center is a small institution that

“offers interpretive naturalist services and programs year-round, such as guided hikes, history talks, guest speakers, and more.” (<https://www.browncounty.com/listings/brown-county-state-park-nature-center/>). This is one example of a potential destination for an environmental education field trip for an Indianapolis school. The head naturalist at the nature center believes field trips, especially nature-based field trips “provide the ability to reach the kids who would otherwise not be able to visit, because their parents are unable to bring them.” (Paul Hautler. Personal Communication. 2021).

A field trip does not necessarily need to be a long distance destination. For schools with fewer resources, a field trip could also mean a walk outside the building. In 2006, Paul Jeffery conducted a Capstone Thesis for Hamline University studying outdoor learning as an alternative to the classroom. He researched the question, *does learning outside increase motivation and enthusiasm of students?* In his methods, Jeffery obtained data over a three week period during the summer with twenty-five students and three teachers and how they performed when they were learning outside. He asked a series of questions at both the beginning of the summer and at the end of the summer and split the students by gender to obtain the answers. Overall, when the students knew they were going to be learning outside on a particular day, they were more motivated to participate in the instruction and activities. Using the outdoors as a tool for teaching is extremely beneficial for student productivity and retention. The buildup of excitement from a field trip both near and far can ignite passion.

Environmental Literacy

Discipline Specific Literacy

Marine Biology as a discipline in informal education heavily relies on particular language functions and needs to take into account the various backgrounds that the students have. Science in particular can be especially precarious because each field of science has its own language. Marine Biology can be classified as a mixture of life and earth sciences and the language is dependent on the unit. In a text by Heineke and McTighe (2020), the importance of the various languages needed in every discipline is explained. They determine that, “Teachers need to first consider the language of particular units of study to engage all students in authentic learning and corresponding language development around scientific understandings, concepts, and processes,” (Heineke & McTighe, 2020, p. 89) This includes the general goal of environmental education, which is an overall understanding to create environmental literacy which will lead to pro-environmental actions and lifestyle changes. By knowing and understanding the goal of environmental education Heineke and McTighe also explain that we are able to “plan curriculum units that include desired understandings and performance tasks that require transfer.” (Heineke & McTighe, 2020, p. 8). Even though terminology may vary, understanding that language and culture are reliant upon each other is the beginning of understanding literacy.

Literacy, or being literate, is the ability to read and write. However, there is more to literacy in the need for a deeper understanding. In an article published by David Orr, he describes environmental literacy as needing to have the knowledge, tools and sensitivity to address an environmental problem properly. By doing this, you can

understand their professional capacity and to routinely include the environment as one of their considerations in their daily lives and work. So what would happen if this kind of literacy was applied in formal classrooms? As important as it is for our students to be linguistically literate, it is equally important for them to become environmentally literate, but that starts with the teachers. Orr describes six ways in which environmental and ecological literacy are important in a formal classroom and why. However, the biggest understanding is that environmental literacy is not always straightforward, but most of the time, complex. It requires a mixture of indoor and outdoor learning, understanding the complex issues, that we need to experience the world in order to understand it, and that the way in which the material is delivered is just as important as the material itself. By having a grasp on these concepts that Orr proposes, we can obtain that deeper understanding that is literacy and apply it to conservation efforts based on the issues at hand with our environment.

Conservation Attitudes

Once a person is equipped with the knowledge and understanding of the environmental issues found in our world, they are able to make conscious pro-environmental decisions and actions in their daily lives. In a study conducted by Anja Kollmuss in 2002, he wanted to understand why people act environmentally and what are the barriers for people from that pro-environmental behavior. He compared linear models, social behavior models, and sociological models.

First, the linear models explained that just because someone has the knowledge means they will automatically act upon it. This theory was eventually proven wrong in the 1970's. Second, Kollmuss looked into altruism, empathy, and prosocial behavior

models which relied heavily on mathematical equations that motivation can actually be measured. He explains that voluntary and intentional behavior that results in benefits for another, whether it is a positive or negative motive. Last, the sociological models looked at the actual barriers that prevented people from being pro-environmental. He found three main barriers: individuality (laziness), responsibility (there is no need for my help) and practicality (lacking on time, money, etc.).

Kollmuss acknowledged that there are numerous factors that contribute to a person's emotions. Emotions are complex with internal and external factors that overlap along with personal views, values, and personality traits. He explains in his analysis that:

Environmental knowledge is a subcategory of environmental awareness and that emotional involvement is what shapes environmental awareness and attitude. This difficulty in defining and delimiting the different factors is due to the fact that most are broadly and vaguely defined, interrelated, and often do not have clear boundaries. (Kollmuss, 2002, p. 248)

Jeffery Swanagan is an author that has a more simplistic approach to how people have conservation attitudes. He believes that it is through personal connections, experiencing issues and ideas firsthand, that a person will become more environmentally conscious. To support his theory, he conducted a study at Zoo Atlanta. Swanagan hypothesized that visitors who had an interactive experience with the zoo's elephant demonstration and bio-fact program would be more likely to actively support elephant conservation than those who simply viewed the animals in the exhibit. The experiment took guests as they were leaving the Atlanta Zoo and gave them an exit survey of 25 questions. They were then asked to sign a petition and/or were given a solicitation card

over a two week period. The results were based on the cards returned and supported his hypothesis. The data shows that the more programs a zoo or aquarium offers, such as animal interactions, computer technology access in exhibits, more information boards, the guests felt more educated and enthusiastic to participate in conservation efforts. Swanagan considers these to be “empowerment variables.”

An example of a few questions Swanagan asked on his questionnaire can be found on Table 1 page 29.

TABLE 1: Elephant Survey: Experience With Elephant Show or Bio-Fact Cart
(Swanagan, 2001, p. 29)

Question	Response	%	Frequency
Q11. Have you ever seen an elephant show or demonstration?	Yes at Zoo Atlanta	17	61
	No	19	69
	At another place	43	155
	At both Zoo Atlanta & another place	21	78
Total		100	363
Q12. Have you ever touched something made from an elephant?	Yes at Zoo Atlanta	12	42
	No	21	76
	At another place	54	198
	At both Zoo Atlanta & another place	13	49
Total		100	362

Swanagan does agree with Kollmuss when it comes to positive incentives or being rewarded for participating in these citizen science programs. A few ideas that Swanagan explained that:

Newsletters containing current information about conservation efforts should be sent to individuals who have acted in a citizenship capacity. Other forms of reward could be discount coupons, passes to the zoo, and photographs of elephants, t-shirts, and other memorabilia. A reward would encourage visitors to repeat that citizenship behavior. (Swanagan, 2000, p. 30)

While comparing the studies of both Swanagan and Kollmuss, both explain that having a conservation attitude is not as simple as it sounds. Multiple factors come into play for every individual that is exposed to environmental issues. Once a person feels that personal connection with something they already have a fondness for they begin to think environmentally.

Ocean Literacy

The discipline of science is extremely broad. It can be broken down into dozens of subcategories based on personal interests and can be pursued as such through degree tracks at universities. The undergraduate degree that I pursued was Marine Science - Biology Track, because that is where my passion lies. The ideas and concepts we have already looked at with environmental literacy can be applied to marine science known as ocean literacy, or the full and deep understanding of the marine ecosystem and all of the environmental issues and conflicts associated with the marine ecosystem. While the vast majority of the population in the United States are considered landlocked and not near a coast or major body of water, the challenge is getting those people to understand that they are still able to impact and make a difference when it comes to our oceans.

In a study by Helena Barracosa, she looked at just this challenge: how do we, being landlocked in the United States, influence the ocean? This question encompasses

what it means to be “ocean literate.” The term ocean literacy does not just mean knowing how currents and tides happen or the main environmental issues occurring in our oceans, such as pollution and coral bleaching. Ocean literacy is about how humans affect the ocean in both positive and negative perspectives. In order to increase ocean literacy among citizens and educators, Ecosystem Services (ES) has been coined as a concept about how the ocean influences us, and how we in return influence the ocean.

This article looked at how a variety of ocean literacy education programs in Portugal were contributing to knowledge growth and impacts on behavior (if people become more environmentally responsible). The goal is “Educating people on marine ES, so they get a better understanding of the tight bond between natural habitats and human well-being, constitutes a powerful strategy to advance toward a more ocean literate society...” (Barracosa, 2019, p. 2). This article is impactful regarding ocean literacy because it gives a precise definition as well as examples for how to apply different projects or programs in our own lives to become more literate. Some of the programs used in Portugal included teacher training, ES projects in classrooms, books on ES, “researcher for a day” program, and informal education (radio interviews, exhibitions, and nautical fairs).

This circles back once again to both formal and informal educators becoming environmentally literate. As adults, we need to take it upon ourselves in our personal lives to partake in these free-choice learning programs so we can pass our knowledge on to the future generations to continue to protect and preserve our planet. For those who are landlocked, that means continuing to encourage and participate in field trips in any form. A free-choice learning experience was performed in a study by Heather Zeppel. She

investigated the emotional responses, conservation benefits, and overall education of marine wildlife tours and experiences from 18 published studies. The goal that all environmental educators want when individuals visit them to learn about their area of discipline, is to see that people make a personal connection with what they have just learned and to change their daily behavior or lifestyle to impact their environmental responsibility. This can be achieved in numerous ways, but this study looked further into free-choice learning experiences. “Settings for free-choice learning include libraries, museums, aquariums, zoos, botanical gardens, science and visitor centers, and guided recreational activities or nature tours” (Zeppel, 2008, pg. 5).

While animals in human care remains a topic of much debate, it is undeniable that “they provide a range of education and conservation benefits for visitors, including emotional responses and learning” (Zeppel, 2008, pg. 3). However, free-choice learning also looks at programs such as wildlife tours (whale watching, swimming with sharks, sea turtle nests hatching, etc.). Any act taken upon a visitor to increase their own knowledge could have the potential of positive impact on conservation efforts. These kind of studies need to be continuous and ongoing because it is challenging to accurately measure how significantly one person’s behavior changes after participating in a dolphin encounter. Studies also need to be done to see if there are any impacts on the animals themselves. However, if a person can adjust their lifestyle by contributing to any action listed in Table 8 from Zeppel’s study on page 11, it is a step in the right direction.

TABLE 8. Conservation Appreciation or Action Endorsed by Visitors to Sea World Australia (R. Saltzer, 2001, p. 11)

Conservation appreciation or action	Response (%)
Education	26
Recycling	20
Giving money	14
Supporting Wildlife Networks	13
Respecting wildlife	12
Looking after animal habitats	8
Reducing pollution	8
Awareness of wildlife	6
Conserving energy or water	6
Cleaning up waterways	5

Education Opportunities Within Zoos and Aquariums

The Zoo Discord

Education and conservation have been the foundation of zoos and aquariums for generations. Throughout the years, zoos have had both positive and negative feedback from both guests and scientists alike in regards to animals in human care. Both sides provide valid evidence to support each argument. Are zoos beneficial? Do they cause more harm than good? Looking into these questions through peer reviewed sources, we can determine for ourselves how we want to view zoos and aquariums. Regardless, they do provide countless opportunities for education.

Early in their establishment in the 1960's, zoos were thought to be places of entertainment and recreation. Their original approach was to essentially place animals on display so people could see strange creatures from other places. Due to this, zoos have a need for constant validation which some believe have turned them into the “model citizen” of a city. In a study conducted by Patricia Patrick in 2012, she wanted to learn further why zoos existed and if they were truly “practicing what they preached.”

Patrick wanted to know why guests, scientists, and professionals believed zoos were bad by looking at mission statements and goals of zoos as the argument. She believed that:

Due to the deteriorating link between humans and the nonurban natural world, zoos are coming under pressure to develop conservation plans and educate the public about the living world while maintaining financial stability. Therefore, zoos have evolved to include education as a priority along with conservation and research. (Patrick, 2012, p. 20)

Because of this, Patrick believes that the general population of zoo visitors and professionals alike agree that zoos have evolved from a place of entertainment to a facility of education, conservation, and research.

Regardless of the feelings of guests, people still visit zoos and aquariums on a regular basis. "More than 600 million people—approximately 10 percent of the world's population—visit over 1300 zoos and aquariums throughout the world each year" (Packer, 2010, p, 25). In a study done by Jan Packer, she wanted to understand the opportunities provided by zoos and aquariums for people who live in urban settings to connect with nature or for people to see exotic animals from different parts of the world.

Packer agrees with Patrick that over the years and throughout history, zoos and aquariums have played many roles but have recently made environmental education a more central part of their mission. However, Packer noticed that patrons visiting these institutions typically do not have education at the top of their to-do list. So how can the zoo or aquarium target a visitor's interest and have evidence that learning is taking place or have an impact on their environmental behaviors?

Packer found that visitors at a zoo or aquarium are more interested in a "fun" experience as opposed to learning like they would at a museum. Thus, he looked further into "educational entertainment." The success is found when previous visitors record a change in their personal habits as a result from an experience at the zoo or aquarium they visited, such as, cutting out plastic in the home, volunteering, changing purchase habits, and discussing environmental issues with others. This then provides another example of "free-choice" learning and we learn that there are different kinds of learners that visit zoos and aquariums. Some examples may be a hobbyist interested in bird species, an explorer, or even an experience seeker, to name a few.

"Zoos and aquariums have the potential to reach large numbers of the general public... and the need for individual and community action" (Packer, 2010, p. 32). By creating learning experiences that make learning a fun experience, guests may be learning while not even realizing they are learning. At the core, that is the goal of informal education. The next step would be determining if this learning style is beneficial in the long term. In other words, does the information stick beyond the learning place to where environmental lifestyle changes continue for years to come and into future generations?

Does Informal Education Work?

You visit a zoo, and you decide to attend a bird talk. You listen to an expert speak about birds and educate you on that species and their habitat. How much of that information do you remember six months later, or a year later? Did you really learn anything? A study conducted by Courtney Collins in 2020 set out to look at the effect of learning beyond immediate exposure from an informal setting at a zoo. They compared a five-day learning camp at a zoo and a school field trip (one day) for students aged 9-12 years of age. After six months, they investigated the children's material knowledge, attitude, and knowledge of positive behavior. She found that, "recent research confirms that children do learn as a result of a trip to a zoo or aquarium, particularly when accompanied by an educational intervention" (Collins, 2020, p. 1008).

The results from Collin's study showed that learning was positively affected by active participation in educational intervention. The children from the camp showed higher knowledge than the field trip students, showing duration of participation and exposure has an influence as well. These results are important for the zoo community. There have been mixed emotions regarding animals in captivity and there is little understanding of children's attitudes towards zoos and captive animals. The results show the reasons for keeping animals in captivity. The study also shows the conservation value of animals in human care, and should be introduced into the curriculum of zoological education programs to enhance learning for children and adults.

Collin's study is updated information from studies that have been conducted over the years. To compare, in 2009 a similar study was done by Jan Mokros. This study taught third to fifth graders about observational data while in math class. While this

seems like a sophisticated topic for children of such a young age, it also taught them how to connect with what they are learning in other contexts by conducting their own observations, surveys, and experiments and drawing their own conclusions. Children of this age need experiences such as this in order to gain confidence that they can apply to all areas of academics. Working with a zoo educator and studying animals lead to higher involvement and engagement with data collection in elementary aged children.

Not only did this article provide an excellent study of an informal education setting experiment, it also gave insights for teachers for how to make the most of the experience while at the zoo. The authors gave examples of questions to ask the educators, how to prepare for the field trip, how to guide students in their data collection, and what to do with the data back in the classroom. The emphasis of the connections the students can make between what it is they are studying to the data collection itself, teaching them that it can be so much more than that, agrees with the study by Collins.

When it comes to retention of information in an informal learning setting, guests want to be engaged and entertained while they are learning. Sometimes, guests don't even want to know that they are learning. However, the more time a person spends learning about an animal, an ecosystem, a habitat; the deeper learning they will have and the longer that information will stay with them. For a student, they need to be given the opportunity for a more independent learning experience, while under supervision, so they can determine that personal connection for themselves. "As well as increasing students' understanding of scientists' work, learning in zoo and aquarium contexts can greatly enrich the connections that students make with observational data" (Mokros, 2009, p.

530). Through personal connection and active participation in learning a person can retain anything they learn at a zoo or aquarium.

The Importance of Elasmobranchs: A Non Charismatic Megafauna

Apex Predator Through History

Elasmobranchii is a subclass of fish vertebrates that includes sharks and batoids (rays). The subclass includes nine orders of sharks and four orders of batoids. These orders then further break down into families. The orders describe the wide range of size, adaptations, and the over 400 species of sharks that exist today.

Sharks have been around for millions of years. Fossils have been found that date back to 410 million years. These animals are living dinosaurs in a very real sense. In an article published by the Natural History Museum, author Josh Davis describes the ample examples of fossilized shark teeth and the various species of prehistoric sharks they belonged to, both extinct and that exist still today. Evolution has barely altered these apex predators and they have essentially survived five mass extinctions.

There is no single reason sharks survived all five major extinction events - all had different causes and groups of sharks pulled through each one. One general theme, however, seems to be the survival of deep-water species and the dietary generalist. It is possible that shark diversity may also have played an important role. (Davis, N.d, <https://www.nhm.ac.uk/discover/shark-evolution-a-450-million-year-timeline.html>)

He believes that it is the extreme diversity of sharks that allowed them to not only survive throughout history, but thrive.

This diversity is immense. Sharks range in size from a six-inch lantern shark to a 40-foot whale shark. Their jaws are adapted to either be filter feeders to eat plankton, crushing jaws able to easily consume a crustacean, to serrated teeth able to cut through sea turtles or marine mammals with ease. Sharks are also both oviparous and viviparous, meaning some species give live birth, and others lay eggs. Some species of sharks must continue swimming in order to breathe while some are able to lay stationary on the seafloor and manually pump water over their gills in order to breathe. The diversity of this megafauna means that they are found in every ocean around the world.

Contemporary sharks, or modern day sharks, are vital to our ecosystems. A few examples of this can be found in a study by Yagnesh Motivarsh where he looked specifically at the importance of sharks in the oceanic ecosystem. He lists the specific reasons why sharks are important. First, he labels sharks as an indicator species. This means that their presence or absence affects that ecosystem and reflects the environmental condition. “Sharks are one of the most important groups of predators on the planet and have a broad distribution of habitats in every ocean. Sharks play a function of keystone predators and they are important for maintenance and stability of the food chain” (Motivarsh, 2020, p. 611).

Motivarsh agrees with Davis in that it is their diversity that has allowed Chondrichthyes (sharks, rays, skates, and chimeras) to have lived this long and through immense evolution has kept them an apex predator. The reasons Motivarsh lists as why sharks are important are that they play an important role in the carbon cycle of the ocean, they create stability and maintain the food web, and they even help the economy. Studies found that in North Carolina, sharks impacted the scallop market. With fewer sharks,

their prey, stingrays, had an increase in population which meant more stingrays were eating scallops. This meant there were fewer scallops for merchants to harvest and sell to the North Carolina population. Balance is a necessity in the ocean.

Another example of balance was found in Hawaii. Tiger sharks are a key species in this ecosystem whose main food source is sea turtles. When the population of tiger sharks declined, the population of sea turtles increased. This meant there were more sea turtles foraging on the seagrass in Hawaii. Seagrass is its own ecosystem in that it provides food, shelter, and geological stability of the sand. Many invertebrates and microscopic organisms call the seagrass bed home, so with more sea turtles grazing on the seagrass, it affects the entire food chain.

Sharks are a vital animal to the oceanic ecosystems. They have survived the test of time and continue to play an important role in the world. Scientists have only just begun to fully study sharks in recent years because for so long, they were feared and categorized as unintelligent killers. The more scientists discover and learn about sharks, we now understand this is far from the case.

Biology, Adaptations, and a Sixth Sense

After learning the diversity of elasmobranchs, it is possible to look deeper into these adaptations to understand why sharks have survived as long as they have. A few key characteristics that define a shark are: a cartilaginous skeleton, no swim bladder present for buoyancy, ampullae of Lorenzini, denticles, and five or more gills; to name a few. (NOAA Fisheries, 2017, <https://www.fisheries.noaa.gov/feature-story/12-shark-facts-may-surprise-you>).

Many studies have been done on the ampullae of lorenzini, otherwise known as a shark's sixth sense. The ampullae of lorenzini are jelly-filled pores at the end of a shark's nose that allow them to detect electromagnetic fields within the earth's crust as well as an acute sense of the vibrations while hunting for prey. These highly sensitive pores also act as electroreceptors. It has been demonstrated by scientists on Scuba, that when a shark is touched, caressed, or continuously stimulated on the end of its nose where the pores are located, the shark goes into a trance-like state where the animal can be flipped upside down and into a state known as tonic immobility. "It occurs in a variety of species, including many sharks and rays. This trance-like state can occur naturally but can also be induced by stimulating the tiny sensory pores located on their snout" (Shark Trust, 2020, <https://www.sharktrust.org/tonic-immobility>). In this state, a shark remains immobilized while the person gently holds and stimulates the ampullae of lorenzini and allows the person to obtain an observation of the animal up close. Some shark species have been known to go into tonic deeply, to where the shark can be turned upside down in a sleep state, and not have to be stimulated on the snout. Scientists have been able to conduct minor procedures with the help of tonic immobility such as inserting tags or even removing fish hooks from their mouths.

Scientists have been interested in behavioral studies to include the ampullae of Lorenzini since its discovery. In a study conducted by James Anderson in 2017, he wanted to investigate the depth at which sharks were affected by electromagnetic fields and their sensitivity towards magnets. This was achieved by observing juvenile sandbar sharks in captivity and their responses to both stimulated and unstimulated behaviors with the incentive of receiving food upon hitting a target. The hypothesis was supported in that

“magnetic field perception in sharks is not solely performed via the electrosensory system, and that putative magnetoreceptor structures may be located in the naso-olfactory capsules of sharks” (Anderson, 2017, p. 1).

In order to support his hypothesis, Anderson obtained juvenile sandbar sharks and successfully conditioned them to find a target to receive a food source as positive reinforcement within a tank encompassed with 100 loops of copper wire. Next, an inhibitor was introduced to see if the sharks would be deterred from the target by head-mounted magnets. When unimpaired, sharks displayed a 100% success rate of swimming over the target to get the food. While impaired, the sharks acted more erratically with greater tailbeat frequency and less passover frequency of swimming over the target. This experiment was conducted over ten trials with a group of five, seven, or nine sharks to produce accurate results. “Perception thresholds of elasmobranchs to electrical stimuli have been well studied. Elasmobranch primary afferent (sensory neuron) response characteristics indicate adaptations to detection of weak phasic (sinusoidal) electrical fields near 1–2 hertz (Hz)...” (Anderson, 2017, p. 8).

Through studies such as these, scientists are able to learn more about these animals that were once considered unattainable because of the oceanic ecosystem they live in. Whether scientists are studying the migration patterns of great white sharks, the parasites that only leave on the eyes of Greenland sharks in the Arctic, or the electroreceptors found in the ampullae of Lorenzini on Sandbar sharks, scientists can share their knowledge of a deeper understanding to this noncharismatic megafauna to ignite curiosity, understanding, and respect. This is necessary because sharks face multiple threats that require action to ensure their survival into the future.

Conservation Efforts

Although sharks have evolved and survived throughout time over millions of years, elasmobranchs are susceptible to a number of threats. Over the last 60 years, sharks have seen great biodiversity loss and exploitation. This can be caused by several things. First, the increase in presence of commercial fishing vessels. Whether as a target species or as bycatch, sharks get caught in large fishing nets all over the world. Once they are caught, they drown. Second, sharks are targeted in fishing industries throughout the world for the harvesting of their fins. Known as “shark-finning,” this process is when a fisherman catches a shark, cuts off the dorsal, pectoral, and caudal fins, and discards the remainder of the animal to sink and drown. Shark fin soup is a delicacy in Asian culture and most commonly consumed during weddings. Third, the ecosystem in which sharks live is being greatly reduced due to habitat degradation and habitat quality. This is caused by an increase in Nitrogen in the water. The higher the Nitrogen concentration in an area of water, the less oxygen present in the environment. This lack of oxygen has been named “Dead Zones” because fish need the oxygen in the water in order to breathe. Without oxygen, fish, including elasmobranchs, cannot survive.

These are just a few of the environmental issues pressing on oceanography and marine biology. Ciaran Hyde is an Australian marine biologist and shark biologist and researcher. She is looking to put sharks on the map by studying their biodiversity loss and determining Important Shark and Ray Areas (ISRA). She is doing this by identifying vital habitats to various elasmobranch species. One of her studies was published in 2022. She created this study based on a similar concept and study that had been done for birds in prior years. Hyde wants to focus on area-specific based conservation and protection in

order to determine areas critical to the success of sharks. Researchers have found that in 2002, the first species of elasmobranchs was placed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Less than 20 years later, there are now 39 species on the CITES Appendix II and 5 on CITES Appendix I. It is estimated that approximately 37% of elasmobranch species are near extinction due to overfishing alone. Due to these numbers, shark biologists are diligently working to determine effective conservation efforts, prioritizing those efforts, and sharing their knowledge for the general population to be informed citizens to make pro-environmental decisions.

In the study conducted by Hyde, she first made a list of the ISRA criteria such as reproductive areas, feeding areas, migration paths, and resting areas. Figure 2 of her published paper defines these and why they are placed as a criteria. With the guidance of the list of criteria, and with the help of various research groups, shark specialists, the ISRAs were identified. “The ISRA approach will directly contribute towards global conservation goals by focusing spatial management where it is most needed for sharks” (Hyde, 2022, p. 12).

FIGURE 2. The Important Shark and Ray Areas (ISRA) Criteria. The term ‘sharks’ refers to all species of sharks, rays, and chimeras (Hyde, 2022, Fig 2, p. 8)

ISRA CRITERIA

CRITERIA	DESCRIPTION
Criterion A Vulnerability	Areas important to the persistence and recovery of threatened sharks. (This criterion must be associated with an additional criterion.)
Criterion B Range Restricted	Areas holding the regular and/or predictable presence of range-restricted sharks, that are occupied year round or seasonally.
Criterion C Life-History	Areas that are important to sharks for carrying out vital functions across their life-cycle (i.e., reproduction, feeding, resting, movement, or undefined aggregations).
Sub-criterion C1 Reproductive Areas	Areas that are important for sharks to mate, give birth, lay eggs, or provide refuge and other advantages to the young.
Sub-criterion C2 Feeding Areas	Areas that are important for shark nutrition at one or more life-cycle stages.
Sub-criterion C3 Resting Areas	Areas that are important for sharks to conserve energy, often related to environmental conditions or temporal factors.
Sub-criterion C4 Movement	Areas used by sharks regularly or predictably during their movements, such as migrations, which contribute to connectivity of other functionally important areas.
Sub-criterion C5 Undefined Aggregations	Areas where an aggregation or assemblage of sharks regularly and/or predictably occur, year round or seasonally, but the function of the aggregation or assemblage is currently unknown.
Criterion D Special Attributes	Areas important for sharks considered for distinct biological, behavioral, or ecological attributes (unique or associated with a unique habitat type), or which support an important diversity of species.
Sub-criterion D1 Distinctiveness	Areas with sharks that display distinct biological, behavioral, or ecological characteristics.
Sub-criterion D2 Diversity	Areas that sustain an important diversity of sharks.

Once specialists and experts have the areas in which to focus their conservation efforts, their attention is then turned toward which efforts prove to be most effective? Salvador Jorgenson hypothesized in his study on emergent research for sharks that there is an effective way to prioritize conservation efforts to find a direction to protect elasmobranchs. He did this by surveying 100 peer reviewed papers. From those papers,

he compiled a list of 20 questions on conservation of elasmobranchs. He then answered these questions with the assistance of 47 experts. The questions were sorted into three categories: 1) Status and Threats, 2) Population and Ecology, 3) Conservation and Management. From the answers of his 20 questions, he was able to synthesize the knowledge and identify gaps that were able to suggest future directions and priorities for protection elasmobranchs.

The review done by Jorgensen is extensive. The 20 questions are listed in Box 1 of his study on page 172. One of his questions he explored was, “What is the role of citizen science in elasmobranch conservation research?” (Jorgenson, 2022, Box 1. p 172). His answer is fairly simple and straightforward. From more eyes being diligent on the beach to sport fishermen recording tagged sharks they find, citizens can be more diligent in their aid to shark research.

Tagged sharks are critical to the studies done by Hyde and Jorgenson. This is how shark researchers obtain all of their data and information. Tags allow scientists to see a world that was once believed to be a forever mystery. Through websites such as *Sharks Pacific* and *OCEARCH Shark Tracker*, and television specials such as Shark Week on Discovery Channel, a person does not need a marine biology degree to help aid in the protection of sharks. The more one learns about and understands about sharks, they can gain oceanic literacy to make pro-environmental decisions for shark conservation. For the vast population not near an ocean or beach, visiting a local zoo, aquarium, or nature center allows you to build personal connections with the marine environment to develop a respect or passion for these animals.

Conclusion

Based upon the reviewed literature, it can be concluded that informal education plays an important role in a child's educational career. While informal education can include any discipline, informal environmental education is a subject that deserves to stand alone. As a student begins to learn a topic within environmental education, they have the opportunity to explore a deeper connection with that topic to create deep understanding, passion, and a literacy of the topic. This is done by allowing the youth to learn in outdoor environments through formal education centers as well as on their own. A personal connection can promote conservation and preservation through education.

Chapter Summary

Informal education is imperative to teaching our youth things that they cannot learn in a textbook. Learning in an informal environment can be done in many ways at any age at any time. This literature review was done with the intention of supporting and obtaining a deeper knowledge of the guiding question: *How can informal educators build deeper knowledge and connections to animals that are non-charismatic such as elasmobranchs, to develop an understanding and need for environmental conservation?*

Throughout the literature review, the importance of informal education and the many forms it can take, is the common theme. While understanding the definition of informal education, it is understood that people do not always realize they are learning in informal settings. Bridging formal and informal learning environments creates excitement while learning a topic. When teachers and educators have a deeper understanding of an environmental topic, they are able to increase student motivation, especially when they

are able to incorporate a field trip, either right outside their classroom or to a local nature center or zoo.

Once a person has a deep understanding of a subject, the full understanding of a topic, they can apply that knowledge to other areas in their life to make pro-environmental decisions. For example, someone who is ocean literate is able to explain a current pressing environmental issue such as shark-finning. They can give you definitions, statistics, causes, effects, but also what can be done to help prevent this devastating environmental issue. These kinds of conservation efforts are important for each person to understand, but zoos and aquariums are able to reach the general public about many environmental issues and conservation efforts around the globe on a large scale.

In the next chapter, I will further explore the question *How can informal educators build deeper knowledge and connections to animals that are non-charismatic such as elasmobranchs, to develop an understanding and need for environmental education?* I will explore this question by creating a curriculum for the Indianapolis Zoo in a Zoo Explorer Camp, in which students have the opportunity to become shark conservationists and researchers.

CHAPTER THREE

Project Description

Introduction

With the literature review as a guide, this capstone project has been created with the ideas and concepts of backward design (Heineke and Mctighe, 2011) in non-formal education settings (Esach, 2007). Informal/non-formal education is essential for students as they can build connections in person to create a deeper understanding of a topic (Johnson, 2017). Chapter 2 describes how informal education can help with conservation messages so students and adults alike can learn about conservation efforts to develop literacy of a topic, such as environmental literacy and ocean literacy (Orr, 1992).

Understanding the current environmental issues that are affecting our planet is how we can change attitudes to promote pro-environmental actions and behaviors (Kollmuss, 2002). With a passion for ocean conservation, I developed a curriculum for the Indianapolis Zoo with the concept that when a person has a personal connection to an animal, they will be inspired to do more to help save that animal (Swanagan, 2000). While the idea of wanting to save animals that are considered charismatic, the cute and cuddly animals such as dolphins, may come a bit more naturally, the non-charismatic animals are equally crucial. Not only to their respective ecosystems, but the food chain as well. Sharks and rays are critical to the marine ecosystems as keystone species (Motivarsh, 2020), and by having an informal education curriculum dedicated to elasmobranchs, that passion and motivation to help protect them can be ignited.

In this chapter, I will describe the overall framework used to design the Shark Researcher Camp curriculum for the Indianapolis Zoo: Zoo Explorer Camp. With the

many resources, artifacts, and materials available, multiple tours, activities, and learning opportunities are represented in the camp. With the literature review as a guide, I designed this curriculum to help answer the question, *How can informal educators build deeper knowledge and connections to animals that are non-charismatic to develop an understanding and need for environmental conservation?*

Project Description

I joined the Education Team at the Indianapolis Zoo in August of 2022. Since then, I have learned about the many education programs that the zoo offers. While assisting in a two-day Dolphin Trainer: Zoo Explorer Camp, I enjoyed the concept of a focused itinerary of a topic. It was during this camp that I thought to myself, “This would be so much fun if it were about sharks.” From that thought, I began thinking about developing a curriculum for a Shark Researcher Camp.

The resources at the Indianapolis Zoo are immense. Located in the Hix Institute at the Indianapolis Zoo, we can design games, activities, give tours, and have access to a vault full of both real and model artifacts of animals and animal products to show to the public. The outline for this curriculum was developed from the ideas in *Understanding by Design* (UbD) by Wiggins and McTighe (2011). The backward concept found in UbD describes that the desired results are identified first. Second, the educator determines what is considered acceptable evidence, such as exams or final projects, that show evidence that the student understands the material. Then, the actual lesson planning and instruction is the final step.

To follow the UbD Backward Design, I first determined the goal of the Shark Researcher camp and that is: To create an environment where students can develop a

deeper connection and understanding to sharks and rays and how to collect data for scientific research to promote environmental conservation. Students will learn the biological mechanics of Elasmobranchs. The students will understand the different types of tags and trackers used and will learn how to ask a scientific question through the scientific method.

Next, I did an inventory of what kind of shark related artifacts were in the vault. Based on the artifacts gathered, I created the main topics I wanted to discuss. These topics were Biology (What is an elasmobranch?), A Shark's 6th Sense (electromagnetic fields), Shark Buoyancy (Why don't sharks sink?), The Scientific Method, and Shark Research and Conservation (Shark Tagging). I was able to find the Science and Engineering Processing Standards (SEPS) for the state of Indiana for grades 6-8 and apply those standards to this camp as well.

Demographics

This Indianapolis Zoo: Zoo Explorer Camp, the Shark Researcher Camp will be offered to the public for any middle school-aged child, 11-14 years of age. The camp will be located in the Hix Institute at the Indianapolis Zoo in Indianapolis, Indiana.

Utilizing data collected from the Education Team Board of Directors, dozens of schools in the city and surrounding counties are assessed for when the posted dates of school breaks are (fall, winter, and spring). Camps are offered by the Indianapolis Zoo during the most common weeks that schools are out so that as many students are able to enroll as possible, without missing days at their respective schools.

Camp Curriculum

Content

A Google Slides PowerPoint was created to help guide the topics. As this camp is meant to be more focused on educational activities and getting the students on grounds of the zoo to make personal connections, the Powerpoint consists of pictures to help identify the main biological features of sharks, facts and definitions, and slides on conservationists and conservation efforts. This also helps guide the conversation for the key talking points if another zoo educator were to run the camp as well. The PowerPoint is meant to be used sparingly so the students do not feel like they are in a lecture hall. The PowerPoint is meant to be the secondary material of education.

Activities and Games

The activities and games were designed with the concept of “edutainment.” (Esach, 2007). Games that are used often at the zoo in other programs such as the Shark Attack Game and Superfish, take what the students have learned about shark biology and turn them into an interactive game. I also included walks through the zoo through areas such as our Oceans building to be able to connect what we are talking about in the classroom to something tangible in front of us.

Another activity that is included with this camp is a “Behind the Scenes” (BTS) tour of our Oceans building where the students can see how we take care of our sharks, Smooth Dogfish sharks, and how we make our own seawater, as well as a BTS of our Commissary building to see where and how we source all the food for our animals, including our sharks and rays.

Artifacts

The artifacts collected for the Shark Researcher Camp can be found in the vault and the main office space inside the Hix Institute at the Indianapolis Zoo. These artifacts are inventoried and maintained by the education department. The artifacts I chose for this program include a variety of shark and ray jaws, dried shark egg casings, a rope that has multiple tags at different lengths to show the size of various species, an assortment of sharks teeth, as well as a few seal and sea lion artifacts as they are a great white shark's food source. These artifacts show the diversity of sharks and takes what the students are learning about in the PowerPoint and puts it in their hands to see and feel it to make a connection.

Experiments

Three experiments are conducted by the students. These experiments are designed to help the students understand shark biology deeper as well as the environmental issues facing our oceans. The first experiment is to understand how the electromagnetic field works. With the help of magnets, students will build a course and have to find out if their metal shark will be able to follow the magnetic path hidden on the opposite side of a piece of cardboard. The second experiment is to allow the students to understand why sharks don't sink and how they are buoyant without the presence of a swim bladder. The third experiment will teach the students about ocean acidification by creating a miniature-scale oceanic environment. In a small 3 ounce cup, vinegar and baking soda will be mixed together to create carbon dioxide gas. The students will observe what happens to the water beneath the paper cup in the larger, 10 ounce enclosed plastic cup.

Students will be able to measure the change in pH of water to better understand how ocean acidification works.

Final Project/Assessments

Informal education, where students are not inside a formal classroom, assessments such as exams are not commonly found nor necessarily wanted. The goals of this project can be determined in other ways. At the end of each day, campers will have the opportunity to display what they have learned by writing on a Post It note. The teacher will ask them to create and fill out at least one Post It note, this could be a new fun fact they have learned, a drawing, diagram, etc. Each student will stick the Post It note to a wall in the classroom with a goal of trying to fill the wall.

The larger “assessment” will take the form of a student presentation. On the first day of Shark Researcher Camp we will talk about how shark conservation is studied through means of tags. I will introduce a website called OCEARCH which is a non-profit organization that is leading shark research with real data in real time. Students will each select one shark from the map on OCEARCH.org and learn all they can about that shark; What is the species? Age? Gender? When was it tagged? Where did it travel this year? Is it full grown? At the end of the day on day two of camp, students will give a brief presentation of their shark to both their classmates and the parents at pick up.

Timeline

The concept of this capstone was created in November 2022 and the writing process of the capstone and curriculum began in January 2023. Chapters 1, 2, and 3 were completed on May 1, 2023. The drafts of this capstone project were completed and submitted to the Indianapolis Zoo for approval in August of 2023. After revisions and

with the help of other Program Educators at the zoo, the curriculum was completed July 24, 2023. Looking to the future, Shark Researcher Camp will be offered to the public for the first time over the spring break camp offerings in 2024.

Chapter Summary

This incredible opportunity will turn students into shark biologists. They will learn about the biology and management of elasmobranchs (sharks and rays) and their important role in our oceanic ecosystems. Students will have the opportunity to go behind the scenes in our Oceans building to discover how the Indianapolis Zoo brings the ocean to the Midwest. Using OCEARCH, a global non-profit organization leading shark research, students will select their own real-world shark and give a brief presentation on that animal and the data collected on it. Students will leave the camp environmentally literate and ocean enthusiasts wanting to help with ocean conservation.

Chapter Three described how informal education can make important environmental topics into fun educational experiences. Using the backward design, this effective curriculum can inspire students to want to protect sharks, why they are important, and how scientists study them. Through the various activities, games, tours, and materials, this camp will be an effective learning experience for any student that participates.

Chapter Four will be my reflection on this capstone project. It will provide a conclusion and potential answers to my research question. I will also discuss what other future programs or works could look like and how other education departments of zoos and aquariums could benefit from a program like this capstone.

CHAPTER FOUR

Conclusion

Introduction

Over the past three chapters, I have introduced my question of interest, utilized a variety of sources to help answer the question, and presented a two day camp for middle school students to feel more connected to our oceans. When reflecting on my question, *how informal educators can build a deeper knowledge and connection to animals that are non-charismatic, such as elasmobranchs, to develop an understanding and need for environmental conservation*, I believe I have answered this question. Students of all ages can benefit greatly from getting out of the classroom by formal educators utilizing informal education institutions.

In this chapter I will reflect on what I have learned, not just throughout this Capstone journey, but throughout my Hamline career as well. I will revisit the literature I had reviewed and how those findings shaped my project, any implications my project may have as well as limitations. In this chapter I will look ahead to any future research or projects that may benefit from my project, explain my results further to my question's answer, and finally reveal what overall benefits my Shark Researcher Camp will have not just for the student's themselves, but on conservation for our planet as a whole.

Major Learnings

For the past six years, I have been focused on trying to become an educator, a teacher. I had no idea where to start and I had so many questions. What is a curriculum? How do you plan a lesson? What is the most effective way to reach kids on a deeper level? I knew I wanted to teach but I just didn't know how. Reflecting back on these past

three years at Hamline University, and upon the questions just listed, I have realized that in order to become an educator, you must first become a learner. When we understand how a person learns and obtains new knowledge, we can then teach that knowledge. The process of understanding learning can take many forms. You can learn values that can lift the community to become part of a solution. You can turn surface learning into a deeper understanding form of learning by obtaining a personal connection. You can use discipline specific language to determine a goal and build learning around that goal by curriculum design. Learning is the foundation of teaching. Throughout this program I have become a better researcher, a better writer, and a better learner.

The science discipline relies heavily upon research. Reviewing peer-reviewed papers was not a new concept to me. Throughout my educational career, I have read dozens of articles and scientific papers. However, this capstone project pushed me to read deeper, to obtain a deeper understanding. For this paper, I was not solely reading what an author studied, what their hypothesis was, what their results were. I was comparing and contrasting both their research and their interpretations. I was needing to understand why they chose to analyze their data a certain way or why they chose that particular study. This made me a better researcher because I learned that these scientists wanted their audience to learn about their topic that way for a reason. I read these articles with a different lens to be able to understand not just what the author was doing, but why.

To say this paper in its final form is my greatest academic accomplishment is accurate. The gap between my undergraduate degree in 2014, to this graduate degree in 2023, has changed my voice as a writer. Not only have I matured as a person, but as an intellectual, which has reflected in this paper. As a woman now firm in her career as an

informal educator, my voice can be heard. This voice speaks for conservation, for preservation, and for education about our marine ecosystems and the amazing animals that inhabit them. That journey was not an easy one. During the writing process, I struggled every step of the way learning the correct APA citation formatting. Using all of my resources available to me, the writing center at Hamline University, the website Purdue Owl, and many of my peers and professors, I believe I am now a better writer. When we are so deep in our own writing, sometimes lines can get blurred and we start to miss our own mistakes. Having multiple eyes on your writing gives you different perspectives, different opinions on how to make your writing and your voice the best it can be. Being able to put my voice onto paper to promote environmental education has been an absolute privilege.

Revisit Literature Review

The amount of literature to review for this Capstone was extensive. In fact, it felt quite daunting. What helped keep myself organized and on track was breaking the second chapter into four subtopics and I treated each subtopic like its own individual paper. Then, I was able to go back and create transitions from one topic to the next. I gathered all the sources for each subtopic from previous literature I had read throughout my courses at Hamline as well utilizing the Bush Library resource on the Hamline University website and Google search engine if I still felt like I needed more supporting work.

One such resource that I felt guided me not just through this Capstone project, but through the entire time at Hamline and now in my career as a Programs Educator at the Indianapolis Zoo, was a paper by Jeffery S. Swanagan (2000). I read this paper in September 2020, during my very first course, Foundations in Environmental Education.

Swanagan hypothesized that zoo visitors at Zoo Atlanta who had an interactive experience with the zoo's elephant demonstration and bio-fact program would be more likely to actively support elephant conservation than those who simply viewed the elephants on exhibit. Through exit surveys, he determined that this form of "personal connection" gave guests "empowerment variables." The more programs a zoo/aquarium offers, the more guests are educated and enthusiastic to participate in conservation efforts. This resonated the most with me because I agree with his thought of personal connection and want guests at the Indianapolis Zoo to feel a personal connection with any animal they may come in contact with, from our sloths, elephants, dolphins, and in our shark encounter exhibit where guests can pet/touch our Smooth Dogfish Sharks and Southern Stingrays.

The other concept that influenced my work was to gain a deeper understanding of what informal education was and how others interpret informal education. I read multiple papers and articles from various authors as they described their own definition and interpretation of informal education. However, it was a website posted on infed.org by Tony Jeffs and Mark Smith (2019) that resonated the most with me. They described informal education as a series of conversations, activities, or involvement that provokes learning. The example Jeffs and Smith use is, "when you are going fishing with your dad and he shows you how to bait a hook and throw your first cast of line into the water." This most simplistic example of how we learn shows emotion, deep understanding, and connection, even though it may not seem like it in the moment of "just" learning a new hobby. It is those emotions and those concepts that made me want to do more in my Shark Researcher Camp than just teach these students in a classroom at a zoo. I designed

conversation talking points for small groups at a table, various games and experiments so they would be learning without studying, and guided tours and walks through the zoo to bring what they are doing in the classroom into perspective.

These connections that I made between each and every source used throughout my Capstone project were chosen with great thought. Each source has a purpose and a connection between one topic to the next. These sources in their various forms not only support my question of *how informal educators can build a deeper knowledge and connection to animals that are non-charismatic, such as elasmobranchs, to develop an understanding and need for environmental conservation*, but show my own understanding of informal education and how it plays a role in conservation for our oceans.

Implications

For a new camp program to be implemented at the zoo, there are multiple steps that must be taken. I will first present it to my direct supervisor, who then will present it to the entire education board at the Indianapolis Zoo. These are people I respect and value their opinions on. They will provide feedback, concerns, and suggestions to look ahead to ensure not only a positive outcome, but that this reflects the voice of the Indianapolis Zoo.

During such time, I will explain that this camp will inspire kids. This camp is going to be a tool for shark conservation in the midwest. I want to highlight all the conservation work that the Indianapolis Zoo has done and is doing for marine ecosystems around the world. The Indianapolis Zoo is an accredited zoo, aquarium, and botanical

garden. I want to focus on the accredited aquarium portion and explain that title is well earned for such a facility in the midwest.

Limitations

As my Capstone Project is completed, I have found a few questions that could still be answered. The first question is, is a two-day camp enough? The Indianapolis Zoo offers a variety of camps that range from two days to five days. Is two days enough time for students to obtain the amount of information, experience, and literacy needed to be the ocean enthusiasts and conservationists I wish for them to be? Will they, after a two-day camp, be inspired to have those changes in environmental attitudes where they can make even small differences in their own lives to make a difference on marine ecosystems?

The second question that remains is, do we know the kids will retain this information long-term or implement such lifestyle changes once they leave? Will the students forget this information after a week, a month, a year? In other words, what is the long term impact students participating in camps like these have? During my literature review, this seems to be a similar question others have also asked when looking at zoological education as a whole.

Future Research

When students sign up for a program at the Indianapolis Zoo, only a handful of students are participating in more than one program in a calendar year. Typically, one student will only have the opportunity to participate in one or two programs in their youth. This makes any kind of follow up difficult, particularly because these students are minors without their own form of communication. Most communication goes through

their parents or guardians. Unlike formal education where schools keep records on their students from kindergarten through high school, we don't keep track of such records.

One thought on how we could begin looking at those long term impacts, is to begin keeping such records. By keeping a phone number or an email address, we could send a "one year post-camp survey." In the survey we could ask questions such as, "Name one thing you changed in your daily routine to promote environmental conservation." Or even more general as, "Have you changed anything in your daily routine to promote marine conservation?" This could be done by setting a calendar event on the education department computer for exactly one year from the end date of the program. Not only would this help us answer those long-term questions, but also serve as a reminder to them not only about their time with us at Shark Researcher Camp, but that we appreciate their participation and can send them well wishes.

Another future work that could be implemented is a series of camps that focus on non-charismatic megafauna. "Non-charismatic" may be open for interpretation, because one person may find spiders to be terrifying and another may find them adorable. However, keeping the term "megafauna" as generic and general as possible may help guide more camps. These camps could include topics such as insects, invertebrates, snakes, rodents, etc. The possibilities can be limitless when bringing light to a group of species that maybe not everyone sees as important.

Communicating Results

At the completion of this Capstone Project, I want to promote my Shark Researcher Camp to the best of my ability. Working for such an incredible institution I have such great resources at my disposal. On the Indianapolis Zoo's website, the public is

able to select the *Learn and Explore* tab. From this tab is a drop down menu that features all the programs and activities the Education Department offers at any given time. My Shark Researcher Camp will be featured on the *Zoo Camp* screen. The title, description, dates, age group, and registration will be available up to three months in advance before the cutoff date for registration. The education board at the Indianapolis Zoo will look at over one hundred schools in the Indianapolis area and surrounding counties to take into account when the breaks are for the schools; fall, spring, and winter breaks. The camps are offered on the most common week that schools are out to give as many students as possible the opportunity to enroll in these camps.

Once the camp is posted on the website, the camp will also be featured on both a paper and email copy of the Zoo Newsletter. This newsletter is sent out to members of the Indianapolis Zoo but can be shared to anyone. Through the assistance of the zoo's own advertising on billboards, television and radio commercials, and newspapers, Shark Researcher Camp will be available to the public.

Benefits

This camp was written to promote marine conservation as a whole, with a specific enlightenment on elasmobranch biology and management. Our oceans face threats from global warming, pollution, overfishing, overexploitation, and people are at risk from suffering from those threats. My Shark Researcher Camp will be an inspiration to youth. The students will leave this program not only understanding those threats but what can be done to help positively change our environmental impact, a concept known as ocean literacy. The students will come to the zoo excited to learn about sharks and what we can do to protect them for future generations. This camp will not only benefit shark and ray

species and the marine ecosystem, but will benefit these students by getting them out of the classroom, out of their homes on a school break, and make them ocean enthusiasts even in the Midwest.

Summary

In this chapter, I have explained how the idea for Shark Researcher Camp came to life.. Such works from Swanagan (2000) and Jeffs and Smith (2019) and many others have made me a better educator, a better learner, and a better researcher. I have looked both back on my project and reflected on why this project is important to me, and ahead as I have shown what can be done to further investigate how programs like these make a difference in the long-term and who can benefit from this program and why. This camp will be available to the public to promote marine conservation and preservation of such a keystone species, elasmobranchs.

Conclusion

To answer my question, *how informal educators can build a deeper knowledge and connection to animals that are non-charismatic, such as elasmobranchs, to develop an understanding and need for environmental conservation*, we need to bring students out of the classroom every once in a while. We need our youth to connect with nature on a deeper level. We need to promote and stimulate conversations with each student. We need to elaborate and explain the threats our planet faces. We need to show our youth how we can make a difference, even when we feel far away or that the goal feels impossible. We need to shed light on why the planet, each individual ecosystem, has a keystone species and why they are vital to our planet's survival. We need informal education for conservation and preservation of our planet.

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