Empathy for invertebrates:

Adults' empathic behaviors at aquarium touch tanks

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Abstract

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In recent years, developing empathy for animals has become a strategy to encourage zoo and aquarium visitors to change their behavior in order to save the environment. However, it is much easier to feel empathy for charismatic megafauna – cute, familiar animals, like mammals – than for non-charismatic animals such as invertebrates. The purpose of this study was to determine whether and how adult aquarium visitors empathize with non-charismatic species they encounter at aquarium touch tanks. Observations of 258 adults at three different aquariums across the United States were conducted. All participants displayed empathic behaviors as well as behaviors that are related to empathy. Non-parametric statistical tests revealed that the specific aquarium and specific animal involved in the interactions, as well as facilitation of interactions and engaging in caregiver-specific behaviors, showed significant differences in visitors' behaviors toward the animals. When compared with results from a similar study on charismatic animals, the findings demonstrate that more staff encouragement and facilitation are needed to produce empathic behaviors for both charismatic and non-charismatic animals. These findings inform zoos' and aquariums' efforts to help visitors change their behavior to protect the environment. Facilitation strategies and implications for practice and future research are explored.

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Chapter 1: Introduction

Empathy is one of the zeitgeists of our time. It has been called a "social emotion" that forms a bridge between two separate people, encouraging prosocial behaviors, like helping a neighbor carry a heavy grocery bag (Luebke, 2018; Thompson and Gullone, 2003, p. 175). A feeling of "oneness" and identifying commonalities with others can both result in empathic responses (Borshuk, 2004; Cialdini, Brown, Lewis, Luce, and Neuberg, 1997, p. 481).

Museums and cultural institutions look to harness their visitors' capacity to empathize as a way to make meaningful connections with other cultures, beliefs, and species. Zoos and aquariums, in particular, have begun to focus on fostering empathy for animals because one of their primary goals is to effect pro-environmental behavior change among their visitors (Young, Khalil, and Wharton, 2018). Numerous studies show that empathizing with animals can positively change people's intentions toward the environment, and some research even suggests a link between feeling positive emotions or empathy for animals and making pro-environmental behavior changes (Luebke, Watters, Packer, Miller, and Powell, 2016; Mann, Ballantyne, and Packer, 2018; Pfattheicher, Sassenrath, and Schindler, 2015; Skibins and Powell, 2013).

Other research in zoos and aquariums has focused on best practices for building empathy for animals. For example, the Woodland Park Zoo, in conjunction with the Seattle Aquarium and Point Defiance Zoo and Aquarium, recently developed six best practices for empathy-building in conservation institutions (Owen and Seattle Aquarium, 2015), including strategies such as encouraging people to find similarities between themselves and animals (Chawla, 2009; Gebhard, Nevers, and Billmann-Mahecha, 2003; Myers, Saunders, and Bexell, 2009; Young et al., 2018).

Much of the research on fostering empathy for animals is focused on animals that seem similar to humans, such as gorillas or otters, who have distinct faces and respond to stimuli in their environments (Myers et al., 2009; Owen, 2015; Young et al., 2018).

However, less is known about how to foster empathy for animals who lack similarities to humans, such as jellyfish, who do not have eyes, hearts, stomachs, or brains (Luebke, 2018). Some of these "less charismatic" animals are not as well-studied as those who seem more human-like, leading some scientists to fear non-charismatic animals' extinction (Clark and May, 2002, p. 191; Ducatez, 2019; Lorimer, 2006; Marešová and Frynta, 2008). Contemporary research calls for a "more robust understanding" of how humans can connect and empathize with non-charismatic species, as their future may depend upon it (Skibins, Dunstan, & Pahlow, 2017, p. 168).

Many aquariums offer touch tank experiences to facilitate interactions between visitors and non-charismatic animals. These are places where visitors can actually reach in and touch a sea cucumber or anemone. Recent research on touch tanks focuses primarily on human interactions, such as family conversations about ecology or scientific reasoning (Kisiel, Rowe, Vartabedian, and Kopczak, 2012; Kopczak, Kisiel, and Rowe, 2015). One particularly salient study investigates touch tanks' effectiveness in promoting pro-conservation intentions and fostering an appreciation for wildlife (Ogle, 2016). However, this research does not explore which empathic behaviors are displayed at touch tanks or how touch tanks can contribute to empathy development, which may help the field better understand how humans can feel a connection to non-charismatic wildlife. Moreover, much of the research on empathy development focuses on children (Arluke, 2003; Chawla, 2009; Chen-Hsuan Cheng and Monroe, 2012; Giusti, Barthel, and Marcus, 2014). Less is known about what it takes for adults to empathize with animals, let alone non-charismatic animals. Previous research has also not compared incidences of empathic behaviors across multiple aquariums.

The purpose of this study was to determine whether and how aquarium visitors empathize with non-charismatic species they encounter at aquarium touch tanks. Three research questions guided the study:

1. What empathic behaviors do visitors express during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?
2. What factors seem to influence visitors' empathic behaviors during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?
3. How are visitors' empathic behaviors towards these non-charismatic animals similar to and different from visitors' empathic behaviors towards more human-like animals?

Both zoos and aquariums benefit from the results of this study, as many of them are invested in using empathy as a tool to inspire pro-conservation action. It is, nonetheless, a recognized struggle to find ways to connect visitors to animals who may not be relatable. If more is known about feeling empathy for non-charismatic species, zoos and aquariums may be able to design more targeted programming and exhibition material for these animals, thereby eliciting empathy from visitors, helping them gain a better understanding of how their behavior affects our shared environment, and potentially inspiring them to act on behalf of that environment.

It is possible that many humans may not be able to connect with non-charismatic animals. If so, that information would be useful to know as well, so researchers and wildlife conservationists can continue to strategize and study other ways to motivate humans to care about the preservation of non-charismatic species. Ultimately, this research study aimed to add to the body of knowledge about human interaction with non-charismatic species so we can work together to maintain biodiversity.

Chapter 2: Literature Review

The purpose of this study was to determine whether and how adult aquarium visitors empathize with non-charismatic animals they encounter at aquarium touch tanks. There are four bodies of literature that inform this study. They are 1) research on the nature of empathy, 2) research and best practices regarding empathy in the field of wildlife conservation, 3) research on the nature and effects of charisma in animals, and 4) research on facilitated experiences in aquariums, especially those at touch tanks. The conservation field already knows a great deal about how to foster empathy for animals, but less is known about how empathy can be encouraged for non-charismatic animals and whether feeling empathy for these animals is generalizable to aquarium visitors at large.

The Nature of Empathy

Psychological researchers have determined that there are two major types of empathy – affective and cognitive. Affective empathy occurs when someone vicariously experiences the perceived emotions of another (Mehrabian and Epstein, 1972; Young et al., 2018). Cognitive empathy, on the other hand, is the ability to cognitively understand someone else's emotions (Cuff, Brown, Taylor, and Howat, 2014; Owen, 2015). It involves being able to take the perspective of someone else and imagine their reality (Hoffman, 1977; Mehrabian and Epstein, 1972; Young et al., 2018). For this reason, empathy develops as a child's theory of mind develops - one has to be able to understand that other humans are separate entities from oneself to be able to view the world from different humans' perspectives (Eisenberg, Losoya, and Guthrie, 1997; Hughes, C., 2011; Ornaghi, Brockmeier, and Grazzani, 2013; Piaget, 1997).

When the construct of empathy was initially introduced, only the cognitive aspect of it – a dispassionate understanding of someone else's situation – was considered (Batson, Fultz, and

Schoenrade, 1987). However, in the 1960s, the emotional side of empathy was explored and defined (Batson et al., 1987; Stotland, 1969; Wispé, 1968). Later, in the 1970s, the meaning of empathic emotions was narrowed to include "those feelings that are more other-focused than self-focused" (Batson et al., 1987, p. 20).

Empathy, Altruism, and Prosocial Behavior. It has further been theorized that empathy evokes altruistic feelings (Batson et al., 1991; Hoffman, 1977). Hoffman (1975) defined empathy as "a motive independent of egoistic motivation to help [another] person" (p. 607). In other words, Hoffman considers empathy to be selfless.

As evidence of the altruism embedded within empathy, Batson et al.'s (1991) study tested two competing theories - the empathy-altruism hypothesis, which asserts that people are motivated to help others by a selfless concern for their wellbeing, and the empathic-joy hypothesis, which asserts that people are motivated to help others because of the good feeling of sharing in someone's joy at being helped. The study consisted of three experiments that each tested the two hypotheses, and the results of all three were consistent with the empathy-altruism hypothesis (Batson et al., 1991).

Altruistic motivations evoked by empathy are important because they can catalyze prosocial behaviors (Batson, Fultz, and Schoenrade, 1987; Luebke, 2018). The term *prosocial behavior* denotes a wide array of actions that are intended to benefit others, like "helping, comforting, sharing, and cooperating" (Batson and Powell, 2003, p. 463).

Empathic Concern and Prosocial Behavior. Empathy is significant in promoting prosocial behaviors through another channel as well (Eisenberg and Miller, 1987; Telle and Pfister, 2016). Building on the constructs of both affective and cognitive empathy, a third facet of empathy was identified - empathic concern. Also called compassion or motivational empathy, empathic concern drives people to take action on behalf of someone who is suffering or in need

(Eisenberg and Miller, 1987; Mehrabian and Epstein, 1972; Pfattheicher et al., 2015; Young et al., 2018). It is this third construct that is present when someone chooses to donate to a wildlife fund or rescue a stray, for example (Young et al., 2018).

Cialdini et al. (1997) found that empathic concern leads to prosocial behavior by way of "a perceived sense of connection or commonality with another person" (Luebke 2018, p. 345). This research reinterprets the idea that altruism is the main product of empathy and, therefore, the primary catalyst for helping. Rather, Cialdini et al. (1997) argues, there is a condition of "self-other overlap" that results in the desire to help (p. 491). This means it may sometimes be this sense of oneness – rather than altruism – that prompts people to help someone after empathizing with them. However, regardless of what causes empathic concern, the fact that empathy leads to prosocial behavior is not under dispute.

Positive Empathy. Despite the focus on suffering maintained by much of current and past empathy research, "positive empathy" is beginning to be explored (Morelli et al., 2015; Young et al., 2018). It occurs when someone feels motivated to "sustain or extend" someone else's "positive state of being" because they have empathically shared those positive feelings (Young et al., 2018, p. 330-31). Positive empathy has been found to increase social competence, and it also inspires prosocial behaviors, just as empathy produced by suffering does (Morelli et al., 2015; Sallquist, Eisenberg, Spinrad, Eggum, and Gaertner, 2009; Telle and Pfister, 2016).

Positive empathy can be useful in the context of developing empathy for animals, as it provides conservation institutions with an alternative means of inspiring visitors to take action on behalf of animals. Focusing on how to improve the lives of animals and extend their happiness –

as opposed to fixating on animal suffering – might prevent visitors from leaving a zoo or aquarium feeling despair (Young et al., 2018).

Neurology of Empathy. Despite the wealth of research on empathy, there is still not a single agreed-upon definition for it (Bernhardt and Singer, 2012; Cuff et al., 2014). Nonetheless, research about the neurological processes surrounding empathy is fairly concrete. For instance, Preston and De Waal's (2002) work suggests that when someone witnesses the emotional state of another person, corresponding autonomic and somatic responses arise in the observer (Thompson and Gullone, 2012). The brain reacts almost as if the witness is experiencing the same emotions as the person they are seeing (Eres, Decety, Louis, & Molenberghs, 2015; Menon and Uddin, 2010; Young et al., 2018). The discovery of mirror neurons – nerve cells that produce this "involuntary neurological 'echo'" upon witnessing someone else's emotions – confirms that there is a "neural mechanism" for feeling what someone else is feeling (Gerdes, Segal, and Lietz, 2010, p. 2331; Bernhardt and Singer, 2012, p. 3; Rizzolatti and Craighero, 2004; Rizzolatti, Fogassi, and Gallese, 2001).

There is a limited basis in research for the possibility that mirror neurons react in a similar fashion when humans perceive emotions in non-human animals (Franklin et al., 2013; Myers, 2007; Young et al., 2018). Furthermore, it is well documented that animals inspire myriad affective and empathic responses in humans (Luebke et al., 2016; Myers et al., 2004; Powell and Bullock, 2014; Smith, Ham, and Weiler, 2011; Webber, et al., 2017). The implications here for the wildlife conservation field are great. Scientists and conservation professionals can look to empathy as a way to catalyze feelings of altruism for and oneness with the environment. If empathy is used in conjunction with other proven ways to inspire conservation, pro-environmental behaviors on behalf of animals and their habitats may one day

become common enough to enact lasting, positive change on our endangered planet (Berenguer, 2007; Pfattheicher et al., 2015; Schultz, 2014; Young et al., 2018.)

Empathy in Wildlife Conservation

Building on the psychological research on empathy and affect, research began to explore how empathy influences people's attitudes toward the environment (Berenguer, 2010; Chawla, 2009; Schultz, 2000; Sevillano, Aragones, and Schultz, 2007; Tam, 2013). Early on, Schultz (2000) found that participants who took the perspective of an animal harmed by pollution showed higher environmental concerns than participants who were told to remain objective. Berenguer (2007) replicated Schultz's (2000) study and found that participants' willingness to donate to environmental associations could be predicted by how much they engaged with empathy-triggering activities (Young et al., 2018).

Similarly, Berenguer (2010) illustrated that participants who demonstrated high levels of empathy were able to display more "moral reasoning" – i.e., listing moral reasons instead of practical reasons – on behalf of the environment than those with low empathy (p. 110). For example, some of the participants were asked to consider a vulture who might be hurt if humans carried out an environmentally harmful action. Participants in the high empathy category listed significantly more "ecocentric" (i.e., environmentally focused) reasons why the vulture should be saved than participants in the low empathy category (p. 123). These findings bolster the field of conservation psychology, as they provide a basis for using empathy to work toward saving endangered species.

Researchers in the wildlife conservation field have also focused on zoo and aquarium visitors' attitudes and intentions toward the environment and conservation practices (Clayton, Fraser, and Burgess, 2011; Hughes, 2013; Luebke et al., 2016; Rabb and Saunders, 2005).

Falk et al. (2007) carried out a multi-institutional, National Science Foundation-funded study that investigated the impact of a visit to a zoo or aquarium. The researchers determined that visitors believe their connection to nature was strengthened as a result of their visit. Furthermore, they indicated that their visit allowed them to see themselves as part of the solution to current environmental problems. Some took issue with this study and pointed out what they consider to be methodological flaws (Marino, Lilienfeld, Malamud, Nobis, and Broglio, 2010). Regardless, Falk et al.'s (2007) research and subsequent defense of that research (2010) demonstrates that zoos and aquariums have the power to impact how visitors see themselves in relation to the natural environment.

On a smaller scale, Wyles et al. (2013) found that visiting an aquarium improved participants' overall attitudes and intentions toward conservation. Participants completed a questionnaire about their attitudes toward marine sustainability and their corresponding behavioral intentions before and after their visit. Half received a brochure detailing specific behaviors that can help solve the problem of overfishing. The aquarium visit was found to have improved participants' overall behavioral attitudes and intentions, and receiving the brochure also significantly improved intentions (p. 95).

Similarly, Brown, Ham, and Hughes (2010) used targeted messaging to encourage visitors to national parks to change their beliefs and attitudes about picking up litter. Similarly, Powell and Ham (2008) found that targeted interpretation during eco-tours can increase "supportive attitudes" towards the host-protected area and enhance intentions of pro-environmental behavior (p. 467).

However, despite these positive results, it has been noted that attitudes and intentions are not great indicators of actual, sustained pro-environmental behaviors (Hughes, 2013). Although

both of the messaging-focused studies mentioned above found that participants' pro-environmental actions improved while they were on-site, there were no measures for determining if participants continued to demonstrate these positive behaviors once they left the parks (Ballantyne and Packer, 2011). In fact, several studies show that, if messaging and positive experiences on-site are not reinforced after the visit, "planned environmental actions" are not fully realized (Adelman, Falk, and James, 2000; Ballantyne and Packer, 2011, p. 208; Dierking et al., 2004; Rickinson, 2001). Ultimately, good intentions about future behavior are not an accurate measure of off-site behaviors; research suggests more post-visit support would help visitors follow through with pro-environmental intentions (Ballantyne and Packer, 2011; Ballantyne, Packer, Hughes, and Gill, 2018; Hughes, K., 2011; 2013).

Measuring Action and Behavior Change. To move beyond the issue of measuring only intentions and on-site behaviors, wildlife conservation research has become more focused on studying measurable pro-conservation actions and lasting behavior changes, such as donating to a wildlife fund or using less plastic (Mann, Ballantyne, and Packer, 2018; Schultz, 2011; Skibins and Powell, 2013; Young et al., 2018). As climate change continues to progress, there is a sense of urgency in discourse on this topic, as researchers and scientists like Schultz (2011) declare that "conservation is a goal that can *only* be achieved by changing behavior" (p. 1080).

Those who have proposed models of pro-environmental behavior change acknowledge that the myriad factors that influence human behavior are so complex that such models will likely never be comprehensive or authoritative (Hines, et al., 1987; Kollmuss and Agyeman, 2002). Nonetheless, these models are useful in demonstrating the types of factors that most likely influence pro-environmental behaviors – demographics, institutional infrastructures, economic factors, sociocultural factors, internal motivation, personal environmental knowledge and values,

environmental attitudes and awareness, emotional involvement, and personal notions of responsibility and priorities can all play a part in pro-environmental behavior change (Kollmuss and Agyeman, 2002).

To bring some clarity to the confusing array of factors that affect human behavior, Schultz (2014) enumerates several tools that can be effective in overcoming barriers to behavior change. Specifically, social modeling and normative messages, offering incentives, providing feedback, using prompts (e.g., signs reminding people to recycle), and encouraging people to make pro-environmental commitments (e.g., riding a bicycle or bus at least three times a week) are all proven strategies that can encourage people to make changes. Most important, Schultz (2014) asserts, is the necessity of tailoring the strategy to the situation. In other words, every strategy does not work well for all contexts or for all visitors. Rather, program developers at zoos and aquariums should choose one or two strategies that fit well with the specific behavior they are attempting to change.

Despite the inherent complexity involved in changing visitors' behaviors, the results of several studies are somewhat encouraging to the conservation field. For example, Mann, Ballantyne, and Packer (2018) investigated the impact of uShaka Sea World's *Penguin Promises* conservation action campaign. They found that, when participants were contacted a year or more after their visit, half could give an example of at least one pro-environmental action that they attributed to the campaign. In another such study, Skibins and Powell (2013) determined that *conservation caring* – a measure of visitors' connection to a species – is a strong predictor of species-oriented behaviors, such as "adopting" a zoo animal (Rabb and Saunders, 2005). However, conservation caring is a weak predictor of biodiversity related behaviors, such as "supporting sustainability policies" (Skibins and Powell, 2013, p. 529). These and other relevant

studies demonstrate that conservation institutions can and do impact visitors' future actions, but there is still more research that needs to be done (Luebke, Kelly, and Grajal, 2014; Skibins, Powell, and Hallo, 2013; Squires, Lowry, and Banks, 2016).

Empathy best practices in wildlife conservation. Pro-conservation behavior change is a major goal of most major zoos and aquariums today (Luebke and Grajal, 2011). Pursuant to this goal, six best practices for developing empathy have been put forth by Seattle's Woodland Park Zoo, in conjunction with the Seattle Aquarium and Tacoma's Point Defiance Zoo and Aquarium (Owen and Seattle Aquarium, 2015). These best practices are the product of a research study called "Measuring Empathy: Collaborative Assessment Project" [MECAP] and are as follows: 1) framing, 2) modeling behavior, 3) increasing knowledge, 4) providing experiences, 5) practicing empathy, and 6) activating the imagination (Owen, 2015; Owen and Seattle Aquarium, 2015; Young et al., 2018). These best practices have been integrated into the messaging and programming in exhibits and experiences at the above institutions, and evaluations surrounding the best practices and their outcomes have been conducted to ensure they are useful (K. Khalil, personal communication, October 2018).

a) Framing

Narrative framing in the context of building empathy for wildlife involves facilitators referring to animals as "he" or "she," or using inclusive words and phrases like "we," "together," or "all of us" (Owen and Seattle Aquarium, 2015, p. 9). Framing can also occur through behavior – children and adults alike may take note of the way conservation professionals care for animals, transport them, and interact with them (Owen and Seattle Aquarium, 2015).

b) Modeling

Modeling comes from the well-researched idea that role models - trusted adults and mentors - can positively influence ways of thinking through demonstrating positive values and behaviors (Arluke 2003; Chawla, 2009; Owen and Seattle Aquarium, 2015). Achieving results through modeling can be difficult at institutions like zoos and aquariums, where visitors only stay for a short amount of time. However, the MECAP study notes that some of the most successful instances of modeling occur when staff empower parents and caregivers to display positive behavior toward animals (Owen and Seattle Aquarium, 2015). By engaging parents, encouraging them to model positive behaviors for their children, and rewarding children's positive behaviors, both adults and children can have an enhanced learning experience and develop empathy toward the animals involved (Owen and Seattle Aquarium, 2015).

c) Increasing Knowledge

There are specific types of knowledge that can lead to the development of empathy. For example, verbalizing one's own emotions and listening to others' emotions and perspectives enhances empathy (Arluke, 2003; Myers et al., 2009; Owen and Seattle Aquarium, 2015). In a wildlife-specific context, sharing information about animals' needs, experiences, behaviors, and personal life histories can help visitors better understand and empathize with the animals (Myers, 2007; Owen and Seattle Aquarium, 2015). Sharing similarities and differences between humans and animals is also useful, and similarities are especially useful for non-charismatic animals with whom it is typically more difficult to empathize (Owen and Seattle Aquarium, 2015). Understanding how animals experience the world greatly contributes to developing empathy for them (Hills, 1995; Owen and Seattle Aquarium, 2015).

d) Providing Experiences

Interacting with an animal is one of the best ways to develop a connection with the animal (Blizard and Schuster, 2007; Chawla, 2007, 2009; Chen-Hsuan Cheng and Monroe, 2012; Giusti et al., 2014; Myers and Saunders, 2002). This interaction is even more impactful if there are few constraints imposed on it (Chawla, 2007, 2009; Owen and Seattle Aquarium, 2015). For zoos and aquariums, this means providing "naturalistic" experiences for interacting with animals is incredibly useful in helping humans bond with them, especially if the animals can choose to engage with visitors voluntarily (Myers, 2007; Owen and Seattle Aquarium, 2015).

e) Practice

What the MECAP study means by "practice" is "providing opportunities for people to successfully practice empathy and receive positive feedback when observed" (Owen and Seattle Aquarium, 2015, p. 11). Positively reinforcing empathic behaviors helps visitors believe this is a valuable way of thinking and behaving toward animals and the environment (Myers et al., 2009; Owen and Seattle Aquarium, 2015). Specifically, when visitors are involved in providing care for animals, they may be more easily able to interact empathically with the animals (Arluke, 2003; Kohl and Wenner, 2012; Owen and Seattle Aquarium, 2015).

f) Activating Imagination

The idea of activating visitors' imaginations comes from the well-researched principle that perspective-taking leads people to develop their empathy skills (Davis et al., 1996; Gebhard, et al., 2003; Ornaghi et al., 2013; Schultz, 2000; Owen and Seattle Aquarium, 2015; Sevillano et al., 2007). When people take the perspective of an animal, they are closer to understanding that animal's situation and perceived feelings (Berenguer, 2010; Myers et al., 2009; Schultz, 2000). A concrete example of this best practice in a zoo or aquarium setting is when a facilitator asks, "How would you feel if someone did that to you?" (Owen and Seattle Aquarium, 2015, p.12).

Staff can also encourage mimicry of an animal, as this motion activates mirror neurons and can help visitors feel what it might be like to be the animal (Myers, 2007; Owen and Seattle Aquarium, 2015; Varkey, Chutka, and Lesnick, 2006).

So far, these six best practices have worked well in developing empathy for animals in the zoos and aquariums that conducted the MECAP study (K. Khalil, personal communication, October 2018). However, a lot of the narrative on the best practices is directed at children's empathy development, and there is less research about how to engage adult visitors to conservation institutions in empathy development. It is known that adults can experience higher levels of empathy when they are encouraged through training programs or simulations (Foubert and Perry, 2007; Hastings et al., 2018; Varkey et al., 2006). However, these studies only focused on developing empathy for humans, and it is unclear whether showing empathy for humans is linked to showing empathy for animals (Paul, 2000). Therefore, it would be useful if further research were to investigate how adults respond to these empathy best practices in zoos and aquariums.

Furthermore, there is little research about whether and how empathy development works in other institutions across the country that similarly strive to promote pro-conservation behavior. There is also no research that compares the results of various empathy best practices at different aquariums. It would be beneficial to know more about what works best to develop empathy specifically for non-charismatic species, such as invertebrates.

Non-Human Charisma

Several studies highlight the difficulty of connecting visitors to non-charismatic animals, or animals that most people do not consider cute, such as invertebrates and other animals that do not have many similarities in appearance to humans. Animals who display agency, display

affectivity, and have body coherence (i.e., those that are easily recognized as whole animals, especially those with facial characteristics such as eyes), are perceived as more charismatic and tend to elicit more empathy (Jipson & Gelman, 2007; Myers et al., 2009; Owen, 2015; Young et al., 2018). Accordingly, zoo visitors' reactions to animals can vary widely across different species (Luebke, 2018; Marešová and Frynta, 2008; Myers, Saunders, and Birjulin, 2004). In fact, some visitors express disgust for species who differ morphologically from humans (Cushing and Markwell, 2011).

Non-charismatic species may be unattractive to some, but they are essential to our continued existence on Earth. Maintaining the biodiversity of our planet depends upon conserving as many species as possible. *Biodiversity* is a term with a broad definition. Essentially, it "covers the diversity between every different natural process, species and habitat as well as the diversity within each of those. [...] Biodiversity is about how lifeforms, habitats, and processes are interconnected and essential to all of us (Raffaelli, 2017, p. 1). Losses in biodiversity (i.e., in species or habitats that support them) will compromise the health and wellbeing of everyone and everything on the planet (Raffaelli, 2017).

In fact, biodiversity loss is already as much of a threat as "major forms of environmental stress," such as climate change, and stronger protections against it are necessary (National Science Foundation, 2012, p. 145). Recently, the United Nations has determined that over 1,000,000 species are at risk of extinction, "many within decades," which is more than ever before in human history (Díaz et al., 2019, p. 3). Moreover, biodiversity, when threatened, is a "nonlinear and saturating" process, which means that change in ecosystems accelerates as biodiversity loss continues (Cardinale et al., 2012, p. 61). It is essential that species conservation

initiatives be successful so that accelerating rates of biodiversity loss and the subsequent damage to ecosystems can be curbed.

Biodiversity and charisma. The problem of biodiversity loss and non-charismatic species are inextricably linked, because the most unattractive species often struggle to be represented in research and conservation initiatives, whether government-funded or zoo-based (Clark and May, 2002; Ducatez, 2019; Lorimer, 2006; Nash, 2004). Numerous studies have found that species' perceived attractiveness is a strong predictor of whether people want to help them and whether or not their conservation status is threatened (Brambilla, Gustin, and Celada, 2013; Colléony, Clayton, Couvet, Saint Jalme, and Prévot, 2017; Lorimer, 2006; Marešová and Frynta, 2008; Martin, Lurbiecki, Joy, and Mooers, 2014; Tisdell, Wilson, and Nantha, 2006). These studies agree that species rated as more attractive are overrepresented in conservation projects and often have better conservation status (Brambilla et al., 2013; Colléony, et al., 2017).

For example, Lorimer (2006) found that the UK's Species Action Plans [SAPs] – i.e., targeted conservation plans – cover only 0.65 percent of the total insect population. There are more SAPs for insects than for other taxonomies (including mammals), but the percentage is so small because the insect population is so massive. A second – and perhaps larger – problem Lorimer (2006) brings to light is the difference in resource allocation between different taxa. In the UK, NGOs dedicated to specific species wield a great deal of influence regarding the conservation of that species. Larger NGOs tend to be better funded and to have a larger support network, whereas smaller conservation organizations attract less attention, and therefore, less funding for their respective species. These larger organizations tend to represent species that are more well-known and well-studied, such as vertebrates – specifically mammals and birds

(Lorimer, 2006). This "taxonomic partiality," however unintentional, biases the field against less popular species, like most invertebrates (Lorimer, 2006, p. 546).

In contrast, Martin et al. (2014) studied species that are currently well-represented in zoos. However, this research is consistent with the above claims. Using a matched-pair system, these researchers compared species in zoos to highly similar species that are not in zoos. The findings demonstrate that both mammal and bird species within zoos are larger in body size and have larger spatial ranges in the wild than do their counterparts who are not in zoos. Furthermore, the species in zoos are less endemic – they are not restricted to only one specific location in the wild, but can survive in many locations. Finally, the species in zoos are less threatened than their wild counterparts. That means "zoos house species of lesser, rather than greater, conservation priority" (p. 93). This seems counterproductive, considering that the mission of almost all zoos and aquariums involves conservation, especially of endangered species (Luebke and Grajal, 2011).

Perhaps a major reason for this overrepresentation of non-threatened species is the reliance of many zoos and aquariums on the *flagship species* model. In this model, the most charismatic megafauna (elephants, tigers, etc.) serve as figureheads for other endangered species and their conservation needs (Ducarme, Luque, and Courchamp, 2013; Marešová and Frynta, 2008; Skibins et al., 2017). These megafauna are stand-ins for the other species in their home region and are meant to be "rallying points to stimulate conservation awareness and action" (Ducarme et al., 2013, p. 2). Incidentally, flagship species are central in zoo and aquarium fundraising campaigns and revenue generation, and they are used to stimulate tourism as well (Brambilla et al., 2013; Sims-Castley, Kerley, Geach, and Langholz, 2005; Skibins et al., 2013; Skibins, Powell, & Hallo, 2016; Skibins et al., 2017; Tisdell and Nantha, 2007). Conservation

institutions may also be wary of boring or disturbing visitors who know less about biodiversity with a plethora of non-charismatic species (Kerley, Geach, and Vial, 2003; Lemelin, Fennell, and Smale, 2008; Lindsey, Alexander, Mills, Romañach, and Woodroffe, 2007; Skibins et al., 2016). Hence, flagship species are the default stand-ins for their less cute counterparts, despite a growing body of research that suggests the flagship species model is not the most effective method to champion conservation (Andelman and Fagan, 2000; Lindsey et al., 2007; Martin et al., 2014; Skibins et al., 2017; Smith, Veríssimo, Isaac, and Jones, 2012).

This is not to say that the flagship model is totally invalid just because it is not perfect – there is simply more work to be done (Skibins et al., 2016). In fact, researchers are already working to develop alternative models. There is evidence that increasing the amount and types of species typically considered flagships allows visitors to connect with more animals than expected (Skibins et al., 2016; 2017; Smith et al., 2012).

Furthermore, Tisdell, Nantha, and Wilson (2007) cast some doubt on the idea that the most dominant factor in species conservation is a species' likeability. This study asserts that likeability may be important, but the "perceived degree of endangerment" is more influential in determining the public's monetary support of a species (p. 627). Similarly, Tisdell and Nantha (2007) found that when participants learned of the northern hairy-nosed wombat's poor conservation status, their willingness to fund the wombat was higher than it was for the koala, despite the koala's cuddlier aspect and popularity. These findings suggest that lesser-known species have the potential to be well-funded, if visitors to wildlife conservation organizations are properly informed and encouraged (Colléony et al., 2017; Skibins, et al., 2016). Furthermore, these studies illustrate that there are ways to produce empathic concern that are not predicated on morphological or behavioral similarities between humans and the species in question.

A “more robust understanding” of how zoo and aquarium visitors can connect and empathize with less charismatic species is necessary, as their future depends upon it. (Brambilla et al., 2013; Marešová and Frynta, 2008; Skibins et al, 2017, p. 168). It is possible that utilizing empathy best practices will be able to produce empathic concern even for the most non-charismatic species. However, more information is required concerning whether and how visitors empathize with less charismatic species across different institutions and, if so, which behaviors are most common.

Touch Tanks in Aquariums

It has been understood for some time that direct physical contact with animals, when combined with educational messaging, can improve learning outcomes and lead to empathic responses (Kidd, Kidd, and Zasloff, 1995; Morgan and Gramann, 1989; Orban, Siegford, and Snider, 2016). Direct contact with animals is also associated with positive health outcomes in both humans and animals (Hosey and Melfi, 2012; Sahrmann, Niedbalski, Bradshaw, Johnson, and Deem, 2016; Yorke, Adams, and Coady, 2008). Accordingly, zoos and aquariums can advance their goals of conservation education and behavior change through these types of facilitated interactions (Kreger and Mench, 1995; Orban et al., 2016; Owen and Seattle Aquarium, 2015).

One such semi-facilitated experience that is almost ubiquitous in aquariums is the touch tanks. They are usually monitored by staff and/or volunteers who are trained not only in proper care for the animals, but also in the organization’s messaging prerogatives (Owen and Seattle Aquarium, 2015). Touch tanks at aquariums typically include several types of invertebrates (i.e., non- charismatic species), which means they are a prime spot to foster connections with less well- loved animals (Jackson and Khalil, 2017).

Recent research studies at touch tanks focus primarily on human interactions, such as family conversations about ecology or scientific reasoning (Kopczak, Kisiel and Rowe, 2015; Kisiel, Rowe, Vartabedian, and Kopczak, 2012; O'Brien, Rowe, and Farley, 2014). Additionally, Sahrmann, et al. (2016) found that people who interacted with animals at touch tanks experienced a decrease in mental stress – they were "happier, more energized, and less tense" (p. 4).

One particularly salient study investigates the effectiveness of touch tanks in promoting pro-conservation behaviors and fostering an appreciation for wildlife – Ogle (2016) found that interacting with marine invertebrates increased participants' perceived knowledge about marine wildlife. Participants also felt it was likely that they would take action to protect marine wildlife after experiencing the touch tanks. In contrast, the experience barely changed how participants felt about the value of marine wildlife, and it also did not affect how strongly they felt about protecting marine wildlife.

Ogle's (2016) work is closely related to the missions of conservation institutions, but it does not explore empathic behaviors or how touch tanks can or cannot contribute to empathy development (Luebke and Grajal, 2011). However, the MECAP study sheds a great deal of light on this arena (Jackson and Khalil, 2017; Owen, 2015). The multi-institutional project found that the Seattle Aquarium's touch tank elicited more empathic responses than either of the charismatic animals' exhibits that were observed at the Woodland Park Zoo – the gorilla and jaguar. This may seem surprising, since touch tank inhabitants are largely invertebrates, which are generally non-charismatic. A likely explanation for the many instances of empathic responses is that several of the indicators on the MECAP study's observation instrument involve "gentle touch" (Jackson and Khalil, 2017). When the researchers removed these indicators from the data

set and reanalyzed the remaining data, the charismatic animals' exhibits were shown to elicit more empathic behaviors (Jackson and Khalil, 2017).

The MECAP study's results illustrate the foundational nature of touch in fostering empathy for animals. However, more research regarding instances of empathic behavior at touch tanks should be conducted so the field can learn more about encouraging empathy for vulnerable, non-charismatic species. It is especially important to obtain more observational data at touch tanks, because we do not yet know whether the empathic responses observed at the Seattle Aquarium mirror those at other institutions or differ from them. More data is needed to be able to determine whether touch is the *only* major factor that seems to connote empathy at touch tanks, or if other empathic behaviors are manifesting as well. Finally, more research regarding what factors might influence empathic behaviors at touch tanks is also needed.

Summary

As this literature review has demonstrated, feeling empathy for animals has the potential to motivate visitors to zoos and aquariums to change their attitudes, intentions, and possibly even their behaviors for the benefit of the environment. It is imperative that these pro-environmental behavior changes happen soon, as climate change marches forward, and our planet's biodiversity is more threatened than it has ever been.

There is a great deal of research on how empathy is developed and on what triggers empathy for animals in humans. There is a slight amount of research about whether and how human behaviors actually change after having empathic experiences at zoos or aquariums, and there is less research on how humans can empathize with non-charismatic animals. This study confronted the challenge of building empathy for animals that are morphologically different from humans. Research must determine whether and how empathy for non-charismatic animals occurs

and what factors influence its development prior to determining whether touch tank experiences can aid in driving pro-environmental behavior change.

Chapter 3: Methods

The purpose of this research study was to determine whether and how adult aquarium visitors empathize with non-charismatic species they encounter at aquarium touch tanks. The study was designed to answer three research questions:

1. What empathic behaviors do visitors express during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?
2. What factors seem to influence visitors' empathic behaviors during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?
3. How are visitors' empathic behaviors towards these non-charismatic animals similar to and different from visitors' empathic behaviors towards more human-like animals?

The study utilized a descriptive survey design. Data were collected through observations of adult visitors at aquarium touch tanks at three aquariums across the United States. The following chapter describes the research sites, sampling, data collection process, data analysis, and limitations of the study.

Research Sites

Aquariums in three different regions of the United States were chosen as research sites in order to avoid any regional idiosyncrasies and better generalize data to aquarium visitors nationally. All three sites were accredited by the Association of Zoos and Aquariums (AZA), to ensure they all comply with accepted standards in operations and animal welfare. The sites' individual interpretive approaches varied distinctly, as will be further discussed below. This variation in interpretation allowed for better generalization, as divergent conditions were taken into account.

New England Aquarium. The New England Aquarium (NEAQ) in Boston, MA, considers itself one of the "premier visitor attractions in Boston" and sees 1.3 million visitors per year. It is committed to research, education, and conserving the environment, as its combined mission and vision is as follows: "The New England Aquarium is a catalyst for global change through public engagement, commitment to marine animal conservation, leadership in education, innovative scientific research, and effective advocacy for vital and vibrant oceans." According to the NEAQ's 2017 annual report, its educational efforts are working – 79% of surveyed visitors indicated they were "very likely" to help the oceans after their visit to NEAQ.

Although concern for animals is evident in its mission and vision, the NEAQ does not specifically integrate empathy-building best practices into its interpretation. The NEAQ's interpretive approach to conservation education utilizes strategic framing as its key technique. For example, the NEAQ has found that framing climate change as a resource protection and management issue resonates most with adult visitors. Therefore, climate change interpretation designed for adults often discusses topics like strategic fishing, ocean health and habitat loss, and community solutions.

Oregon Coast Aquarium. The Oregon Coast Aquarium (OCA) is located in Newport, OR – a seaside town with a population of approximately 10,500. Though Newport itself is relatively small, the OCA's visitors come from a range of areas, both far and near. It receives about 450,000 visitors per year, and more than 30% of them are from out of state. The OCA is also committed to pro-environmental education, as its mission is "to create unique and engaging experiences that connect you to the Oregon coast and inspire ocean conservation." Its interpretive plan is 27 years old at the time of this writing, so most exhibit signage does not

reference climate change or actions visitors can take to conserve the ocean. Rather, the majority of conservation messaging comes from programming and volunteers.

Empathy-building is not a primary focal point for the OCA, but love for animals is central to the work it does. For example, the Aquatots program for preschoolers utilizes some empathy-building best practices that the Seattle Aquarium and Woodland Park Zoo developed, though OCA staff were not necessarily familiar with MECAP when they developed the lesson plans. One Aquatots class session declares participants will "become a crab and explore how you use your claws to survive" – which is perspective-taking. Another session will "explore what makes sharks super special." This is an example of increasing knowledge as a way to foster appreciation for an animal. Of course, this program is for children – adult programming is sparser at OCA.

Aquarium of the Pacific. The Aquarium of the Pacific (AOP) is located in Long Beach, CA, about twenty-five miles from downtown Los Angeles. Long Beach's population is about 470,000, and it is the second busiest shipping port in the US, second only to the port of Los Angeles. Approximately 6 million tourists travel to Long Beach every year, and the AOP directly benefits from these numbers. Even though Long Beach has 200,000 fewer residents than Boston, it gets 400,000 *more* visitors than the NEAQ – 1.7 million in 2017. This makes AOP the fourth most visited aquarium in the nation. The AOP's 2017 annual report asserts that it hopes to make use of this vast reach by "turning visitors into ocean stewards," and it considers marine conservation and "protecting endangered species" one of its highest priorities. Accordingly, the AOP's mission is "to instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems."

Similar to the other two aquariums in this study, the AOP does not intentionally utilize empathy-building best practices, but its care for the environment and marine animals is evident in its mission and activities. One program for adults that stands out is the Aquatic Academy – a series of courses designed to encourage participants to dialogue on issues such as resilience to climate change, sustainable seafood, and human impacts on the ocean and the environment. Similar to the NEAQ's approach to adult education, the AOP focuses on climate change, resilience, and resource management solutions to environmental problems rather than fostering empathy specifically.

Sampling and Data Collection

Observations of adult visitors – over the age of 18 – were conducted at the three aquariums during the month of March 2019. The researcher spent approximately three days at each research site. Participants were selected through convenience sampling and remained completely anonymous, as no demographic or identifying information was collected. At each site's invertebrate touch tank, the researcher stationed herself at a place where she could move about the entire area to view participants as they moved along the tank. She conducted observations of three animals – sea stars, sea urchins, and sea anemones – in chunks. For example, she would prepare several ethograms for sea stars and then observe the next visitor who interacted with sea stars, and the next, until the prepared ethograms ran out. Then, she moved on to sea urchins, etc.

Instrument. This study used an existing observational instrument, developed by staff at the Seattle Aquarium and Woodland Park Zoo as a result of their aforementioned MECAP study (Jackson and Khalil, 2017). This instrument measures 5 empathic behaviors – 1) Understands needs of animal, 2) Able to take perspective of animals, 3) Has compassionate concern for

animals, 4) Shows positive behavior towards animals, 5) Has desire/wants to help animals. It also measures 5 related observable behaviors that deal with less overt empathic behaviors, which are more commonly seen with non-charismatic animals like invertebrates – 6) Has interest or curiosity towards animal, 7) Has appreciation/respect for animal, 8) Recognizes animal as individual with own agency, 9) Engages in direct action to help animal, and 10) Supports positive behavior and attitudes. Under each of these categories are listed the specific observable behaviors alongside spaces to mark how many times a participant engaged in each behavior. (See Appendix A for the observational instrument.)

The researcher made slight modifications to the instrument, as it was originally designed to incorporate some children's actions that do not apply to adults. For example, on the original instrument, one behavior under Category 8 was "Uses pronouns/personal name of animal," and another behavior listed under Category 10 was "Caregiver uses pronouns/personal name of animal." Since the researcher only observed adults, it would be redundant to include both behaviors. Therefore, the caregiver version of this behavior was removed, and pronoun use was recorded under Category 8 when any participant – caregiver or not – engaged in it.

A new behavior under Category 10 was added in the deleted behavior's place. After witnessing numerous adults encourage children to touch animals during pilot testing, "Encourages child to touch animal" was added. This behavior is important because touch is highly associated with fostering empathy. Though caregivers who encouraged children to touch animals may not have touched the animals themselves, they *were* engaging in facilitating another individual's empathic inclinations. For this reason, a similar behavior, "Encourages other adult to touch animal" was also added under Category 10 upon witnessing this behavior during pilot

Testing. Category 10 was renamed "Supports positive behavior and attitudes," as it now did not exclusively deal with caregivers.

Additionally, this study considered there to be 4 caregiver behaviors on the instrument – "Corrects behavior of others to be more positive around animal," "Caregiver models gentle touch," "Caregiver reinforces positive behavior around animal," and "Caregiver encourages child to touch animal." In Jackson and Khalil's (2017) study, "Corrects behavior of others to be more positive" was not considered an exclusively caregiver behavior, since children can engage in this behavior too. However, this study only observed adults, and every instance of correction involved an adult correcting a child. Therefore, "Corrects behavior of others" is considered a caregiver-specific behavior in the scope of this study.

Under Category 2, the behavior "Mimics the behavior – prompted or cued by presenter" was removed, as touch tanks do not typically incorporate this programmatic element, and it is not typically aimed at adults, regardless.

Finally, a box at the top of the instrument was added to indicate whether the interaction was facilitated (by a volunteer or staff member) or not. Gauging how many visitors showed empathic behaviors on their own – compared with those who received encouragement from aquarium staff – will shed more light on the nature of empathic encounters with non-charismatic animals.

Research Participants

The researcher conducted 258 observations across the three research sites. None were discarded or incomplete. The distribution of observations by research site was 34.9% (n=90) at NEAQ, 32.6% (n=84) at OCA, and 32.6% (n=84) at AOP. The distribution of observations by animal was 32.9% (n=85) sea urchin, 34.5% (n=89) sea star, and 32.6% (n=84) sea anemone.

No demographic information about the research participants was collected. However, 50% (n=128) of participants engaged in at least one caregiver behavior. Additionally, 43% (n=111) of the observed interactions were facilitated by staff or volunteers.

Data Analysis

The observational instrument provided quantitative data through an ethogram-like system of making checkmarks in boxes that corresponded to each specific behavior listed. Descriptive statistics were used to summarize data from the instrument and interpret trends across research participants. These analyses were useful in answering the first and second research questions. Descriptive statistics were also used to compare this study's data on invertebrates with the Jackson and Khalil's (2017) data on more charismatic animals (the gorilla and jaguar), which aided in answering the third research question. Inferential statistics were used for significance testing and generalizing this study's quantitative data to the population of US aquarium visitors at large, helping to more thoroughly answer the first and second research questions.

Limitations

One limitation of this study is that results may skew slightly positive due to selection bias. Since sampling was based on convenience – observing the next person to interact with a given animal – results do not show the number of people who passively walked by without engaging at all. Instead, the data only describes those who chose to interact in some way, however small.

Additionally, when utilizing observational methods, all data is mediated through the observer. Though she may try her best to minimize biases, the occasional misunderstanding, inattention, or misinterpretation cannot be completely prevented. Therefore, this limitation may

also skew the data somewhat positively. However, pilot testing was utilized to mitigate this issue as much as possible.

Finally, because such minimal data were collected regarding participants' demographics, the study is unable to describe or compare how various subsets of the population may differ with regard to their empathic behaviors toward marine invertebrates. Nevertheless, the intent of this study is to generalize, and data was collected from a diverse array of locations, so comparisons of demographic subsets are not requisite.

Chapter 4: Results

This chapter presents the results of observations to determine whether and how adult aquarium visitors empathize with non-charismatic species they encounter at aquarium touch tanks.

1. What empathic behaviors do visitors express during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?

Observations of visitors during encounters with sea urchins, sea stars, and sea anemones focused on five categories of empathic behavior, as documented in previous research (Jackson and Khalil, 2017): 1) understands needs of an animal; 2) able to take perspective of animals; 3) has compassionate concern for animals; 4) shows positive behavior towards animals; and 5) has desire/wants to help animal(s).

Across the 258 participants, the researcher observed a total of 451 instances of empathic behavior directed towards either sea urchins, sea stars, or sea anemones. Table 1 shows how many instances of each specific empathic behavior occurred, grouped by the five categories mentioned above, which are highlighted in green.

Table 1: Frequency of empathic behaviors (N=451).

Empathic behaviors	**Frequency**
1) Understands needs of animal	**0% (0)**
(a) Talks about animal's basic needs of food and water	0% (0)
(b)Talks about additional animal needs	0% (0)
(c)Compares self to animal (similar)	0% (0)
(d)Contrasts self to animal (different)	0% (0)
2) Able to take perspective of animal	**0.9% (4)**
(a)Predicts or speaks to animal's state or behavior	0.7% (3)
(b)Spontaneously mimics behavior of animal	0.2% (1)
(c)Provides reasonable explanation for prediction of behavior	0% (0)
3) Has compassionate concern for animal	**0.7% (3)**
(a)Shows concern for direct well-being of animal	0.7% (3)
(b)Expresses way to contribute to animal's direct well-being	0% (0)
4) Shows positive behavior toward animal	**98% (444)**
(a)Touches animal gently on their own	94% (424)
(b)Corrects behaviors of others to be more positive around animal	4% (19)
(c)Adjusts or corrects own behavior to be more positive around animal	0.2% (1)
(d)Self-regulates own behavior to make animal feel safe or calm	0% (0)
5) Has desire/wants to help animals	**0% (0)**
(a)Expresses way to contribute to animal's direct well-being	0% (0)
(b)Wants to take action to directly help animal	0% (0)
(c)Wants to take action to help animals in general	0% (0)
(d)Mentions way they can help animal	0% (0)
(e)Shares with others actions they can take to help animal	0% (0)

In addition to observing empathic behaviors, the researcher also recorded instances of 5 related observable behaviors, as documented in previous research (Jackson and Khalil, 2017). The following categories are numbered in accordance with their numbers on the instrument: 6) has interest or curiosity towards animal; 7) has appreciation/respect for animal; 8) recognizes animal as individual with own agency; 9) engages in direct action to help animal; and 10) caregivers support positive behavior and attitudes. These behaviors do not necessarily indicate empathy itself, but they are *related* to feeling empathy (Jackson and Khalil, 2017). A total of 1,026 instances of these related behaviors were recorded by the researcher, as seen in Table 2.

Table 2: Frequency of related observable behaviors N=1,026).

Related observable behaviors	Frequency
6) Has interest or curiosity towards animal	**49% (502)**
a) Observes animal closely	23% (239)
b) Verbalizes observations of animal	15% (154)
c) Seeks information about animal	6% (57)
d) Wants to observer longer or for second time	5% (52)
7) Has appreciation/respect for animal	**16% (160)**
a) Shows non-verbal love or appreciation towards animal	9% (89)
b) Verbalizes appreciation, gratitude, or love for animal	6% (62)
c) Verbalizes positive feelings about animal's characteristics	0.9% (9)
8) Recognizes animal as individual with own agency	**6% (61)**
a) Comments on animal's independent movements	5% (47)
b) Uses pronouns or personal name of animal	1% (14)
c) Greets or says goodbye to animal	0% (0)
9) Engages in direct action to help animal	**0.1% (1)**
a) Protects or reduces danger to animal	0.1% (1)
b) Provides care for an animal directly	0% (0)
10) Supports positive behavior and attitudes	**29% (302)**
a) Caregiver encourages child to touch animal	18% (180)
b) Caregiver reinforces positive behavior around animal	8% (83)
c) Encourages another adult to touch animal	2% (21)
d) Caregiver models gentle touch	2% (18)

2. What factors seem to influence visitors' empathic behaviors during encounters with sea urchins, sea stars, and sea anemones in the touch tank environment?

Four factors were examined to determine their potential influence on visitors' empathic behaviors during encounters with non-charismatic species in an aquarium touch tank: a) the

specific aquarium; b) the specific animal; c) whether the interaction with the animal was facilitated or not; and d) caregiver behaviors.

a) Empathic behaviors by aquarium

Data were collected at three different aquariums, each with non-charismatic species in their touch tanks: New England Aquarium, Oregon Coast Aquarium, and Aquarium of the Pacific. In comparing medians across these three groups for all five empathic behaviors, two sub-behaviors within Category 4 – "Touches animal gently" (p=.000) and "Corrects behavior of others" (p=.006) – showed significant differences by aquarium. Specifically, visitors to Aquarium of the Pacific touched the invertebrates more frequently than visitors to the other two aquariums, while visitors to New England Aquarium corrected others' behavior more than did visitors to the other two aquariums.

b) Empathic behaviors by animal

Visitors were observed interacting with one of three non-charismatic species in this study – sea stars, sea urchins, and sea anemones. When medians across the three animals were compared for all five empathic behaviors, one behavior within Category 4 – "Corrects behavior of others" – was found to show a significant difference (p=.005). Specifically, visitors were more likely to correct others' behavior at the touch tanks when the animal involved was a sea star.

c) Empathic behaviors by facilitation of interactions

Some of the interactions at the touch tanks were facilitated by staff members or volunteers, while some were non-facilitated. In these latter instances, participants experienced the touch tanks without asking questions or talking with staff about the specific animal with whom they interacted. The frequency of empathic behaviors was almost evenly split between facilitated and non-facilitated interactions. When medians were compared across facilitation and non-facilitation of interactions for all five empathic behaviors, one significant difference was

found within Category 4 for the behavior “Touches animal gently” (p=.027). Specifically, visitors whose interactions were facilitated by staff were more likely to touch the animal multiple times.

d) Related observable behaviors by aquarium

When the medians of related observable behaviors were compared, three significant differences were found. First, a significant difference was found within Category 6 for the behavior “Seeks information about animal” (p=.048). Specifically, visitors at Aquarium of the Pacific were less likely to seek information about animals than those at the other two aquariums. Second, a significant difference was found within Category 7 for the behavior “Shows non-verbal love or appreciation towards animal” (p=.001). Visitors at Aquarium of the Pacific were more likely to show non-verbal love towards the invertebrates than visitors at the other aquariums. Third, a significant difference was found within Category 10 for the behavior “Caregiver reinforces positive behavior” (p=.001). Specifically, visitors to New England Aquarium were more likely to reinforce their children’s positive behavior than visitors at the other two aquariums.

e) Related observable behaviors by animal

The specific animal involved in an interaction also may have influenced participants’ related observable behaviors. Upon comparing medians across the three animals for all 5 of these behaviors, two behaviors in Category 6 were found to show significant differences by animal. The behavior “seeks information about animal” was more likely to be displayed in conjunction with anemones than the other two animals (p=.006). Also, the behavior “Wants to observe longer or for a second time” was more likely to be displayed in conjunction with sea stars (p=.008).

In Category 8, the behavior "Comments on animal's independent movements" showed a significant difference by animal (p=.003). Specifically, participants were more likely to comment on a sea urchin's movements than those of the other two animals.

f) Related observable behaviors by facilitation of interactions

Participants' related observable behaviors also varied depending on whether their interactions were facilitated by staff and volunteers or not. When medians across facilitation and non-facilitation of interactions were compared, 3 of the 4 behaviors within Category 6 were found to show significant differences. Specifically, participants were significantly more likely to observe an animal closely if the interaction was facilitated (p=.000). Participants were also significantly more likely to seek information when the interaction was facilitated (p=.000). The third significant behavior, "Wants to observe longer or for a second time" was also more likely to occur if the interaction was facilitated. (p=.004).

Moreover, in Category 7, 2 behaviors showed significant differences by facilitation. Specifically, the behavior "Shows non-verbal love or appreciation towards animal" was significantly more likely to occur if the interaction was facilitated (p=.000). Similarly, the behavior "Verbalizes appreciation, gratitude, or love for an animal" was significantly more likely to occur if the interaction was facilitated (p=.000).

g) Touching an animal by whether participants engaged in caregiver behaviors

There were four caregiver-specific behaviors measured in the observations – "Caregiver encourages child to touch animal," "Caregiver reinforces positive behavior around animal," "Caregiver models gentle touch," and "Corrects behavior of others to be more positive around animal" (see Appendix A). Upon comparing medians, 2 caregiver-specific behaviors showed a significant difference by touch. Caregivers who "reinforced positive behavior" were significantly

less likely to touch animals than other visitors who did not reinforce positive behavior (p=.000). Similarly, caregivers who corrected others' behavior were significantly less likely to touch animals than other visitors who did not correct children's behaviors (p=.045).

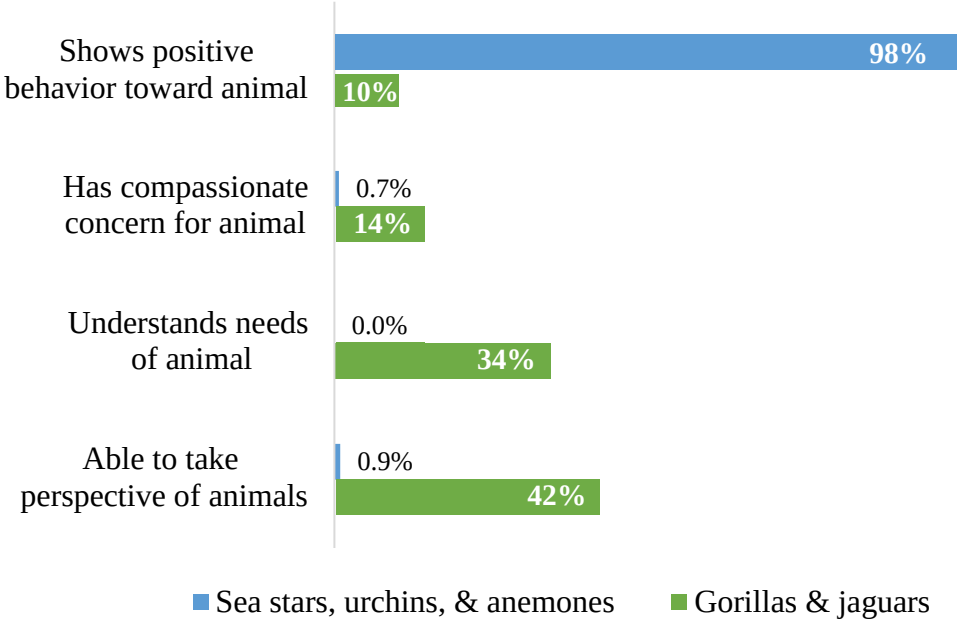
3. How are visitors' empathic behaviors towards these non-charismatic animals similar to and different from visitors' empathic behaviors towards more human-like animals in the aquarium?

To answer this research question, data from this study were compared to data from a recent study conducted at the Woodland Park Zoo and the Seattle Aquarium, using the same instrument (Jackson and Khalil, 2017). Jackson and Khalil investigated zoo visitors' empathic behaviors towards charismatic animals – specifically jaguars and gorillas. Jackson and Khalil observed 50 instances of empathic behaviors at these 2 charismatic animals' habitats. In contrast, the current researcher observed 451 instances of empathic behaviors directed towards sea stars, sea urchins, and sea anemones at touch tanks across the three aquariums represented in this study.

a) Empathic behaviors towards charismatic and non-charismatic animals

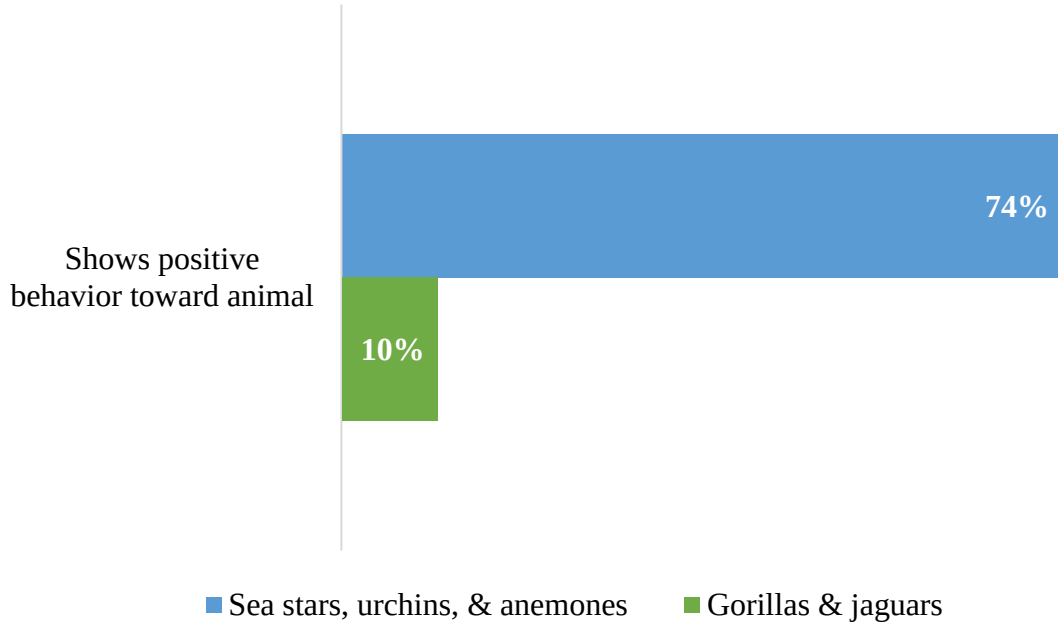
Figure 1 compares how many empathic behaviors were observed at the charismatic animals' habitats at the zoo and the non-charismatic invertebrates' touch tanks in the three aquariums in the current study.

Figure 1: Percentages of empathic behaviors directed toward charismatic gorillas and jaguars (N=50) compared with percentages of empathic behaviors directed toward non-charismatic sea stars, urchins, and anemones (N=451).



The marine invertebrates received so many more instances of "showing positive behavior" largely because touch is included in this category. As zoo visitors did not have the opportunity to touch the gorillas and jaguars, Figure 2 factors touch out of the results for a more nuanced understanding of the distribution of showing positive behaviors.

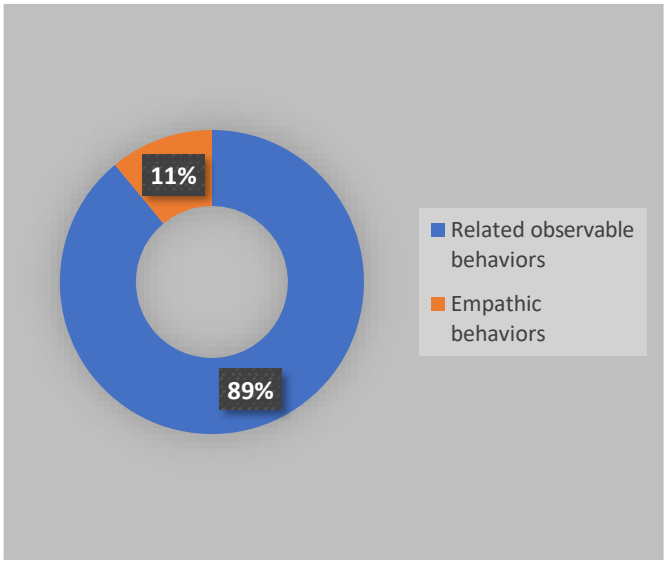
Figure 2: Instances of positive behavior – excluding touch – directed towards sea stars, urchins, and anemones (N=27) vs. gorillas and jaguars (N=50).



b) Empathic behaviors vs. related observable behaviors directed toward both charismatic and non-charismatic animals

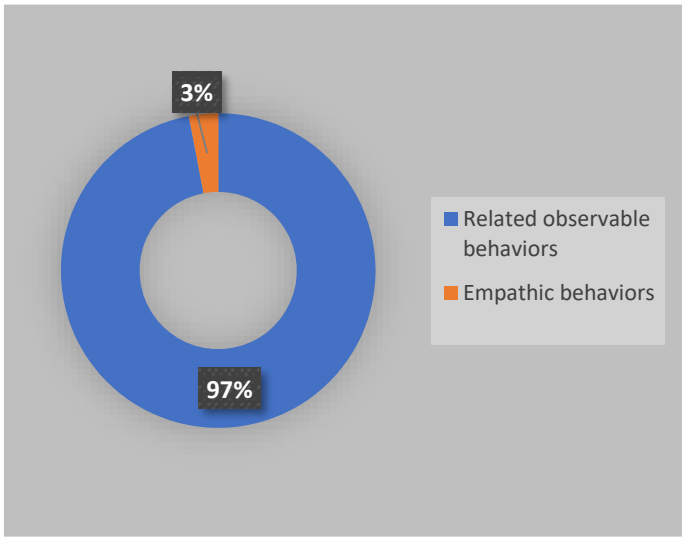
As seen in Figure 3, Jackson and Khalil's study shows that visitors demonstrated mostly related observable behaviors when interacting with the charismatic animals at the Woodland Park Zoo. Again, instances of touch are excluded from these results, as touch was not an opportunity at the gorilla and jaguar habitats.

Figure 3: Empathic behaviors vs. related observable behaviors directed towards the jaguars and gorillas at Woodland Park Zoo (N=436).



Similarly, aquarium visitors in the current study showed mostly related observable behaviors when interacting with the non-charismatic marine invertebrates, as seen in Figure 4.

Figure 4: Empathic behaviors vs. related observable behaviors directed towards the sea stars, urchins, and anemones at three aquariums (N=1,053)



Chapter 5: Conclusions and Implications

In recent years, building empathy for animals has become a recognized strategy for inspiring pro-conservation behavior. There is evidence that zoos, aquariums, and other wildlife conservation organizations can utilize empathy as a tool to promote better, more environmentally friendly practices among their visitors. However, evidence also shows that it is more difficult to build empathy for non-charismatic animals – those who look the least like humans. Their different morphologies can render them strange and repellent – even disgusting to some (Cushing & Markwell, 2011; Marešová & Frynta, 2008).

This study investigated what types of empathic behaviors people tend to show towards non-charismatic invertebrates and what factors might influence these behaviors. Specifically, this study determined 1) the empathic behaviors aquarium visitors display during touch tank interactions with sea stars, sea urchins, and sea anemones, 2) the factors that seem to influence these behaviors, and 3) how these visitors' empathic behaviors are similar to and different from other visitors' behaviors toward more human-like, charismatic animals. Observations of 258 individuals at three different aquariums were collected over a period of one month. A total of 451 empathic behaviors and 1,026 related observable behaviors were displayed towards the marine invertebrates during touch tank interactions.

This study adds to the conversation about utilizing empathy as a strategy to change adult visitors' behaviors for the benefit of the environment. The results have implications for practice and future research.

Conclusions

1. What empathic behaviors do visitors express during encounters with sea urchins, sea stars, and sea anemones in an aquarium touch tank environment?

a) The primary empathic behavior displayed by visitors was touch**.**

The majority of participants touched either the sea stars, sea urchins, or sea anemones at least once. Many visitors who did not display any other empathic behaviors at least engaged in touching the invertebrates, and touch was often encouraged by touch tank staff and volunteers. Of course, visitors to touch tanks might come with the expectation of being able to touch animals, so this finding in itself is not surprising.

The other empathic behaviors were not displayed as frequently as was touch. In fact, participants displayed few other empathic behaviors. The second most frequent empathic behavior was correcting others' behavior to be more positive around the animals. Parents corrected their children's behavior when it became too unruly and/or could have harmed the animals. There were also a few instances in which participants showed concern for the invertebrates in the touch tanks or talked about what emotions the invertebrates might be feeling. One participant even mimicked what he imagined an anemone would feel like if it got touched on its center, which is discouraged because it is stressful and unpleasant for the anemones. Another participant expressed sadness and concern when she learned anemones sometimes exhibit so many signs of stress that they must be moved to a non-touch tank for a while to recover. These results suggest that, though displays of empathic behavior (other than touch) towards marine invertebrates are uncommon, visitors do have the capacity to empathize with these non-charismatic animals, but many may need more pointed encouragement to do so (Tisdell et al., 2007; Young et al., 2018).

b) Behaviors related to empathy were more often displayed by visitors.

Though empathic behaviors other than touch were not common, every single participant displayed at least one of the related observable behaviors, such as observing the invertebrates closely, verbalizing observations about them, or seeking information about them. These

behaviors may not connote empathy itself, but they are considered closely related to empathy (Jackson and Khalil, 2017).

The most frequently displayed related observable behavior was closely observing the invertebrates. Second most common among the related behaviors was verbalizing observations. Participants commented on what they saw or felt when they viewed and/or touched the sea stars, anemones, or urchins, calling them "spiny," "wiggly," "soft," etc. Participants also (albeit less frequently) asked questions about these animals and sometimes continued to seek them out in other areas of the tank. Aquarium visitors show abundant curiosity and interest towards the non-charismatic marine invertebrates they encounter at touch tanks.

Almost one-third of the instances of related observable behaviors dealt with supporting positive behavior in others. These behaviors involved encouraging children or adult friends to touch the invertebrates, modeling gentle touch for children, and reinforcing children's positive behavior. Encouraging children to touch animals was by far the most common behavior among these and accounts for almost one-fifth of all the related observable behaviors. These results suggest that many aquarium visitors, whether they experience empathy themselves or not, often assist in fostering someone else's empathy (Jackson and Khalil, 2017; Owen and Seattle Aquarium, 2015).

A few instances of behavior involved showing appreciation or respect toward the invertebrates or recognizing them as individuals with their own agency. Though these behaviors were less common than the other related observable behaviors mentioned above, together they represent just over one-fifth of all related observable behaviors. Aquarium visitors have the capacity to appreciate, respect, and perhaps empathize with non-charismatic animals. This finding is congruent with Skibins et al.'s (2016) findings that less charismatic animals enjoy

more appreciation and success than expected when zoos give them the chance to be flagship species.

2. What factors seem to influence visitors' empathic behaviors during encounters with sea urchins, sea stars, and sea anemones in the touch tank environment?

Four factors may influence visitors' empathic behaviors during encounters with non-charismatic species in aquarium touch tanks: a) the specific aquarium; b) the specific animal; c) whether the interaction with the animal was facilitated; and d) whether the human participant was a caregiver.

a) How the specific aquarium may influence empathic and related observable behaviors

Aquariums' interpretive plans can be very different, even though most of them have similar goals, especially conserving the environment (Luebke & Grajal, 2011). For example, the Oregon Coast Aquarium's [OCA] interpretive plan hasn't changed in 27 years, so although climate change matters to the board and staff, visitors will not find any signage with information about the effects of climate change or what humans can do to stop it. Rather, interactions with staff and volunteers during programs and facilitated experiences like touch tanks provide this information to visitors. In contrast, the Aquarium of the Pacific [AOP] has concentrated much of its interpretation on climate change and dialogue around the environmental issues that threaten the planet.

These differences in aquariums' high-level interpretive frameworks may impact what visitors experience on the ground, and they also determine the various methods staff are trained to use when interacting with visitors at facilitated experiences like touch tanks. For example, volunteers at New England Aquarium's [NEAQ] touch tanks were highly diligent about reminding almost every incoming visitor to use only two fingers to touch the invertebrates, and most did not hesitate to correct children's or adults' mistakes. This vigilance is reflected in the

data – visitors to NEAQ were significantly more likely to correct their children's behavior and reinforce positive behaviors than visitors to the other two aquariums.

More specifically, the spatial layout and level of chaos at a given touch tank may also affect what visitors experience there. Though AOP's touch tanks were incredibly busy during the times the researcher observed them, visitors were significantly more likely to touch the animals multiple times than were visitors to the other two aquariums. As AOP's touch tanks were situated in a linear shape, and there was almost always a long queue of visitors wrapping around the room waiting for their chance to touch the animals, staff frequently sent visitors from the beginning of the touch tanks farther down to make room for others. Visitors who moved were then able to touch more animals in the farther sections of the tanks. Visitors also may have wanted to make the most of their touch tank experience, as they had waited so long in line before their opportunity came.

Similarly, visitors to AOP were significantly less likely to seek information, which may be accounted for by the noise and chaos produced by so many adults and children in a small area. Nonetheless, it appears that AOP visitors generally enjoyed their time at the touch tanks, as they were significantly more likely to show non-verbal love or appreciation to the invertebrates through smiling, laughing excitedly when interacting with them, etc.

b) How the specific animal may influence empathic and related observable behaviors

Different animals may produce different responses in the humans that interact with them. Sea stars, for example, were significantly more likely to be the animal involved when a parent was correcting their child's behavior. This is likely due to the ease with which children could pick up or mishandle a sea star as compared to an anemone, which is attached to the tank floor by its base, or an urchin, whose spikiness is a deterrent. Visitors were also significantly more

likely to observe sea stars longer or for a second time, as there were often more of them scattered throughout the touch tanks than the other two animals. Sea stars are arguably the most well-known and familiar of the three animals in this study, and familiarity is often crucial to empathy development (Jipson & Gelman, 2007; Myers et al, 2009; Young et al., 2018).

Visitors were significantly more likely to comment on an animal's independent movements if it was a sea urchin. This result is probably accounted for by the emphasis AOP and OCA (and NEAQ, to a lesser extent) touch tank staff place on "getting a sea urchin hug." They often encouraged visitors to place a finger in between the urchin's spines, which would result in the urchin slowly moving those spines to more tightly enclose the finger, as it tried to determine what entered its area. This "hug" often resulted in wonder and comments on these spine movements.

c) How the facilitation of interactions may influence empathic and related observable behaviors

Whether a touch tank interaction was facilitated or not may influence visitors' behaviors. Some conservation institutions like Seattle Aquarium and Woodland Park Zoo train their staff to build empathy for animals among visitors (Jackson and Khalil, 2017; Owen and Seattle Aquarium, 2015). But even aquariums that do not follow this specific interpretive approach train touch tank staff and volunteers to encourage visitors to touch the animals and to regale them with interesting or comical facts, which can also build empathy (Owen and Seattle Aquarium, 2015; Young et al., 2018). Accordingly, those who interacted with staff or volunteers were significantly more likely to touch an animal multiple times, to observe the animal closely, and to observe the animal for a second time during their touch tank experience. The researcher observed numerous instances in which visitors would have walked right past an animal if a facilitator had not drawn their attention to it.

Visitors were also more likely to show appreciation or respect for the invertebrates if their interactions with them were facilitated by staff. Specifically, participants were significantly more likely to verbalize love, gratitude, or appreciation and to show non-verbal love or appreciation towards an animal if the interaction was facilitated. Often the facts and anecdotes told by staff induced visitors to comment on how "cool," "fascinating," or "interesting" an animal might be. This finding is congruent with findings that demonstrate that learning more about an animal helps people empathize with them (Myers, 2007; Owen and Seattle Aquarium, 2015).

d) How being a caregiver may influence visitors' empathic and related observable behaviors

Half of all participants in this study engaged in at least one caregiver-specific behavior, and playing a caregiver role as opposed to visiting an aquarium without children in tow may influence the types of behaviors visitors display at touch tanks. Being a caregiver significantly influenced whether or not participants touched the animals. Specifically, caregivers who reinforced their children's positive behaviors and caregivers who corrected children's negative behaviors were significantly less likely to touch the animals than other visitors. Similarly, encouraging children to participate by touching animals was one of the most frequent behaviors observed.

These results suggest that caregivers may be more focused on their children's experience at the touch tanks than their own. The results are also in keeping with findings that suggest caregivers and other close role models can exert considerable influence over children's attitudes on nature and whether they feel empathy for it (Arluke, 2003; Chawla, 2009; Chen-Hsuan Cheng and Monroe, 2012). Caregivers at aquarium touch tanks are interested in the invertebrates, but

perhaps more on behalf of their children. Whether that interest is enough to provoke empathy or change behavior is less certain.

3. How are visitors' empathic behaviors towards these non-charismatic animals similar to and different from visitors' empathic behaviors towards more human-like animals in the aquarium?

Zoo visitors at the jaguar and gorilla habitats at Woodland Park Zoo displayed more instances of empathic behaviors overall than did visitors to the touch tanks at the three aquariums in this study (Jackson and Khalil, 2017). This result was expected, considering the well-researched difficulty of connecting to non-charismatic animals, like the sea stars, urchins, and anemones in this study (Brambilla et al., 2013; Colléony et al., 2017; Lorimer, 2006; Marešová & Frynta, 2008). However, these three marine invertebrates received far more instances of empathic behavior in the category "shows positive behavior towards animal," as touching the animals and correcting others' behavior belong to this category (see Appendix A for instrument). This anomaly occurred because touching the gorillas and jaguars is not an opportunity available to zoo visitors, and correcting others' behavior at the touch tanks usually stemmed from children touching the animals too roughly or splashing the water, which would not happen at the jaguar and gorilla habitats.

Perhaps more revealing is the comparison between the amounts of empathic vs. related observable behaviors shown at the charismatic animals' habitats and at the touch tanks where the non-charismatic invertebrates live. Excluding instances of touch, both the charismatic and non-charismatic animals overwhelmingly received related observable behaviors as opposed to directly empathic behaviors. Nonetheless, the amount of empathic behaviors directed towards the charismatic animals was almost four times the amount directed towards the non-charismatic marine invertebrates. This data is in line with research that demonstrates the difficulty of

empathizing with non-charismatic animals, yet it also indicates that empathy has the potential to be elicited on behalf of non-charismatic animals, especially during facilitated experiences (Brambilla, 2013; Marešová & Frynta, 2008).

Implications

The conclusions above have implications for zoo and aquarium practice and future research.

Practice

Aquariums and zoos can design more facilitated experiences that foster empathy for non-charismatic animals, potentially leading to pro-conservation behaviors. The results of this study demonstrate that adult visitors to touch tanks do show some empathic behaviors towards non-charismatic marine invertebrates; and they show a great deal of behaviors that are related to empathy towards these animals as well. Aquariums and zoos can do more to tap into this potential for empathy-building for non-charismatic animals. Many wildlife conservation organizations already have programming for popular, charismatic animals, such as penguin feedings or bird shows; but programs and/or facilitated experiences focused on non-charismatic animals may prove beneficial as well. This study demonstrates that adults are responsive to facilitation, although it may need to be more pointed to truly encourage empathy.

Though much of the research surrounding empathy development focuses on children, adults are the ones with disposable incomes. Children can make a difference in the future, but adults can impact the fates of certain non-charismatic animals now. To do so, they need more direction from conservation organization staff and volunteers. If zoos and aquariums incorporate more empathy-building programming about non-charismatic animals that is inclusive of all ages, they might be able to successfully encourage adults to donate to a wildlife fund for the non-charismatic animals, potentially helping to save some species from endangerment.

Use facilitation strategies that encourage visitors to empathize with non-charismatic animals and to think about how visitors might change their behavior to benefit animals and their environments. Facilitation played an essential role in visitors' touch tank experiences throughout the course of this study. Many visitors began to pass by the marine invertebrates without engaging, but facilitators sought them out and encouraged them to participate at the touch tanks. The facilitators' thoughtful questions and enthusiastic information-sharing shaped how visitors viewed and experienced the animals and significantly lengthened the amount of time they spent with the animals.

Going forward, facilitators who want to encourage empathy and pro-environmental behavior change can use seven strategies – based on relevant literature and the results of this study – to help visitors consider the needs and experiences of non-charismatic animals:

1) Work to increase visitors' knowledge about non-charismatic animals. Knowing more about an animal's unique characteristics helps people understand the animal's value to the planet and to human life (Hills, 1995; Myers, 2007; Owen and Seattle Aquarium, 2015).

2) Explain how non-charismatic animals are similar to and different from humans (Owen and Seattle Aquarium, 2015). Focus particularly on highlighting the similarities, as differences are obvious for species that have many morphological differences from humans.

3) Encourage visitors to take the perspectives of non-charismatic animals (Berenguer, 2010; Myers et al., 2009; Schultz, 2000). For example, facilitators at touch tanks can engage visitors in this activity when discussing what appropriate touch looks like by saying, "How would you feel if someone stuck their hand in your mouth/picked you up with no warning?" Visitors may also engage in perspective-taking if they are asked questioned like "What do you

think the sea star is able to sense/feel?" or "How do you imagine the mother opossum protects her babies?"

4) Encourage visitors to touch non-charismatic animals when applicable. Touch is not only an indicator of empathy; it can also aid in empathy development (Myers et al., 2009; Orban et al., 2016; Owen and Seattle Aquarium, 2015). When visitors in this study touched the marine invertebrates, this engagement often led to further related behaviors, such as commenting on what the animal felt like, smiling and laughing in surprise, or making positive comments about the animal's characteristics.

5) Discuss non-charismatic animals in conjunction with climate change, their endangerment status, and/or how they have been harmed by human actions (Tisdell & Nantha, 2007). To make the most impact, share these facts while the visitor is engaging with the animal. This information may trigger empathy in visitors, help them understand that our behavior often has negative consequences for these animals, and prompt them to think about the animals' value to Earth and what it would mean if they became extinct.

6) Encourage visitors to think about specific actions they can take to help non-charismatic animals (and all animals) avoid the effects of human damage to the environment and climate change (Eisenberg and Miller, 1987; Mehrabian and Epstein, 1972; Pfattheicher et al., 2015; Young et al., 2018). Again, these conversations will make the most impact while the visitor is engaging with the animal in question. For example, a facilitator might say, "Anemones and the fish that live in them are harmed by the amount of plastic garbage in the ocean. We humans really need to stop using plastic to keep the ocean safe and healthy." Of course, these conversations should come about organically and feel natural rather than forced. Each facilitator

will need to judge what is best to say in the moment, but if they are cognizant of how to get visitors thinking about their own actions, more of these necessary conversations may occur.

7) Finally, encourage visitors to think about what non-charismatic animals might enjoy, to tap into positive empathy and lessen the focus on suffering (Morelli et al., 2015; Young et al., 2018). Zoos and aquariums do not want visitors to leave feeling distressed and sad, although it is important to promote pro-environmental behavior change. Discussing what makes animals happy and healthy will allow visitors to feel happiness along with the animals, rather than only sharing in their suffering.

Appeal to adults even during children's programming. As mentioned above, half of the participants in this study engaged in caregiver behaviors. In other words, they became facilitators of their children's touch tank experiences. They looked for ways to engage their children with the experience of touching animals and learning about them. When adults attend children's programming and/or age-inclusive programming, they are primed to receive the messaging given out by zoos and aquariums, so they can help their children learn more and understand. Designing more age-inclusive empathy-building programming and facilitated experiences that are centered around non-charismatic animals will invite caregivers to empathize with these non-charismatic animals while simultaneously teaching their children to do so as well.

Utilize empathy-building techniques in conjunction with other techniques to change pro-environmental behavior. As seen in this study, empathy for non-charismatic animals can happen, but it does not happen on a large scale – at least, not without more directed facilitation. However, the empathy-building technique is not meant to be used alone, but rather as part of a multi-pronged strategy that works to eliminate barriers to pro-environmental behavior change (Schultz, 2014; Young et al., 2018). As Young et al. (2018) discusses, providing some combination of

convenient behavioral alternatives, incentives, measurable feedback, and social pressure – depending on the specific behavior zoos and aquariums are trying to change – will work in tandem with empathy-based strategies and may increase the likelihood of successful pro-environmental behavior change among visitors (Schultz, 2014). Empathy can be a strong emotion, but other methods must be in place as well to fully inspire people to act on their empathy.

Further Research

What are visitors actually feeling when they display empathic behaviors? This study's methodology was observational, which allowed for determining which specific empathic behaviors participants showed. However, there was no way to determine precisely what participants were feeling while the empathic behaviors were occurring. Further research could allow visitors to report their own emotions during their interactions with animals, as Jackson and Khalil (2017) also suggested. It might be useful to match visitors' responses to observations of those same visitors during a facilitated experience. This technique would provide a greater understanding of how empathic behaviors are or are not typically linked to visitors' emotions.

Does feeling empathy for animals really lead to pro-conservation behaviors? While the results of this study show that aquarium visitors display numerous related observable behaviors and some empathic behaviors to non-charismatic animals, this field of research lacks conclusive evidence that feeling empathy at a zoo or aquarium can truly lead to pro-conservation behaviors. Longitudinal studies are needed to investigate which – if any – actions visitors take after empathizing with animals and encountering persuasive arguments to change their behaviors to positively impact the health of the environment. Furthermore, a study with this type of design

could investigate whether empathic experiences at wildlife conservation organizations continue to impact visitors weeks or months later.

What influences caregivers to feel empathy for animals at zoos and aquariums? This study found that caregivers are engaged in facilitating their children's empathic experiences at aquariums, perhaps at the expense of their own experiences, at times. It would be useful to know what techniques – if any – can contribute specifically to caregivers' empathy development. This information might help zoos and aquariums design more pointed age-inclusive programming and facilitated experiences.

What are the differences – if any – between how various demographics experience feeling empathy for animals? This study explored whether and how adult visitors to aquariums display empathic behaviors to non-charismatic animals there. However, this study did not collect demographic information. It would further develop the study of empathy for animals to learn how different subsets of the population experience empathy at zoos and aquariums.

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Appendix: Observational Instrument

Observable Behavior or Engagement	obs.1	obs. 2	obs.3	obs. 4	obs. 5	Supporting evidence/notes
Facilitated?						
Date:						
Animal:						
1) Understands needs of an animal						
A) Talks about animal's basic needs of food and water						
B) Talks about additional animal needs						
C) Compares self to animal (similar)						
D) Contrasts self to animal (different)						
2) Able to take perspective of animals						
A) Predicts or speaks to animal's state or emotion						
B) Provides reasonable explanation for prediction of emotion						
C) Spontaneously mimics the behavior of an animal						
3) Has compassionate concern for animals						
A) Shows concern for the direct well-being of an animal						
B) Expresses way to contribute to animal's direct well-being						
4) Shows positive behavior towards animals						
A) Touches animal gently on their own						
B) Self-regulates behavior to make animal feel safe or calm						
C) Adjusts or corrects own behavior to be more positive around animal						
D) Corrects behavior of others to be more positive around animal						
5) Has desire/wants to help animal(s)						
A) Wants to take action to directly help an animal						
B) Wants to take action to help animals in general						
C) Mentions way they can help animal						
D) Shares with others actions they can help animal						

Related Observable Behaviors	obs. 1	obs. 2	obs. 3	obs. 4	obs. 5	Supporting evidence/notes
6) Has interest or curiosity towards animal						
A) Observes animal closely						
B) Verbalizes observations of animal						
C) Seeks information about animal						
D) Wants to observe longer or for second time						
7) Has appreciation/respect for animal						
A) Verbalizes appreciation, gratitude or love for animal						
B) Shows non-verbal appreciation/love towards animal						
C) Verbalizes positive feelings about animal's characteristics.						
8) Recognizes animal as individual with own agency						
A) Comments on animal's independent movements						
B) Uses pronouns/personal name of animal						
C) Greets or says goodbye to animal						
9) Engages in direct action to help animal						
A) Provides care for an animal directly						
B) Protects or reduces danger to animal						
10) Supports positive behavior and attitudes						
A) Caregiver encourages child to touch animal						
B) Caregiver models gentle touch						
C) Caregiver reinforces positive behavior around animal						
D) Encourages another adult to touch animal						

Additional comments: