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Series Editor: John Fraser

John Fraser
Joe E. Heimlich
Kelly Riedinger *Editors*

Zoos and Aquariums in the Public Mind

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Psychology and Our Planet

Series Editor

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The book series Psychology and Our Planet comprises edited volumes, monographs, and briefings that focus on the interaction between mental process and the environment. At present environmental, population, and conservation psychology represent broad areas of practice that tend to have a disaggregated publication record. While the work in past builds on a broad base of research, synthesis of these papers tends to only appear in service to a specific research publication, and more importantly, is seldom synthesized in ways that are useful to academic training and policy advancement. The series seeks to redress that gap by providing a forum and meeting place for psychologists from across disciplines to advance the exchange ideas, and, where appropriate, provide opportunities for collaboration. The aim of the series is to publish books on the many dimensions of how people conceive themselves within the biological and cultural systems that shape the world, and to expand the full range of human relationships to the conditions that have created the world we live in today, and the decisions that will guide anthropogenic impacts on the planet's future.

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Zoos and Aquariums in the Public Mind

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Abbreviations

AZA	Association of Zoos and Aquariums
CBD	Convention on Biological Diversity
CEC	Association of Zoos and Aquariums' Conservation Education Committee
EAZA	European Association of Zoos and Aquariums
SSRA	Social Science Research Agenda
WAZA	World Association of Zoos and Aquariums
WZAM	Why Zoos and Aquariums Matter
Z/A	Zoos and Aquariums

Chapter 1
An Integrated Approach to Museum Learning Research

John Fraser, Joe E. Heimlich, Kelly Riedinger, and Uduak Grace Thomas

Introduction

The term "informal learning environments" is commonly applied to zoos and aquariums (Z/A). Unfortunately, the use of that technical label can misrepresent the range of learning experienced by users. It suggests that learning in these settings is incidental or happenstance rather than intentional.

By definition, a zoo, an aquarium, or any other cultural institution is visited intentionally. The public has no qualms describing these destinations as educational institutions, despite the technical distinctions made in learning theory. Popular culture, however, has tended to disregard these learning purposes. Bates and Ferri (2010), for example, categorize museums as an elite type of entertainment, while Z/A's are publicly considered an egalitarian pleasure accessible to all. Unfortunately, human exceptionalism takes, at face value, that learning must be linked to an economic benefit or a career pursuit with fiscal benefit to be valued, characterizing effort which does not contribute to national economic gain as effectively stealing from economic growth (Weber, 1976). Lieb (2001) suggests this paradigm has led entertainment experiences to be considered unworthy of academic study, a concept that positive psychologists take umbrage with (i.e. Stebbins, 2016). Zoo research

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has already demonstrated that learning itself is a pleasurable activity (i.e. Sickler & Fraser, 2009). Through this chapter and the subsequent chapters that our colleagues present in this book, we argue that the museum experience in general, and the Z/A in particular, embrace the differing structures of learning at the same time, and that informal, incidental, and everyday learning are not the same. All types of learning can occur in informal settings, even though intended learning is the basis of the experiences and programs offered by the institution.

That is to say, learning is constant, and informal learning is an intentional pursuit by visitors or guests. A self-aware person is better able to integrate or apply new information, and develop a greater understanding of a topic. Without being aware of it, a person guides their own learning journey within an ecosystem of STEM learning opportunities.

A common misunderstanding of how learning is categorized and facilitated within each structure[1] has the unfortunate effect of designating informal learning institutions, like Z/As, as destinations for frivolous experiences rather than a pleasurable part of being a learning entity. By way of introduction to this book, we offer an integrative model for reconceptualizing Z/A learning, and possibly all informal learning, as more aligned to how these institutions can and do fit into society. We do so, in part, to dispel the potentially pejorative monikers that may limit appreciation of the breadth of affordances that *can* be offered by the sector, but more importantly, to forward the discussion of the broad social contributions of Z/As to society. In so doing, we hope this framework and the research in the following chapters can free research in these spaces from the assumed constraints of one-time cause and effect studies that hide the complexity of the museum enterprise.

A Brief History of Informal Learning Designations

A growing body of research demonstrates how experiential learning in museums like Z/As contributes to knowledge gains across the spectrum of cognitive learning, affective understanding, and conation and behavioral growth. Throughout history, these institutions, widely referred to as informal learning environments, have been assigned a variety of responsibilities. For example, in the early 1800s, soon after the London Zoo was opened as a scientific institution for the study of animals, the government decided to include public visiting hours, with the goal of educating their visitors as a diversion from the more prurient leisure activities they attributed to the working class like drinking to excess or fighting (Ito, 2006). In a similar vein, as the United States of America was first developing its experiments in democracy, the shakiness of the enterprise led to the creation of a standing army tasked with defending the fledgling democracy. At the time, there was no national tradition of formal

[1] Here we refer to the five types of learning structures: formal, informal, non-formal, incidental, and the everyday.

education for the general public since it was not considered a right of the citizenry.[2] That exercise led to the establishment of a museum at each army base tasked with the responsibility of teaching the principles of democracy (Phillips, 2005).

In the nearly 275 years since the museum as a learning institution emerged, we have struggled to understand both how learning happens in these experiences and the desired outcomes we can have for that learning. The intersection of the democratic model of public education coupled with this movement toward the use of collections for education created what was seen as a necessary distinction and comparison between the contexts and purposes of what became known as 'formal' education or schooling (instruction) versus what was given a blanket label of informal (personal growth or enlightenment). The Imperial European model of the public museum as a public teaching tool, originating at the turn of the eighteenth century (Abt, 2006), came into focus with the 1750s physician's teaching collections in London (Abt, 2006) and Padua (Zanatta & Zampieri, 2018). These were collections of physical objects, since dubbed curiosities, but reflecting a more elitist model of instruction through objects (Hooper-Greenhill, 1992). Since that time, the expansion of democracy and equality and formal education systems has continued to make an intentionally sharp distinction between formal schooling and places for personal enlightenment, growth, and satisfaction.

In the first two decades of the twenty-first century, the European Union focused on crafting policies to encourage integration across the different facets of the cultural sector that includes museums like Z/As. They did so to support economic competitiveness, employability, and personal development. The policy included a focus on lifelong learning, despite reservations that the evidence about the actual contribution these institutions make to employability or economic participation might be lacking (European Commission, 2002; Werquin, 2010). Despite that expressed concern, the OECD categorized the museum sector solely as an informal learning environment. That same misappellation is frequently used to describe museums in the US (i.e. National Research Council, 2009), even though lifelong learning includes incidental, pre-conscious, and unplanned learning (Jarvis, 2012). We suggest the term "informal learning" helps to perpetuate the myth that learning at a museum like a Z/A might not be intentional or that informal learning is equivalent to a formal structure. We argue that formal, informal, non-formal, incidental, and everyday learning are often not well connected in a person's mind, yet a lot of planned learning or learning that is incidental to a plan is valid and part of an individual's learningscape (Heimlich & Reid, 2017) and how they draw learning outcomes in their learning ecosystem (Bronfrenbrenner, 1992; Gupta et al., 2020; National Research Council, 2014, 2015).

While simplifications make policy writing easier, summary classifications can lead to misconceptions. To explain, we distinguish between two of the structures of non-school-based learning. *Informal learning* is defined as the acquisition of

[2] We note that Massachusetts did have a tradition of public schools dating to the 1600s but that tradition was not considered common throughout the 13 founding territories that became the USA (Cremin, 1972).

knowledge broadly defined that occurs as a result of daily activities where information is curated and learning structures are designed, but the individual makes choices to attend, how to engage, and to what they give attention (Mocker & Spear, 1982). *Non-formal learning* occurs as part of planned activities that are intentionally pursued by the learner for their own ends, as we witness with hobbies and vocational pursuits (Fraser 2017; Heimlich et al., 2017). Both structures of learning are clearly evident in studies of visitor motivations for visiting a Z/A (Falk et al., 2008).

Furthermore, exhibits and live programming are structured around formal learning goals and structures, even if the learner is not enrolled in a formal learning system. More importantly, all of these categorizations assume an a priori role of physical presence as the sole source where learning can occur, while the digital footprint and media presence of museums has rapidly escalated with the rise of online learning. The media presence of museums, a component of what is considered incidental learning (Mocker & Spear, 1982), has created a learning opportunity for the general public based on the institution's scholarship and are well-regarded sources for the detailed discussion of policy and propriety.

Overlapping Learning Modalities

We suggest that the distinctions between structures of learning can be valuable for research, but only if we liberate the institution from any one definitional affiliation. With this book, we suggest that the reader consider learning as a more comprehensive model that defies categorization. Each chapter explores the interaction effect between a type of learning sought intentionally (non-formal), what they might learn in context but outside their explicit intention (informal), the formal defined contextual learning curriculum set by the institution's offerings, and the impact of that institution on public discourse based on its perceived legitimacy and authority (incidental).

In the remainder of this chapter, we explore one way of thinking about Z/As exemplars of a more comprehensive way of understanding public learning and the museum sector. In so doing, we offer an alternative, more accommodating theory of the cultural institution as an ongoing dialogue between the many ways learning occurs, whether as part of a visit, or the presence of the museum in the media and public discourse. We do not, however, assume that this model applies to all subsequent chapters, only that it is the lens that we, as editors, used in organizing the book.

Why Zoos and Aquariums Matter

The group of studies collectively known as "Why Zoos and Aquariums Matter" (WZAM) were the first field-wide, multi-institution studies on learning in Z/As (Falk et al., 2007, 2008; Fraser & Sickler, 2009). These studies demonstrated the

enormous potential for science learning present in Z/As and identified a set of factors that positively influence that potential. In the last 20 years, a rash of research into Z/As has shown how these institutions support the advancement of literacies (cf. Adelman et al., 2000; Balmford et al., 2007; Clayton et al., 2009; Falk et al., 2007; Miller 2004; Ogden & Heimlich, 2009). Other work demonstrates how these institutions play an important role in the informal learning fabric of communities (Falk, 2014; Falk & Needham, 2016; Fraser & Sickler, 2009) or help people connect with nature (Bruni et al., 2008). Z/As are also the most demographically representative of all Informal Science Environments (ISE), attracting young and old as well as rich and poor, and are also equally representative of those who hold conservative or liberal beliefs (see, Fraser & Sickler, 2009), although as Lerner and colleagues (2021, Chap. 7, this volume) demonstrate, there are some unique psychographic variables that differentiate Z/A visitors from the general public.

It is a short step from exploring how basic mental processes work to redefining how many types of learning processes co-occur in a museum setting, the novelty of place, and its implied story of ourselves and the world around us as a stimulus. These puzzles are formed by what is brought to the experience, how we behave together, think in parallel or negotiate in our social group about the meaning of this novel thing; be that learning about something new to us, or learning about how the social in-groups and out-groups operate around us. The so-called informal learning environment is, at its heart, a kind of puzzle, an organization and display of a phenomenon for reconciliation with prior knowledge by groups of users, and a memory mnemonic that will inform future cognitions as we reconcile new information long past that visit. The Z/A setting is a venue that stands as an icon in the community and a place we visit with all of our pre-loaded expectations about that type of place, how we interact with others while there, what we take away from those encounters, and how we continue to reconcile those concepts and the media claims by and about those cultural icons as we go about our daily lives.

We describe this cycle of learning in Fig. 1.1.

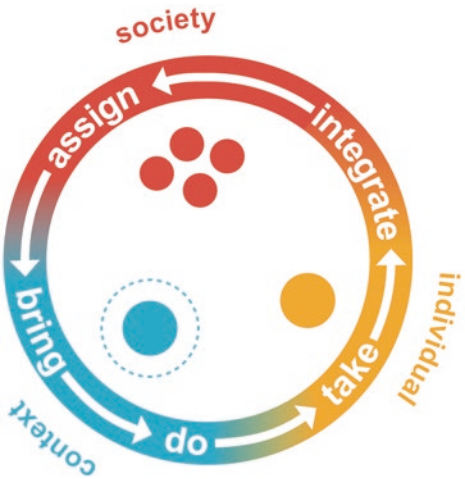

Fig. 1.1 The cycle of learning affordances at place-based learning institutions

We characterize the perspective of the potential user as a member of a community who assesses the value of an institution based on social narratives and discourses that assign a value, authority, and legitimacy that may rise to the level of importance sufficient to encourage someone to visit a place. In that setting:

- An individual BRINGS these ASSIGNED values with them to the context where they will have an experience
- Those preconceptions of utility drive what the choose to DO with the learning contexts on offer, from instructional encounter or passive wandering with a close friend
- These preconceptions shape what they will TAKE AWAY from their visit, and more importantly,
- Serve as memory tools that they will then use to INTEGRATE all the kinds of learning that they experienced during a visit and all the other social discourses on these topics, into the value they assign to these institutions as social actors
- Eventually leading to new ASSIGNMENTS of value and legitimacy that will support future learning from the public declarations of these institutions and their associations, or what is said about their claims by others

This frame would, therefore, disconfirm the moniker of informal learning institutions as appropriate for any museum type. Rather, it suggests that all types of learning are at play, and that the institutions, as destinations, deliverers of content, and social actors advocating for any type of literacy through their public communications, are simply learning institutions. Their products would, therefore, also live across the spectrum of learning types, and encounters.

STEM Literacies at Zoos and Aquariums

Zoos and their brethren, aquariums, bioparks, and nature centers presenting live animals, are generally accepted to be perceived as conservation organizations (Fraser & Sickler, 2009), but their users also acknowledge the linguistic trope of zoo as a pejorative metaphor to explain an illogical chaotic grouping of convenience (Kendall & Kendall, 1993). The result of these natural inclinations creates the conditions for a complex mental process that the user navigates various ASSIGNMENTS of authority, between the content presented by the museum, the social stereotype of the institution brought into tension with the content and prior knowledge, and the apriori value of the group activity as a strategy for the development of social bonds and connections in relation to a knowledge world.

Some research findings indicate that STEM education is often constructed in ways that make it appealing to higher income and educated strata of society, but may not speak to underserved or non-dominant groups (Greene et al., 2006; Mertens & Hopson, 2006; National Research Council, 2009, 2012). So we acknowledge that the ASSIGNMENTS may also include perceptions of whether the material presented by the institution, be it through public forums or exhibitions and programs at

the venue, might already be considered as coded messages that exclude some groups or classes of people.

Other research into the visitor experience at Z/As has helped shape our understanding of how this type of cultural experience contributes to human development. Previous studies have, for example, looked at how affective connections with animals and their natural habitats may encourage visitors towards pro-environmental attitudes and behaviors (Luebke & Matiasek, 2013); how interpretation that does not account for visitor expectations can constrain learning (Mony & Heimlich, 2008); and how affect and cognition can integrate (Randler et al., 2007; Staus & Falk, 2013). Other studies have looked at how interaction with experience while seeing the animal increases knowledge gain (Kisiel et al., 2012; Lindemann-Matthies & Kamer, 2006); how individual media preferences can guide visitor attention and learning (Yocco et al., 2011); and how cognitive outcomes increase with multiple layers of interpretation (Smith et al., 2010). These studies demonstrate the value of the destination and that Z/As can be valuable democratic laboratories for holistic studies of public learning at the societal, interpersonal, and intrapersonal level. But visitation statistics and interactions alone do not tell the full story. The challenge with many of these studies is that they do not situate that learning in the larger community context and life of the visiting individual. This need for further quantitative and qualitative research to understand the Z/A learner experience more comprehensively was the impetus for the WZAM initiative. It resulted in Z/As being the first of the informal science institutions to have an industry-driven research agenda in the ISE field (Fraser et al., 2010) that included recommendations for cross-institutional and field-wide studies. The proposal for the WZAM study was based on the first international cross-institutional study of science centers undertaken in 2012–2013 (Falk et al., 2015) and on a study of connected learning in STEM that advances the notion of learning ecologies (National Research Council, 2015).

In many European nations, zoos, operating as branches of government or federal education departments, are tasked to provide formal instruction to students on field trips as part of their science education curriculum. Specifically, they are required to teach classes in partnership with local departments of education. But those instructional settings have an explicit formal approach that meshes the facility's resources with guided instruction. It is not the primary way that most people experience and interact with these places, nor are their interactions of the kind that produce canonical learning (e.g. Moss et al., 2015).

The purposeful visit by a facilitator (Falk, 2016), i.e. the group member who facilitates the decision-making process for the visiting experience, involves additional learning modalities that are not neatly grouped into the three kinds of learning we have mentioned so far. In addition to learning about certain aspects of nature and conservation, families use these visits to teach the values and norms of social interactions (Fraser, 2009; Falk, 2009). In other words, families pursue their own nonformal structured learning when they elect to visit a Z/A. As we consider the informal processes that are considered leisure visits to ZAs, there is an inherent prejudice that any learning that takes place might be accidental or embedded but

that the primary purpose of a leisure visit to a cultural institution is not purposeful because it is pleasurable. But this is not the case as the value proposition for visiting Z/As is, in fact, the pleasure of discovering the systems and relationships is a core motivation and part of the satisfaction of a visit (Sickler & Fraser, 2009). In other words, part of the reason that people choose to visit Z/A are the opportunities to see and potentially better understand the complex nature of the world in which we inhabit.

Given the rapid changes across media, we would be remiss to not reflect on the role of media, especially social media, in the learning aspect of these communications. As social media has evolved, we have tended to focus on the visit as more of a "bring, do, take" activity. In practice, "bring" means "I go to the museum with some purpose and informal objectives" (Fraser & Sickler, 2009), "do" means "we do a whole bunch of stuff" (Kisiel et al., 2012), and then the "take" is a focus on outcomes, or in other words, "what did I get or learn" (history of visitor studies of outcomes – see Friedman, 2008).

The accessibility of mobile devices has also changed the tools visitors have at hand to help shape and make meaning of/from the visit. Using these tools to gather deeper information to answer a question, engaging in a post-visit text exchange about a visit, using them during the visit to make decisions, the use of these media serves an important role as incidental (Mocker & Spear, 1982; Heimlich, 1993) and/or everyday learning (e.g. Jarvis, 1987, 2009; McNaghten, 2003) educational tools. When communication messages, whether in a movie, a newspaper, a radio or cable news program, or any of the scores of other platforms and vessels, are written/prepared by someone wanting to get a message across, we think of those as incidental learning messages. On the other hand, the things we stumble across in random conversations, we pick up from others, or we learn over time just through living are considered everyday learning. Incidental learning is important to consider if we look across the structures of learning at Z/A messages and ask how they all work together to convey consistent messages (or often, not). The everyday is important and resonates with how well our visitors are in conveying accurately and consistently our key conservation messages. Even though incidental and everyday learning are less 'front and fore' related to a visit to an institution, they are part of the visitors' learningscapes (Ardoin and Heimlich, 2021; Heimlich & Reid, 2017) and certainly a part of the Z/A as a component of the informal science learning ecosystem in the community (Sedita, 2003; DeWitt & Archer, 2017).

Despite substantial progress in the study of Z/As, most current studies of learning outcomes have focused on the psychological, sociological, or anthropological impacts, isolating each aspect of "learning" as if they are not integrated into the learner and thus eschewing a coordinated transdisciplinary effort to characterize the full lived learning experience. Currently, there are calls for more collaborative research to resolve questions related to why learner agendas, personal motivations, or institutional outcome goals are seldom aligned (Heimlich & Storksdieck, 2007). Lacking knowledge about how cultural, social, and societal factors influence the interplay between what actions individuals can take and which they choose to take

is a significant impediment to the effectiveness of current informal conservation education learning strategies.

When we ask why someone might go to a Z/A versus another museum type, we can say with confidence that the pursuit is social and interactive (Pekarik et al., 1999) within a particular context. We are arguing that these priorities draw attention to two types of processes that require redress to fully account for learning in museums: (1) the role of social stereotypes and media in framing visit potential and (2) the interaction effect between intersubjective learning of the visitor group's norms and behaviors, and the content that might be on offer from a museum. With regard to the concept of bias or assumption about what describes a type of experience – what can the individual expect, what are the affordances and prejudices that influence what learning is possible or will be pursued. We suggest that this is more than an entry narrative that guests are able to restate to capture societal values and beliefs. In this context, the second dimension we argue is understudied in the museum setting is the actual learning groups engage in as part of their development *as a social group*. In this latter context, we argue that the learning may not be related to an institution's mission, but central to the construction of a social bond that situates topical learning within the essential social group and unique to the visit in the institutional setting.

Today, the priority in museum settings, reflecting a growth since some of the early work by Falk, Dierking, and their colleagues (i.e. Falk & Dierking, 1992), is that the social interaction effect is essential for framing what might be taken away from the visit and whether that aligns with the work of the museum. To a lesser extent, there is now limited data on how that content is reintegrated into the individual's life and social world (Gupta et al., 2020). But we note that the integration into the individual's life and social world is accomplished by interactions with people, media, and memory and is influenced by what matters to the individual. Since memory is flexible, reconstructed, tentative, and situationally subject to change, we can argue that the salience of a social visit to a museum will rest on a variety of recollections beyond the content itself. Fraser (2009) has demonstrated that initial questions regarding an earliest childhood memory of a Z/A visit often elicit a memory of observing the behavior of a single animal, but after prompting to describe smell, clothing, and taste, people working in field conservation can easily recall who they were with and the moral lessons and conventions prioritized by their adult companions (usually a parent or other significant caregiver).

Therefore, we suggest that to fully understand the role of a cultural institution type, such as a Z/A, and its social import, we need to understand not only the actual experience but also how we negotiate its meaning as part of our social priorities both before and during a visit and subsequently in everyday life. That negotiation is influenced by our assumptions about the institution's authority and legitimacy to advocate or advise on any particular content that will shape what people bring, do, and take away from their experience. This is the constant cycle of reconstruction that human beings engage in regularly as we build knowledge in our everyday lives (Hamilton, 2006).

Conclusion: An Appreciation of Zoos and Aquariums in the Public Mind

We borrow our inspiration from Carr's (2001) statement that an experience at a museum starts in the middle of the visitor's learning journey. The visit to a Z/A, their websites, or mentions in the press is simply a momentary event in an individual's range of learning experiences as they move through daily life (Heimlich & Reid, 2017). And the visit is not one of informal, non-formal, or incidental learning, but all of these, frequently at the same time. We suggest that the identification of learning requires a more nuanced exploration of the interaction effects that flow between the formal pedagogical learning objectives of an institution, how prejudice, bias, and social conventions shape the authority of the institution, and only then how social priorities and conversations intersect with the pedagogical goals set by the institution. We propose that museum research can benefit by shedding the notion that some learning is by happenstance and other intentional. We suggest that an additive approach be taken, in order to fully engage the interaction between public narratives, social stereotypes, the priority of learning to be a group together in the context of novel stimulus, and the missionary goals of each museum to shape culture through individual learning. We believe that the chapters that follow are all food for thinking about how Z/A are tools for thinking and learning.

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Chapter 2
Evaluating the *AZA Framework for Zoo and Aquarium Social Science Research*: A Review and Analysis of Relevant Literature 2011–2019

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Introduction

In 2010, the Association of Zoos and Aquariums (AZA) Conservation Education Committee published recommendations for social science research needs in the zoo and aquarium (Z/A) field (Fraser et al., 2010). Asserting that Z/A-focused social science research had grown "exponentially" between 2000 and 2010, the *AZA Framework for Zoo and Aquarium Social Science Research* was based on a synthesis of research efforts up until that point. The *AZA Framework* suggested that "we no longer need to ask the same, basic questions" about education at Z/As, recommending instead that the Z/A community "engage in the next generation of evaluation and research, driven by a need to continue pushing the field forward" (Fraser

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et al., 2010, p. 11). The *AZA Framework* included recommendations for seven research directions:

1. The role of Z/As in lifelong learning
2. Comparing Z/As with other informal learning institutions
3. The role of Z/As in social action and social activism
4. The role of Z/As in social services
5. The unique characteristics of Z/A-based learning
6. The profession of Z/A educators
7. Synthesis, dissemination, and application of existing (Z/A-related) knowledge

Research agendas such as those put forward in the *AZA Framework* can help advance research in a field by prioritizing efforts. In developing this particular social science research framework, however, AZA failed to build a formal structure or plan for monitoring progress toward the specified research goals. Therefore, to that end, we aim to address the central question: What progress has been made over the past decade in carrying out research related to the areas of recommendation that AZA highlighted?

Previous Reviews of Zoo- and Aquarium-Focused Social Science Research

Up to 2010, social science research at Z/As, with a focus on learning at these institutions, had been fairly well documented by three previous efforts. Churchman (1987) conducted one of the earliest, comprehensive literature reviews focused on Z/A education. He synthesized more than 400 works in the literature, finding that "coverage of topics is uneven, underlying theoretical dimensions are poorly identified, and much of the literature that does exist is descriptive" (p. 19).

Dierking et al. (2002) carried out a literature review 15 years later as part of AZA's Multi-institutional Visitor Research Project (MIRP). Those authors found that most research during that time had focused on visitor perceptions of animals. They concluded that "little actual research assessing impact [at zoos and aquariums] has been conducted" (p. 19) and that "a tremendous need" (p. v) existed particularly for visitor-focused studies.

As an extension of the "Why Zoos and Aquariums Matter" (WZAM) project in 2007 (Falk et al., 2007), the AZA Conservation Education Committee assembled an annotated bibliography (Association of Zoos and Aquariums, n.d.) of 192 articles focused on learning at Z/As and published in the peer-reviewed literature between 2001 and 2010. This review categorized studies based on research focus and then designated each category by the number of articles within it. The "abundant" resources category (with 15 or more articles) included those with studies focused on learning and engagement in Z/As, best practices in Z/A education, use of program animals, the effect of interpreters on visitor learning, impacts of specific program types, and the role of Z/As in communities.

Methods

Inclusion and Exclusion Criteria

Since the purpose of our review was not to judge the quality or merit of Z/A-related social science studies, we included only peer-reviewed literature to ensure the reviewed studies met a certain level of research rigor. We acknowledge that including only peer-reviewed studies may have resulted in some research efforts being overlooked. To begin our review process, we replicated the methods used in the "Why Zoos and Aquariums Matter" literature review (Association of Zoos and Aquariums, n.d.). We reviewed the table of contents for issues published between January 2011 and December 2019 in *Zoo Biology*, *Visitor Studies*, *Curator*, *The Australian Journal of Environmental Education*, *The Journal of Environmental Education*, *Environmental Education Research*, and the *Journal of the International Zoo Educators Association*. We scanned article titles for their relevance to social science[1] research in Z/As. Often, the title alone was enough to warrant either including the article in our full review or removing it from consideration. When the title suggested potential relevance to, but did not specifically state a focus on, a Z/A setting *and/or* a social science research topic/approach, we reviewed the abstract to further assess the relevance and whether it met all of the inclusion criteria (see Table 2.1). If the abstract indicated a focus on Z/A settings as well as a social science research approach/topic, we tagged the article to include for a full review. In rare cases, when neither the title nor the abstract provided sufficient detail to determine the article's appropriateness for inclusion, we scanned the article's full text.

We also recognized that, since the publication of the *AZA Framework* in 2010, social science research occurring in Z/A settings had expanded and was now published in a wider range of peer-reviewed journals. Therefore, we conducted six additional searches in two comprehensive article databases: Academic Search Complete/Ultimate[2] and Education Research Complete. We conducted the first search in 2016,

Table 2.1 Criteria for inclusion in literature review

Criteria	Requirements
Publication date	January 2011–December 2019
Research focus	Z/A setting
Research focus	One or more social science disciplines

[1] For the purposes of our review, social science included the disciplinary categories outlined by the United Kingdom's Economic and Social Research Council: (1) demography and social statistics, methods, and computing; (2) development studies, human geography, and environmental planning; (3) economics, management, and business studies; (4) education, social anthropology, and linguistics; (5) law, economic, and social history; (6) politics and international relations; (7) psychology and sociology; (8) science and technology studies; and (9) social policy and social work.

[2] For the searches conducted in 2016, Academic Search Complete was used. For the searches conducted in 2020, Academic Search Ultimate was used.

seeking articles published between 2011 and 2015; we conducted a second search in 2020 for articles published between 2016 and 2019. Initially, we searched separately for the terms "zoos" and "aquariums" in Education Research Complete, seeking peer-reviewed publications completed between January 2011 and December 2019. We chose to use Education Research Complete as the *AZA Framework* heavily focuses on the areas of education and learning in Z/As. Then, we used the following four search-term combinations in Academic Search Complete/Ultimate to seek articles published between January 2011 and December 2019: (1) "zoo" and "education," (2) "zoo" and "learning," (3) "aquarium" and "education," and (4) "aquarium" and "learning." Again, our terms focused on learning and education because of the *AZA Framework*'s emphasis on those areas.

The Review Process

We reviewed the search results using the same protocol as described above (i.e., initial title review, abstract review as warranted, full-text scan as warranted) to determine whether to include the article in the full review. Although we acknowledge that we may have missed articles through this process, we believe that these searches likely uncovered most of the Z/A-focused articles published between 2011 and 2019. Using the protocols described above, we identified 245 articles published between 2011 and 2019 to include in our literature review.

Two members of our research team reviewed all articles subject to the full review. Both researchers read the abstract and independently categorized each article using the *AZA Framework*'s seven recommendations. If we could not categorize an article using solely the abstract, we reviewed the full article. Each abstract or article was categorized according to the research recommendation it most directly addressed, as well as any focus areas within each recommendation. For example, within the AZA Framework, recommendation #2 focused on comparing Z/As with other informal learning institutions. The recommendation was further divided into four focus areas such as "off-property and virtual free-choice learning" and "the role of zoos and aquariums in the informal science education community." A study that may have addressed how virtual encounters with animals online influenced subsequent learning experiences on site at Z/As would have been categorized by both the overarching research recommendation as well as the related focus area. Once we had completed all of the categorizations, the researchers compared their categorizations. Where discrepancies occurred, the researchers discussed their reasoning for categorization and further reviewed the article until they agreed on a final categorization. In some cases, researchers found that an article did not fit with any of the *AZA Framework*'s recommendations, and these articles were placed in a new category titled "could not be categorized within the *AZA Framework*."

In categorizing the articles, we found frequent overlaps between the *AZA Framework* recommendations. We also found descriptions of the recommendations to sometimes be unfocused or confusing. In instances where articles addressed

multiple areas or where the recommendation descriptions were unclear, we attempted to categorize articles by what appeared to be the most-relevant *AZA Framework* recommendation based on opinions garnered from at least two researchers in agreement. Our decision to limit our categorizations to one recommendation only was based on our aim of concisely summarizing an entire decade's worth of Z/A-related research. Most studies were sufficiently focused to allow for placement in one recommendation category only, and we are confident that this methodological decision did not significantly impact the findings of our review.

In the remainder of this chapter, we note the number of articles and provide examples of studies categorized within each *AZA Framework* recommendation, discuss the implications of evaluating overall progress made toward advancing Z/A--focused social science research over the past decade, and conclude with recommendations for future Z/A-focused social science research efforts.

Findings

Nearly half ($n = 120$, 49%) of the published articles over the past decade focused on the unique characteristics of Z/A-based learning (recommendation #5). The next-closest category, with only 13% of the categorized articles ($n = 33$), focused on the role of Z/As in social action and activism. Three of the recommendations were represented by just a handful ($n < 10$) of articles. Roughly 15% of the articles fell outside of the *AZA Framework's* recommendations (See Table 2.2 for a summary of the number of articles categorized into each of the seven *AZA Framework* recommendations. See supplementary materials for a full list of all 254 studies).

Within each of the seven recommendations, the *AZA Framework* also laid out focus areas for research. As part of our review, we categorized each article into the most relevant focus area (See Table 2.3). Only four focus areas included more than 10 relevant articles, with one ("questions related to specific context and learning") representing more than one-third ($n = 88$) of the articles. The second-highest focus area was centered on behavior change articles. Three focus areas received no coverage in the reviewed literature: "perceptions of role," "meta-analysis of studies," and "archival data-diving."

We also examined trends in dates and venues (journals) for the published studies (See Fig. 2.1). Although variability occurs in the number of articles published annually, an overall upward trend was observed over the course of the decade.

The largest share of articles were published in Z/A-focused outlets, such as the *International Zoo Educators Association Journal*, *Zoo Biology*, and *Anthrozoos*. Visitor studies, informal science learning, and environmental education research journals also appeared frequently (e.g., *Visitor Studies*, *Environmental Education Research*) (See Table 2.4).

To better understand the context and impact of these journals within and beyond the Z/A field, we used impact factors (IF) as proxies. We sought the IF of those journals included in the review that were indexed in the Web of Science in 2018

Table 2.2 Articles reviewed within each AZA Framework recommendation

AZA Framework recommendation	# of studies	% of studies
1. The role of Z/As in lifelong learning	19	7.8%
2. Comparing Z/As with other informal learning institutions	17	6.9%
3. The role of Z/As in social action and social activism	33	13.5%
4. The role of Z/As in social services	5	2.0%
5. The unique characteristics of Z/A-based learning	120	49.0%
6. The profession of Z/A educators	4	1.6%
7. Synthesis, dissemination, and application of existing knowledge	9	3.7%
Could not be categorized within the *AZA Framework*	38	15.5%

(n = 50, 68.5%) (See Fig. 2.2). The average impact factor for those journals was 2.146, with a substantial range: the journal in our sample with the highest IF was *Conservation Letters* (IF: 7.39, one article included in the review), and the journals with the lowest IF (0.000) were *Cultural Studies of Science Education* (three articles), *Cultural Trends* (one article), and *Journal of Early Childhood Literacy* (one article). The largest proportion of articles (n = 126, 51.4%) appeared in non-indexed journals (n = 23, 31.5%), including some of the journals appearing most commonly in our review: *International Zoo Educators Association Journal, Visitor Studies,* and *Curator: The Museum Journal*. Overall, the relatively low average IF may be explained in part by the fact that many of the journals included in our review were practitioner and/or professional journals.

Research Area Receiving Most Coverage in the Literature: Unique Characteristics of Zoo- and Aquarium-Based Learning (AZA Framework *Recommendation #5)*

Over the past decade, the topical area that received the most attention in the empirical literature was "unique characteristics of learning in zoos and aquariums" (*AZA Framework* Recommendation #5), with 120 (49.0%) of the 245 reviewed articles. Further, 88 of the 120 articles categorized within this recommendation focused on "questions related to specific context and learning" (focus area #5e). Seybold et al. (2014), for example, compared the learning outcomes of a zoo-based primate education program with a school-based program, with students in the zoo-based program exhibiting higher cognitive and affective gains. Other studies compared contexts within zoos. Jensen (2014), for example, used a questionnaire and drawings to gather qualitative data from children participating in zoo educator-guided and unguided zoo visits. That study found that "41% of educator-guided visits and 34% of unguided visits resulted in conservation biology-related learning" (Jensen, 2014, p. 1).

Table 2.3 Articles reviewed within each AZA Framework focus area

	# of studies
Recommendation 1: The role of Z/As in lifelong learning	
1a. Zoos, aquariums, and other cultural institutions	4
1b. Institutional roles in the lives of families	4
1c. Z/As as learning communities	9
1d. Z/As in the life of a community	2
Recommendation #2: Comparing Z/As with other informal learning institutions	
2a. Off-property and virtual free-choice learning	10
2b. Environmental learning experiences	3
2c. The role of Z/As in the ISE community (live animals)	3
2d. Arts and humanities	1
Recommendation #3: The role of Z/As in social action and social activism	
3a. Studies assessing the role of scale	3
3b. Issues of behaviors	24
3c. Issues of measurement	6
Recommendation #4: The role of Z/As in social services	
4a. Perceptions of role	0
4b. Potential audiences	2
4c. Existing psychological use and valence	3
Recommendation #5: The unique characteristics of Z/A-based learning	
5a. Relationships between various learning domains (transdisciplinary)	4
5b. Characteristics of learners/learning in Z/As	21
5c. The social nature of group learning	1
5d. The nature of science in Z/As	6
5e. Questions related to specific context and learning	88
Recommendation #6: The Profession of Z/A educators	
6a. Components of a profession	1
6b. Conditions of a profession	1
6c. Progress of the profession	2
Recommendation #7: Synthesis, dissemination, and application of existing knowledge	
7a. Breadth of parent disciplines	2
7b. Deep literature synthesis	7
7c. Meta-analysis of studies	0
7d. Archival data diving	0

Although best categorized within focus area #5e, however, many of the reviewed studies did not fully reflect the recommendation, which called for comparative empirical research to determine "which domains of learning are best facilitated through the overall context." Many of these studies either evaluated programs, exhibited outcomes, or attempted to describe Z/A educational practices. Miller et al. (2013), for example, suggested that dolphin shows can increase participant knowledge, awareness, and intended behaviors related to dolphin conservation, as well as

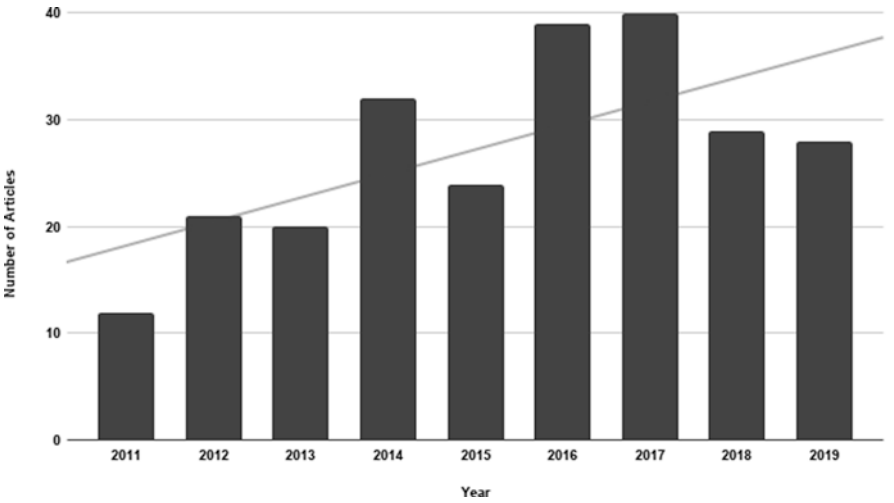

Fig. 2.1 The average number of Z/A-focused social science research articles published annually trended upward between 2011 and 2019, with the most articles published in 2016 and 2017

Table 2.4 Number of articles reviewed by journal title

Journals	# of articles
International Zoo Educators Association Journal	68
Zoo Biology	22
Visitor Studies	19
Environmental Education Research	18
Anthrozoos	10
International Zoo Yearbook	8
Curator: The Museum Journal	7
PLoS ONE	5
Conservation Biology	4
Cultural Studies of Science Education, Journal of Environmental Education, Journal of Interpretation Research, Journal of Sustainable Tourism, Studies in Educational Evaluation	3
American Journal of Primatology, Applied Animal Behaviour Science, Atmosphere, International Journal of Biometeorology, International Journal of Science Education, Journal of Geoscience Education, Journal of Museum Education, Proceedings of the Multidisciplinary Academic Conference, Science Communication, Science Education	2

Note: One article was published in each of 49 additional journals. A full bibliography of all articles published is included as supplementary material with this chapter

self-reports of conservation behaviors 3 months later. In another example, Roe et al. (2014) described the types and prevalence of educational communication that Z/As use to reach visitors.

Numerous studies focused on "the characteristics of learners/learning in zoos and aquariums" (focus area #5b), with 21 published articles (8.6% of the total).

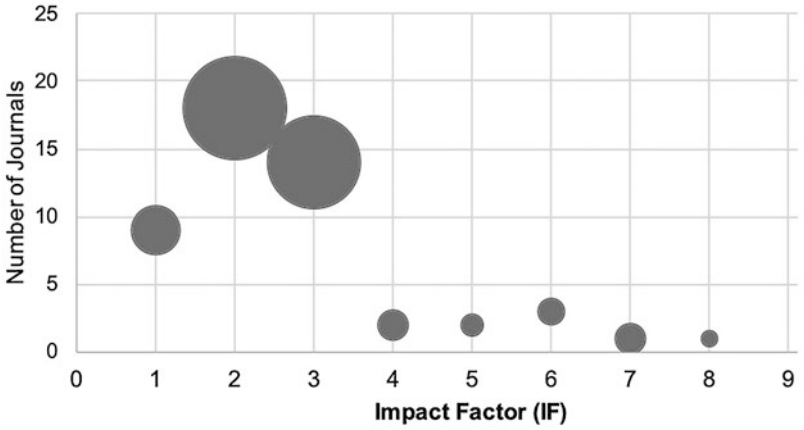

Fig. 2.2 Z/A-focused social science research articles by impact factor. The size of the circle represents the number of articles published between 2011 and 2019 according to the journal impact factor

Many of these articles examined visitor or participant motivations. Schultz and Joordens (2014), for example, applied the visitor model by Falk et al. (2008) to Toronto Zoo visitors and found a different visitor breakdown from US studies. Others in this focus area examined how visitors learn at Z/As. Tunnicliffe and Scheersoi (2012) explored narratives about conservation that zoo visitors enter with and the information that they absorb through interpretive signs.

AZA Framework *Recommendation with Some Coverage: Recommendation #3*

The topical area that received the second-most coverage was "the role of zoos and aquariums in shaping social action and social activism" (*AZA Framework* Recommendation #3), with 33 (13.5%) of the 245 reviewed articles. Further, 24 of the 33 articles categorized within this recommendation focused on "issues of behavior" (focus area #3b), suggesting that behavior change-focused research was an important emerging space for Z/A research over the past decade.

Articles in focus area #3b tended to center on understanding behavior changes in relation to a Z/A visit. The focus area, as described, recommended research on constraints and barriers to behavior change, as well as issues of proximity and agency, in order to help Z/As better focus their behavior change strategies and interventions. While several of the studies (e.g., MacDonald, 2015; Wyles et al., 2013) were more

traditional in their approach (i.e., analyzed the effects of an intervention on individual behavior), a number of the articles aligned with the specific suggestions of this focus area. Luebke et al. (2015), for example, found that zoo visitors in South America were open to learning about climate change and "would be better served by educational resources that demonstrate effective actions, create social and family dialogues around solutions, [and] build optimism surrounding individuals' inclinations to be part of a local collective movement" (p. 392). In another example, Katz-Kimchi and Atkinson (2014) conducted a discourse analysis of climate change messaging within an aquarium exhibit. They found that the exhibit created an accessible entry point for understanding climate change, but individualized the actions/solutions to the problem, which the authors argued was problematic in that it "consumerizes" the problem.

AZA Framework *Recommendations with Limited Coverage*

Two of the *AZA Framework* recommendations received some, but not substantial, coverage between 2011 and 2019. "What role do zoos and aquariums play in lifelong learning experiences?" *AZA Framework* Recommendation #1 was represented by 19 (7.8%) of the 245 reviewed articles, while "comparing zoos and aquariums with other informal learning organizations," *AZA Framework* Recommendation #2 was represented by 17 (6.9%) of the 245 reviewed articles. Further, 9 of the 19 articles categorized within *AZA Framework* Recommendation #1 focused on "zoos and aquariums as learning communities" (focus area #1c) and examined how Z/As are fostering learning within their own networks of staff and volunteers. Parker (2014), for example, found that stronger connections between zoo employees and the organization's field conservation programs were associated with an increase in employee engagement in the workplace.

Within *AZA Framework* Recommendation #2, given the explosion of new media and learning technologies in recent years, it is perhaps not surprising that 10 of the 17 categorized articles explored "off-property and virtual free-choice learning" (focus area #2a). Yocco et al. (2011), for example, suggested several key factors (e.g., age, perceived usefulness of the technology, and perceived ease of use) that may predict the initial use of a technology during a zoo visit. More recently, Light and Cerrone (2018) examined how zoos and other science institutions used Twitter as a science education tool.

Finally, a small handful ($n = 3$) of articles in *AZA Framework* Recommendation #2 focused on "environmental learning experiences" at Z/As (focus area #2b). Ernst (2018) examined how nature play experiences at Z/As were connecting families to the natural world. Similarly, Oxarart et al. (2013) found that zoo-based play experiences for families can increase interest in visiting a local natural area. These articles suggest alignment with recent efforts by Z/As to offer nature play and other outdoor experiences.

AZA Framework Recommendations *with Little Coverage*

Minimal coverage ($n < 10$) was given in recent studies to three of the seven *AZA Framework* recommendations. Despite the recent emphasis in the field of informal science education and within the Z/A community on broadening participation (Association of Zoos and Aquariums Diversity Special Committee, 2004; Ward et al., 2014), "the role zoos and aquariums play regarding social services" (*AZA Framework* Recommendation #4) was represented by just five articles. For example, Liljenquist et al. (2017) tested an evaluation instrument at a zoo and in two other settings to help institutions improve their programs for youth with disabilities.

Similarly, "the zoo and aquarium education profession" (*AZA Framework* Recommendation #6) was represented by four articles. For example, Sellmann et al. (2019) examined job hindrances and challenges facing German zoo educators. Finally, "assessing disseminating, and applying existing knowledge" (*AZA Framework* Recommendation #7) was represented by nine articles, with seven of these focusing on reviews and/or syntheses of published research. For example, Schwan et al. (2014) synthesized literature relevant to learning in museums, science centers, zoos, and aquariums to identify four characteristics of learning in these settings (i.e., mixed motives and goals; staged popular science; physical layout; and social exchange and participation). In another example, Young et al. (2018) reviewed literature on empathy in relation to non-human animals and implications for zoos, aquariums, and similar institutions.

Articles That Did Not Fit the AZA Framework

While not every article we reviewed aligned perfectly with the *AZA Framework* recommendations, in most cases, our review team felt there was a good enough fit to merit categorization in one of the seven *AZA Framework* recommendations. However, our review also found a sizable number ($n = 38$, 15.5%) of articles that were Z/A-focused social science research studies, but had little relation to the *AZA Framework* recommendations and thus could not be categorized within the *AZA Framework.* For example, several articles (e.g., Hewer and Gough (2016); Perkins and Debbage (2016)) focused on the effects of weather and climate variables on attendance patterns at zoos. Among a range of other topics, articles focused on the values of conservation donors (Lewis et al., 2018); the bonds between zookeepers and animals (Birke et al., 2019; Carlstead et al., 2019; Palmer et al., 2016); zoo-related history (Hochadel, 2016); issues related to conducting social science research and evaluation in Z/As (Gillespie & Melber, 2016); and childhood gender socialization in zoo messaging (Garner & Grazian, 2016). Finally, four articles focused on social science aspects of Z/A-led *in situ* conservation efforts. We concluded that these articles could not be categorized because the *AZA Framework*

made no explicit mention of research priorities connected to Z/A *in situ* conservation projects. For example, Squires et al. (2016) examined the application of an education model developed at an Australian zoo in the context of a conservation-based sports program in Kenya. In another example, Breuer et al. (2017) evaluated the use of a film originally developed for a US zoo audience in an environmental education program in the Republic of the Congo.

Discussion

This section synthesizes the findings presented so far in this chapter and discusses their implications for future Z/A social science research. Eight overarching themes emerged from our analysis.

1. *Research has continued to focus heavily on the unique characteristics of learning at zoos and aquariums.*

The *AZA Framework* asserted that research into the nature of learning at Z/As had been frequently addressed in studies before 2010. This review finds that substantial effort continues to focus on studies of the Z/A learning context. In some cases, recent research has advanced by comparing Z/As with other informal learning settings. These studies and others shed more light on similarities and differences between settings, but not necessarily on how those types of learning experiences reinforce, support, or even counteract one another. Overall, while our review found examples of innovative research that aligned with *AZA Framework* Recommendation #5 (the unique characteristics of learning in Z/As), our review suggests that Z/A-focused social science research remains heavily focused on more traditional explorations of program/exhibit outcomes and describing the general characteristics of learning experiences in these settings.

2. *As* Z/A*s increasingly focus on promoting behavior change, more zoo- and aquarium-focused research on behavior change is also taking place.*

The studies categorized within *AZA Framework* Recommendation #3 (how Z/As shape social action and social activism) suggest that the Z/A research community is beginning to look at deeper, more complex questions related to behavior change. While some behavior-focused research continues to investigate the connections between a single visit to a Z/A and changes in behavior, a body of literature is emerging that supports the more detailed behavior-focused recommendations (e.g., agency, proximity, and barriers) within the *AZA Framework*. This increase in research activity may be a response to a heightened emphasis at Z/As worldwide in recent years on promoting conservation action among visitors (Moss & Esson, 2013). However, there is still a need for more studies focused on issues of scale, constraints to behavior, and the development of standardized measures, as the *AZA Framework* more specifically recommends.

3. *A strong focus on lifelong and life-wide learning has not yet emerged in zoo and aquarium research.*

Despite the increasing emphasis within the informal learning research community on lifelong learning and the interactions between learning at these institutions and other learning experiences in an individual's life (Bell et al., 2009), few studies over the past decade have addressed these topics in relation to Z/As. As noted earlier, articles that fit within *AZA Framework* Recommendation #1 (the role of Z/As in lifelong learning experiences) made up just 8% of the reviewed literature. Researchers may want to look more closely at studies such as Moss et al. (2015) in order to better understand how to design measures that can be applied across institutions. What was also notable was the absence of longitudinal studies, which the *AZA Framework* specifically identified as important to understanding lifelong learning.

4. *Despite zoo and aquarium efforts to focus more on community engagement and reaching underserved communities, research has not broadened into that area.*

Overall, this review suggests that a large gap still exists in our understanding of how Z/As are broadening participation and supporting social service agencies, with just five articles (2%) fitting within *AZA Framework* Recommendation #4 (the role Z/As play regarding social services). In order to fully understand the educational, behavioral, and other effects of Z/A experiences, researchers should consider whether their efforts are engaging the range of communities that Z/As serve.

5. *Longitudinal studies remain uncommon in recent zoo and aquarium social science research.*

Few articles in this review attempted to look at the longer-term effects of Z/A experiences through longitudinal studies spanning multiple years. Long-term effects research has the potential to investigate not only how outcomes (e.g., pro-environmental behaviors, conservation values) are achieved in the short term but also how they persist (or not) over time and how they become integrated into people's everyday lives. This more holistic research approach and frame also allows consideration of how behavior change and other outcomes of a Z/A experience are influenced by a range of factors and experiences in one's life. Findings from a study included in this review by Luebke et al. (2015) suggest that long-term effects research may benefit from including a focus on social group interactions and family dialogue or learning, both within the context of the Z/A experience and beyond.

6. *Articles that did not fit within the AZA Framework suggest a broader interest in zoo and aquarium social science research beyond learning.*

Roughly 15% of the articles reviewed did not fit within any *AZA Framework* recommendations, suggesting that a substantial body of Z/A social science research exists beyond what was prioritized by AZA in 2010. While the *AZA Framework*'s emphasis on learning led us to design our search terms accordingly, it is possible that additional Z/A social science research has been published in the past decade, but that those articles did not emerge in this review.

7. *Zoo and aquarium social science research is growing, but it is unclear how much dialogue is taking place between researchers, as well as between researchers and practitioners.*

While the number of studies published each year over the past decade has varied, our review found an overall upward trend since 2011. This is an exciting development and bodes well for the future of Z/A social science research. However, Z/As will need support and capacity building in order to be involved in social science research, given that their current evaluation and research practices do not attempt to measure even immediate or short-term participant outcomes (Johnson et al., 2017). Additionally, given the limited coverage many of the *AZA Framework* recommendations received since 2011, it is unclear how much dialogue has been taking place within the Z/A social science research community (both within AZA institutions and within the global Z/A community) to plan and coordinate research efforts so that they address a wider range of topics. It is also unclear how social science research findings are being communicated to the Z/A practitioner community, who may benefit most from the findings. In short, the dearth of a research output use strategy has limited the impact that social science might have on potential users in the Z/A professional community. However, the large number of articles published in the practitioner-focused *International Zoo Educators Association Journal* is an encouraging sign. That journal may represent an important future venue for communicating social science research findings published elsewhere to Z/A practitioners.

8. *The relationship between the AZA Framework and research taking place globally is unclear.*

The *AZA Framework* was developed by the Conservation Education Committee of the accrediting Z/A association in the United States[3]. All of the original authors of the AZA Framework were affiliated with either AZA or zoos, aquariums, and research organizations in the United States. Our review found a substantial body of research that was affiliated with zoos, aquariums, and other related organizations from around the world. Despite this international activity, it is unclear to what extent the *AZA Framework* was intended to influence Z/A social science research *globally.* Overall, it is important to note that it is not possible to establish from our review any relationship between the development of the *AZA Framework* and the research that took place—whether in the United States or globally—over the past decade.

Next Steps: Delimitations and Recommendations

Our review documents some progress over the past decade toward the research priorities outlined in the 2010 *AZA Framework*. While a sizable body of research has been produced between 2011 and 2019, the focus of these studies has not been as

[3] While AZA does provide accreditation for Z/As globally, the vast majority of its accredited institutions are located in the United States.

wide-ranging as the *AZA Framework* originally envisioned. In this section, we note several delimitations to our work and propose recommendations for the Z/A community to consider to strengthen and better coordinate social science research efforts going forward.

Delimitations

We pursued this review in a systematic manner, yet we note the importance of considering the findings in light of the following delimitations. First, we did not endeavor to assess the quality or merits of, nor to synthesize, the research reviewed within each recommendation. Second, a substantial proportion of the articles in our sample (especially those published in the *International Zoo Educators Association Journal*) are more accurately classified as program evaluation, rather than evaluative research.[4] Yet, because those articles intended to share findings with a wide swath of the Z/A community (especially outside of North America and Europe), we included them in our sample, so long as the authors documented that they employed systematic methods and that their work did not focus solely on visitor satisfaction or programmatic feedback measures. We note that, while such studies generally are not undertaken with a theoretical grounding apart perhaps from program evaluation theory, nor are they pursued with the intention of informing broader systems, processes, and conditions at a wider scale, they can be helpful in providing a wider vision of learning and social-change endeavors across the field. Finally, as noted earlier, our search terms focused on learning and education at Z/As in order to align with the *AZA Framework's* focus. It is possible that including other relevant search terms (e.g., behavior change) may have turned up additional articles.

Recommendations

Social science researchers focused on Z/A settings may wish to consider five persistent opportunity spaces.

1. The next Z/A social science research agenda should consider the research documented here, which has taken place in the 2010–2020 decade, as well as emer-

[4] For the purposes of our review, we defined "program evaluation" as a process undertaken primarily for programmatic improvement purposes, whereas "research" is pursued using a theoretical framework and with the intention of wider applicability or generalizability. "Evaluative research" is a widely recognized field that brings a rigorous theoretical and systematic approach to a program or policy evaluation using standard research methodologies designed to yield generalizable outcomes. The studies we are referring to here are "program evaluations" and, while oftentimes systematic in their approach or methods, typically were not grounded in general theory nor was their aim to create generalizable findings.

gent trends since 2010. As Z/As devote an increasing proportion of their resources to *in situ* conservation efforts, for example, future research agendas might focus on articulating priorities related to that area. The next research agenda would also benefit from clearer boundaries among the various research recommendations and focal areas.

2. The next research agenda should be accompanied by an initiation, implementation, and coordination strategy for documenting efforts. Such a strategy would help ensure a more comprehensive scope of activities is included, and that subsequent research endeavors address all, rather than just a portion, of the recommendations, as our review suggests has happened with the current *AZA Framework*. The AZA social science research community should establish a clear system for monitoring progress toward undertaking, completing, and coalescing findings from this future agenda. The strategy should also consider how to best engage the Z/A and social science research communities outside of the United States, since the articles in this review suggest that research communities focused on Z/As in other parts of the world are influential and active. AZA or the World Association of Zoos and Aquariums (WAZA) might consider sponsoring an annual social science research symposium prior to their annual conferences, for example. What was initially the Research Commission of the North American Association for Environmental Education, for example, initiated a similar effort to reinvigorate, align, and enhance the quality of environmental education research, in collaboration with the association's annual conference; that initiative celebrated its 17th gathering in 2020.
3. Although this review assembled 245 articles published in peer-reviewed literature since 2011, we did not pursue a deep synthesis of this research. In particular, undertaking a thorough review and analytic synthesis of articles categorized in recommendations #3 (behavior) and #5 (context) would help establish what is known, and what remains to be examined or explored, in those key areas, to both avoid future replication as well as advance current areas of knowledge.
4. Examining who carries out social science research in Z/A settings, and the institutions (e.g., Z/As, higher education institutions) with which they are affiliated, could encourage greater reflexivity and inclusivity within the Z/A and research communities. Recognizing whose voices are, and are not, represented in the questions asked, analyses pursued, and findings as (re)applied to practice—and then working actively to change the dynamic wherein some groups are systematically excluded—can help create a more equitable, diverse community that actually reflects the range of Z/A visitors. Such critical reflections may also help identify researchers in relevant and related social science disciplines who are not currently engaged with Z/A studies, but whose perspectives would be enlightening, helpful, and influential.
5. To complement this focus on who is *doing* the research, we recommend paying equal attention to who is *reached* with Z/A social science research findings. The Z/A community is mission-based, committed to driving social and environmental change. Therefore, creating pathways for informing practice and committing to active engagement with practice/research relationships is essential. The bur-

geoning number of articles published in the practice-focused *International Zoo Educators Association Journal* suggests one avenue to bridging divides among practitioners and researchers. A further recommendation is to regularly review the journals where Z/A research is published. It may serve the research community to prioritize publishing in certain journals, potentially taking into consideration impact factors.

Conclusion

The 2010 *AZA Framework* was an ambitious and forward-thinking attempt to bring coherence to and guide Z/A social science research. Our review suggests that progress from 2011 to 2019 toward meeting the *AZA Framework*'s goals has been a mixed success, with a few focus areas dominating the global Z/A social science research landscape. In particular, our review found that researchers have continued to heavily focus on the unique characteristics of learning in Z/As while also cultivating more research related to behavior change. Nearly half of the published articles between 2011 and 2019 focused on the unique characteristics of Z/A-based learning (recommendation #5). The next-closest category, with only 13% of the categorized articles, focused on the role of Z/As in social action and activism. Three of the recommendations were represented by just a handful of articles, and roughly 15% of the articles fell outside of the AZA Framework's recommendations.

Based on these findings, we recommend that the next research agenda being developed by AZA for the Z/A community (which was informed by an earlier version of this review and is detailed in another chapter in this book) should aim to push research into new areas, including some of the recommendations from the *AZA Framework* that had almost no coverage over the past decade, such as how Z/As engage with and reach underrepresented and underserved communities. The new research agenda should also account for emerging and increasing developments in the field, including the role of Z/As in community-based, *in situ* conservation. No matter the focus, a process for implementing and monitoring a future research agenda will be critical to its success. Additionally, actively engaging zoos, aquariums, and social science researchers outside of the United States in this process would bring greater coherence and innovation to this process.

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Chapter 3
Visitors and Conservation: Seeking Behavior

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Introduction: What Does *Conservation* Mean in the Context of an Aquarium or Zoo?

The concept of "conservation" can be at once deceptively simple and complex: Based on academic training, expertise, experience, context, norms, and expectations developed over time, individuals and indeed entire professional communities may, and likely do, have widely varying ideas of what it means to work toward conservation of a species, habitat, and/or the environment. Zoos and aquariums (Z/A), at their core, are about *conservation*, in its many forms and functions. As stated in the vision and mission statements of the Association of Zoos and Aquariums (AZA), AZA member institutions focus on "advancing animal welfare, public engagement, and the conservation of wildlife" with the intention of creating "a world where all people respect, value, and conserve wildlife and wild places" (Association of Zoos and Aquariums, 2019b).

Within Z/As, conservation activities primarily occur through two pathways. The first is direct, exemplified by measures that institutions undertake to protect species

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and restore habitat in place (*in situ*), as well as through off-site measures in Z/A facilities (*ex situ*), and ranges from captive breeding programs to collaborative land protection-and-restoration efforts. The second, equally important pathway is through education and outreach efforts. With these, Z/A engage visitors and communities in developing the knowledge, attitudes, values, and skills that underpin pro-environmental and conservation behaviors in the short, medium, and long term. Following the argument in Schultz's *Conservation Means Behavior* essay, which states, "Efforts to educate the public and raise awareness must include a motivational element—that is, a reason for action" (2011, p. 1081), it stands to reason that both *institutional* and *educational* pathways are essential for thriving ecosystems. The *institutional* pathway works to ensure that species remain viable and habitats intact, and the *educational* pathway builds a motivated, engaged constituency poised and skilled to undertake conservation behaviors.

In this chapter, we explore the institutional and individual aspects of conservation work at Z/A. First, we address Z/A as conservation organizations, considering how they fulfill their mission and vision over time, through complementary structures. Then we address visitor behavior as impacted by interactions with these institutions. In the latter, we leverage data from the third phase of the "Why Zoos and Aquariums Matter" study (WZAM3[1]) to consider behavior before, during, and after zoo visits, examining what Z/A provide in terms of conservation messages, modeling, and action-oriented support. We end with an analysis that draws together the former and the latter: We consider Z/A approaches that amplify conservation messages through creating closer alignment between institutional vision and mission with desired visitor outcomes.

What Makes a Zoo or Aquarium a Conservation Organization?

What we imagine as modern-day zoos are rooted in a long history: Initiated as recreationally oriented private collections of exotic animals, these menageries were often curated for the enjoyment of wealthy, powerful owners and their close friends (Rabb, 2004). The Victorian Era and the Industrial Revolution brought about an intensified emphasis on science and natural history and a concurrent rise in interest in studying wild creatures in captivity, accompanied by the rising cost of keeping them in such settings (Baratay & Hardouin-Fugier, 2004). Societal factors accelerated the burgeoning growth of Z/A at that time: expanding urban populations, shrinking wilderness areas, and an increased desire for family-friendly, close-to-home leisure opportunities (Minteer et al., 2018a; Baratay & Hardouin-Fugier, 2004).

The growing awareness of threats to wildlife and their habitats, especially beginning in the 1990s, shifted the focus of Z/A from recreation to conservation (Hutchins and Conway, 1995; Minteer et al., 2018a). In what is considered the "modern" Z/A

[1] Descriptions of the three phases of the WZAM studies are available here: https://wzam.org/about/

of the twenty-first century, conservation is a value-driven proposition, striving for biodiversity preservation at the levels of genes, species, evolutionary processes, and ecological systems (Fa et al., 2011; Takacs, 1996). Each of these elements is seen as necessary, yet insufficient, for maintaining thriving living systems on our planet (Wilson, 1992). Thus, in practice, many envision aquariums and zoos as essential to the larger conservation-organization landscape, actively working to preserve and restore biodiversity through a range of species survival efforts (Turley, 1999).

As Z/As have shifted in form and function, researchers and practitioners have asked in what ways they are conservation organizations. A *Conservation Biology* essay (Miller et al., 2004) encourages zoos, aquariums, botanical gardens, and natural history museums to consider a set of mission-oriented criteria in light of their conservation commitment. The authors suggest institutional reflection on whether, or to what extent, organizations:

1. Define policy decisions by conservation-related principles.
2. Have sufficient organizational funding for conservation activities.
3. Have a functional conservation department that performs conservation science and/or increases the capacity of others to do so.
4. Advocate for conservation.
5. Provide effective conservation education programs for children and adults.
6. Contribute directly to habitat protection, internationally and locally.
7. Display exhibits that promote conservation efforts.

As these provocations suggest, everything from external influences on the world *writ large* to internal daily operational activities to aspects of programming can, and should be, considered as defining elements of a conservation-oriented organization.

This range suggests two broad areas of consideration for how Z/A might influence conservation through behavior: (1) the behaviors that the *institutions themselves* undertake through supporting and conducting *in* and *ex situ* conservation-related activities and, as an outcome of institutional engagement, (2) the behaviors that institutions *support their constituents*—visitors and communities—*in undertaking*. The remainder of this chapter more fully explores these two pathways to conservation through Z/As.

Zoos and Aquariums Doing Conservation: In situ *and Institutional Efforts*

Whether preserving habitat, protecting biodiversity at all levels, or attempting to slow or reverse the extinction of animals in the wild, Z/A engage in and support conservation efforts across the globe. This field conservation work remains central to the Z/A community, anchoring conservation contributions not only at a single-species level but also at a holistic, ecosystemic scale. In 2018, for example, AZA

institutions spent over USD$231 million in in situ, field conservation research focusing on 888 species and subspecies in 138 countries (AZA, 2019a). Relatedly, every year, zoo and aquarium-affiliated researchers publish hundreds of peer-reviewed articles on conservation-focused studies conducted in their institutions as well as in field settings.

Field-based conservation efforts of Z/A occur in communities proximate to the institutions as well as worldwide, where Z/A personnel partner with local, state, regional, and federal partners. Such efforts, guided by targets like those set in the *World Zoo and Aquarium Conservation Strategy of 2005* (and expanded upon in the decade since), address habitats, such as wetlands and forests, as well as species, including insects, reptiles, amphibians, birds, and mammals of all sorts (Gusset & Dick, 2010). Frequently, these direct, community-oriented, guided conservation efforts involve volunteers and local residents in a range of ways, from one-off cleanup or BioBlitz-type activities to ongoing citizen-science observations and data recording over time (Frost, 2011; Minteer et al., 2018b).

Although individual facilities lead and contribute to species-specific field conservation efforts, many demonstrate and participate in collaborative approaches pursued by consortia of organizations from across the Z/A community. Saving Animals From Extinction (AZA SAFE), for example, pursues collaborative wildlife conservation efforts worldwide through its 147 AZA member partners and 152 field partners (including federal agencies); as of 2019, 54% of AZA SAFE's efforts occurred in the Americas, 38% in Africa, and 8% in Asia (AZA, 2019a). Other collaborations are equally ambitious in effort, yet closer to home in terms of geographic scope. NOAA's Florida Reef Tract Rescue Project, for example, included 41 rescue sites as of 2020, with nearly 1500 coral reef colonies in 18 zoos and aquarium holding facilities in the United States (NOAA, 2020).

In addition to these field-conservation initiatives, Z/A practice conservation in daily operations. Many institutions describe these green practices in their annual reports or in the *AZA Connect* monthly membership magazine, which regularly features the efforts of different institutions. The approaches to and resources for green practices in Z/A are varied and extensive, including but not limited to those addressing areas such as the following:

- *Energy:* energy conservation and production (e.g., solar, geothermal); fuel for fleets; greenhouse-gas emissions reductions
- *Water:* water conservation; water-quality management; wastewater management
- *Waste:* waste management and reduction (e.g., recycling, composting); animal-waste composting and reuse for various products (e.g., elephant-dung paper)
- *Materials*: green building practices, LEED-certified buildings and facilities
- *Employee and business practices:* participation in and leadership of programs such as Bicycle Friendly America, NWF Wildlife Habitat, Green Restaurant Association

Yet, contradictory messages of consumption and separation of humans and nature remain, even with this intensive focus on conservation internally at the operational level. Through overly abundant, and at times wasteful, gift shops, restaurants,

carousels, trains, and other signals—what Braverman (2011, p. 809) calls "small acts of consumption"—a message of conservation values can be conflicting. The inherent tensions of wild animals in constructed environments, and the harsh distance between the public exhibition space and the "backstage" cage area (Mullan & Marvin, 1999), can exacerbate an us-versus-them, human-versus-'nature' mentality, whether spoken or unspoken. Such tensions threaten to unravel much of the internal and policy-focused conservation work of Z/A if deeper consideration is not given to this discussion.

Zoos and Aquariums as Conservation Behavior Organizations: Responsibilities and Opportunities

Although Z/As have long promoted and advocated for conservation—and indeed many have lived those measures internally—such advocacy is insufficient without also addressing several inherent tensions. First, simply by the nature of operating a large-scale customer-serving institution of the twenty-first century, these organizations are bound to harbor elements of wasteful practices. Second, as an institution built around keeping wildlife in captivity and on display, the nature/culture divide, or an emphasis on the division between humans and other parts of the natural world, is woven into the philosophical and institutional fabric. Third, today's rapidly deteriorating environmental conditions are caused by human behavior; therefore, the act of conservation itself is necessarily one of the human behaviors (Schultz, 2011) and, although people rarely hold malicious intent related to environmental destruction, the collective actions and impacts of billions of people on environmental quality are devastating over time. Thus, to be successful, conservation efforts within Z/A must *primarily and directly address human behavior*, within the context of an integrated social-ecological system, recognizing outright the interdependence of all species.

As such, education, communication, and engagement are essential in the conservation toolkit: Rather than simply throwing content at visitors and expecting them to sift through and digest complex, at-times contradictory information on their own, education provides opportunities and structure for scaffolded learning, supported with attitudes and skills to truly make a difference. Thus, through this interactive process, shifts in people's capacities and actions may result (Watson & Tharp, 1972; Schultz, 2011). An embodied and inherently social experience, learning is always tied to some type of participation and action (Nasir et al., 2020), as, by definition, those actions and behaviors are visible manifestations of what has been learned (Heimlich & Reid, 2017).

Within zoo and aquarium experiences, learning encounters can foster and support different kinds of behavioral outcomes. Learning encounters designed to foster empathy, for example, may emphasize up-close-and-personal experiences with wildlife to support feelings of intimacy with an animal's daily activities or may encourage reflection on how one's at-home behaviors might impact the native

habitat of an animal. Exhibits and educational initiatives focused on consumer choices, such as Seafood Watch, or interpretive panels describing bottom-trawl fishing, for example, emphasize information seeking, evaluation of sources and alternatives, recursive dialogue, and consideration of shifting environmental conditions. Still other approaches, such as Reef Safe sunscreens, emphasize physical behavior and critical thinking alongside consumer choice and decision-making, in an effort to connect what a visitor might see in a zoo or aquarium with what one might experience in an embodied way while at the beach or selecting sunscreen from a pharmacy shelf.

Using the criteria described in the *Conservation Biology* essay (Miller et al., 2004), we pursue questions 4, 5, and 7 to ask: *In what ways are zoos and aquariums advocating for conservation, providing effective education, and doing so not only through their organizational practices but also through exhibits and educational programs?*

Behavioral Models in Zoo and Aquarium Research

Social science research, with an emphasis on behavioral and learning sciences, has informed and influenced zoo-and-aquarium scholarship and practice heavily over the past 40 years and in particular behavioral science. The chapter by Ogden et al., pages XX–XX, provides an insight into the history of social science research in Z/A, and the chapter by Johnson et al., pages XX–XX, describes the trajectory over the most recent 20 years. This history is interwoven with a focus on conservation behavior as a desired visitor outcome following zoo or aquarium attendance. Philosophical, pedagogical, and theoretical understandings—and their connections with practice—have become more sophisticated over time, shedding light on the complex relationships between learning-focused experiences and behavioral outcomes.

The following three behavioral models reflect approaches frequently used in Z/A in a rough chronology, suggesting increasing complexification of both educational philosophy as well as understandings of behavior and behavioral change. Here we consider conservation behavior in the context of how Z/A communicate desired actions during the visit and beyond.[2]

Communications/Persuasion Model: Introducing Change Ideas Early behavioral focus in Z/As followed traditional psychological and learning theories suggesting that communication itself can change attitudes and ergo behaviors, most

[2] This is not intended to be a comprehensive synopsis of pro-environmental or conservation behavior research, nor is it intended to be a thorough review of behavioral models. Rather, our intent is to discuss several commonly used frames and approaches in the aquarium and zoo context, alongside illustrative examples. For a more comprehensive discussion, see Heimlich and Ardoin (2008); Ardoin et al. (2013); and Monroe (2003).

specifically when they are linked in the same chain of causality (e.g., Cohen, 1964; Hovland et al., 1953; Petty & Cacioppo, 1986). Various names are given to theories under this umbrella, but most broadly, this family of approaches is known as "communication/persuasion" models. In the communication/persuasion approach, inputs include the source of the information, the message itself, the channel (often a person or institution), the recommended change or behavior, and the outcome (the "destination") of doing this behavior or change. Generally, these destinations are changes in knowledge and behavior. The model is widely used in media and also frequently applied in communications and interpretation contexts, including those in Z/A settings. When an institution shares messages or designs programs based on the assumption that links between cognition (knowledge) and affect (feelings) lead to action, or at least a desire for action, programs or experiences are then built on numerous, related assumptions. These assumptions include that all people do and will have the same perceptions of a particular experience as well as the same feelings and reactions (attitudes) in light of that experience; that those feelings and attitudes motivated by the experience are linked in some, and the same, way to knowledge; and that knowledge connects to behavior. This last step relies on the assumption that these people have the skills, models, and support to transform those attitudes and that knowledge into relevant, sustained, and impactful action.

Research repeatedly has documented that the connection between attitude and behavior is not linear (Ardoin, 2009; Heimlich & Ardoin, 2008), and this indeed remains true: behaviors are brought about by complex, intersecting influences at various spatial and temporal scales, influenced by culture as well as individual and societal forces (Matsumoto, 2007; Nolan et al., 2008). Yet certain approaches—such as the health belief model or transtheoretical model, often used in health communication—can simplify the cause-and-effect chain, be relatively straightforward in application, and be used in the programmatic design. Although it is challenging to ensure that such approaches produce persistent change over the longer term in complex informal or everyday-life contexts, when the assumptions behind the causal chain are correct *and* the stimuli supporting and reinforcing the chain are maintained, they can be useful in helping form an intention to act. If, for example, the source, message, channel, and recommended behavioral outcome resonate for the individual in the moment, and if supporting structures are available to provide continuous reinforcement, that intention to act can be powerful and may then be carried forward.

Misinterpreting intentions or holding faulty assumptions about how people interpret messages occurs frequently, as does assuming that all people perceive a message in the same way and react to that message similarly. One place where scholars are attempting to question some of these assumptions and break down related challenges occurs with regard to the construct of empathy. Within Z/A, studies have revealed that visitors come to care about—and demonstrate or act on that caring—in vastly different ways with regard to wildlife, habitats, conservation overall, and their own conservation-related behaviors (e.g., Leubke, 2018; Young et al., 2018). Further, limits exist on the agency of an individual to act in a way that is

meaningful: Studies find that one of the most significant barriers to individual participation in large- and societal-scale actions on issues such as climate change (e.g., Clayton et al., 2014; Koepfler et al., 2010), habitat loss in a distant area of the world, or ocean acidification (Frisch et al., 2015; Schultz, 2011) relates to the complicated relationship between efficacy and compassion. The "compassion fade"—which relates to not only conservation action but also international aid and public health, among other pro-social areas—occurs when the need for action increases, while the individual's perceived efficacy decreases, making issues feel insurmountable, distant, and impersonal, creating significant barriers for many wishing to engage in impactful conservation action (Markowitz et al., 2013).

Social Marketing: Sustaining Change In the early 2000s, with the growing understanding of challenges to helping people change their behaviors, many Z/A transitioned to strategies adapted from marketing and applied in the pro-social sector. Initially applied in health-related campaigns, many focused-on topics such as vaccination, diet, and sanitation, approaches then moved to those in public safety, such as seatbelt-wearing ("Click It or Ticket"), as well as through public-land management, such as fire suppression (Smoky Bear's "Only you can prevent forest fires" slogan) and litter reduction (Woodsy Owl's "Give a hoot, don't pollute" and Keep America Beautiful's "Don't be a litterbug" jingle), among others. Social marketing approaches focus on changing specific behaviors, identifying and removing barriers, and maintaining messaging around the desired behavior (McKenzie-Mohr et al., 2011). These strategies work to address the challenge that many individuals with environmentally sensitive attitudes, knowledge of an issue, and the desire to "do the right thing" still do not engage in the behaviors desired by the Z/A. Social marketing, therefore, pursues pinpointing of singular, directed actions, provides specific steps, removes barriers, includes supports, and sustains messaging around those actions for a certain period of time—ideally until the behavior is instantiated as habitual (McKenzie-Mohr et al., 2011). Moreover, this approach often includes background research into the audience and context, seeking to move those who are likely to move somewhat easily to the desired behavior, thus facilitating success and focusing energy, attention, and resources on those who wish to engage but perhaps have met with addressable barriers in the past.

Social marketing approaches have long been popular in zoos, aquariums, and other conservation organizations—and continue to be taught at workshops and used widely—as they can often effectively and relatively swiftly target specific, measurable actions as outcomes (Ryan et al., 2019; Litchfield et al., 2018). Such strategies are usually designed and built on a clear logic-model chain, removing outside "noise" from consideration. These approaches work well with certain kinds of behaviors, such as seatbelt-wearing, which require maintenance and reinforcement, resulting in the development of a social norm around a clearly delineated, socially sanctioned behavior that persists (Şimşekoğlu & Lajunen, 2008).

Challenges occur with the use of social marketing, however, on several fronts. One of the most intense and troubling is when a zoo, aquarium, or other conservation organization wishes to encourage recursive, thoughtful reflection, engaged

dialogue, and dynamic behavioral decision-making over time or in light of changing conditions (Heimlich & Ardoin, 2008; Monroe, 2003). Social marketing approaches are not designed to provoke critically creative thought over time and in changing circumstances, individually or societally, nor are they designed to support considerations of one's actions within a broader context. Wearing a seatbelt habitually, for example, does not equate to engaging in other safe-driving behaviors, such as properly inflating one's tires, signaling before changing lanes, or maintaining the appropriate speed limit. At a societal level, such a campaign does not prepare one to engage in discussion with neighbors and civic leaders about future planning of the regional transit system. This critique has been taken up by the broader social marketing field (e.g., Gordon et al., 2016), and points to the need for conservation organizations to consider carefully when the social marketing toolkit, versus—or in combination with others—may be appropriate.

Another challenge arises with regard to persistence over time: Longitudinal studies at zoos, aquariums, and elsewhere demonstrate that habitual behaviors initiated through social marketing approaches may persist after an initial reinforcement-messaging period, but many also require "booster" messaging until the new, desired behavior becomes a societal norm. Even at that point, the targeted behaviors rarely lead to "spillover" behaviors, as studies repeatedly show that most pro-conservation behaviors occur in different domains, whether they are the domains of home, work, or community or of energy, water, climate, forests, and so on (Ardoin et al., 2016). Litter control and seat-belt usage, for example, may require "boosters"; recycling and reusing may require re-education as regulations change and local needs differ; and the wildfire suppression discussion is dynamic in light of climate change, which requires us to completely rethink forest management strategies. Social marketing approaches, therefore, may be efficacious and appropriate in settings that require specific, targeted, habitual behavior such as many institutions' recycling of cell phones as tied closely to gorilla conservation (Litchfield et al., 2018). They may, however, grossly underperform or even dangerously underprepare people in other cases, as is the situation with wildfires under changing climate-related conditions. And they rarely motivate or prepare people to take action outside of the focal domain.

Health Belief Model: Linking Individual Action to Global Conservation Issues A variation of values-expectancy theory, the Health Belief Model (Rosenstock et al., 1988; Prochaska & DiClemente 2005), relies on three key assumptions: first, that members of the target audience are sufficiently motivated to make a change; second, that the issue of focus is relevant to the person; and third, that the person has self- and response-efficacy—that is, they have the skills and ability to undertake action and believe the action will bring about the desired future state. Beyond that, this social-cognitive approach—initiated in the community health field, yet highly applicable to conservation settings—posits that people act based on the perceived utility of a behavior. In other words, they trade off the inputs required with the potential outputs gained, asking, "What's in it for me?" That question is answered through the subjective interpretation of the threats of inaction weighed against the benefits of potential action, combined with the likely utility of that action's outcome

to oneself as well as to the overall issue. A range of other factors balance these weighted tradeoffs, including the numerous scenarios the individual understands and the universe of imaginable outcomes.

Like all models, the Health Belief Model is more complex than it initially appears. In this model, for example, the "perceived threat" is a combination of how severely the individual is impacted by the issue, the potential consequences to the individual, and the likelihood of the issue actually occurring or happening to and/or impacting the individual personally. What someone sees as perceived susceptibility involves his or her own subjective assessment of risk or threat to themselves or something or someone about whom they care. Perceptions of both threat and severity are based on what a person knows, or thinks they know, about an issue. Individuals weigh calculations of threat and severity against their assessment of the value of pursuing risk-decreasing behavior, then consider all of those against potential barriers such as inconvenience, cost, difficulty, side effects, and image (e.g., "Is this something that 'someone like me' would do?"), among others. They also consider aspects of self-efficacy, or whether they have the competence and ability to successfully perform a behavior. This variable, later added to the Health Belief Model, attempts to better explain individual differences in taking up and persisting in certain actions (Abraham & Sheeram, 2005).

These dimensions of the Health Belief Model create a platform for *potential* action. For action to occur, a cue or a trigger is necessary to prompt/to motivate the individual. Such a cue can be internal such as a habit or a fear of harm, or external such as physical pain, or a reaction to a message from someone about whom the person cares. The intensity of the cues needed to prompt action varies among individuals depending on their initial susceptibility to the message(s), perceived benefits, existing barriers, and other conditions, including existing prior behaviors, among other variables.

This Health Belief approach is evident in many zoo and aquarium messages and programs. They first emphasize caring about an animal, for example, then work to transform visitors' care into taking some action—such as giving money or committing to a citizen-science initiative—to help protect the species and/or conserve its habitat. The assumption is that feeling good about taking an action to help the species creates a virtuous cycle: the person then feels better as their action continues to support something toward which they already have a positive affect, which is often the case. Purchasing an aquarium or zoo membership, for example, as a transactional tool for both saving money and allowing the institution to market that deal to encourage *more* membership, thus creating a steady income stream for conservation, provides one example of this behavioral model in action. Yet this message about saving money (valuing efficiency and frugality) may compete with messages around giving funds to conservation (valuing generosity and pro-social support), appealing not only to different people but also to different aspects of the same person. We also see this underlying belief approach in programs or exhibits where a direct, simple ask ("pledge," "give," or "do") follows an engaging, feel-good message, relying on the held beliefs and emotions of the moment to trigger a person to

a one-off action in the hope that those one-offs eventually become habits. Thus, to facilitate behavior more effectively over time and within context, stronger cues for action based on what we know about visitors, their context, and their interests can be important.

Sociocultural Learning Perspectives: Coalescing Behavior for Key Visit Aspects

As evidenced in all the models and approaches described—as well as in their evolution—human learning and relatedly behavior are *complex*. Two people may seemingly have a similar experience, yet take away different learnings, resulting in different actions, and for entirely different reasons—or two people may have quite different experiences, yet derive similar knowledge, attitudes, and skills from those experiences, resulting in undertaking an action similar to that first person. Relatedly, and equally perplexing, the same person today may have a motivating experience and take one action today, yet a different one tomorrow, with purportedly the same underlying motivations. Thus, no single approach, experience, interaction, or context will motivate—or sustain that motivation for—everyone. Moreover, nobody takes action separated from the larger context or, as English poet John Donne famously wrote in 1624, "No man is an island." We are all constantly interacting within and influenced by broader sociocultural and institutional values, practices, and beliefs (Rogoff, 2003; Nasir & Hand, 2006). For these reasons and many more, no single message, ad campaign, educational program, or interpretive experience will resonate equally; such experiences will not and cannot be universally meaningful to and lasting for every visitor, in every community, in every sociocultural context, or in every institution.

Further, asking people to change what they are doing or add an action is challenging for many reasons. One is that adopting new or changing ingrained behaviors requires not only shifting what are often a series of habitual actions but also changing the broader structures in which those actions occur (Heimlich & Ardoin, 2008). This is why certain times of life or events, such as starting or leaving college, becoming first-time parents or empty-nesters, or entering retirement, offer excellent opportunities for change—the broader context of life shifts, and with it comes opportunities for change in patterns of behavior.

Moreover, environmental behaviors—while they may appear similar on the surface—are actually comprised of countless micro-actions. Research has found, and repeatedly confirmed, that pro-environmental behaviors do not co-vary with one another (Ardoin et al., 2016); rather, each is often a discrete behavior or action, unless tied together through a broader super-construct such as identity, which can create a constellation of related and intertwined behaviors (Heimlich & Ardoin, 2008). That is, just because a zoo or aquarium visitor recycles does not mean that

they will conserve water, use public transportation, eat a vegetarian diet, or vote in support of climate-friendly policies (Ardoin et al., 2016).

To address such a perspective requires taking more of a unified, identity-focused approach, evident in sociocultural learning perspectives (Rogoff, 2003; Nasir & Hand, 2006). Visitors to Z/A, however, do begin to display and deploy some of these identity-related characteristics as many of them differ from "the general public," participating in learning trajectories over time (Barron 2006; Nasir et al. 2020). Certain discerning characteristics separate Z/A visitors from non-visitors, as documented in the WZAM studies and others. Findings suggest that some unifying characteristics may relate to a predilection to caring about animals and wildlife overall, as well as to an overarching desire to do more to benefit the environment (Clayton et al., 2011; Bruni et al., 2008).

When They Come[3] Findings from the WZAM3, a national study, were consistent with those from previous WZAM studies (Heimlich et al., 2004; Fraser & Sickler, 2008) and others, indicating that Z/A visitors enter with an inclination to support conservation and the environment. Visitors generally have very positive feelings toward nature and want to do things that benefit the environment.

Nearly three-quarters of Z/A visitors report having hobbies that include "nature" (defined as engaging physically and intentionally in the outdoors or an activity that requires interaction with the physical environment), and two-thirds have hobbies involving being active outdoors, including nearly half reporting being gardeners. Zoo and aquarium visitors also report being likely to visit museums, gardens, music performances, historical sites, and theatre performances at other museums and botanical gardens with a slight majority also going to dance performances, indicating a pattern of ongoing engagement with informal, cultural, and scientific institutions.[4] More than two-thirds of visitors report visiting a national or state park at least once per year. A majority, however, did *not* report donating funds to conservation groups.

An important element of the Z/A visit is that those who are on a return visit—and even some who are not—have memories associated with the Z/A they are visiting. Overall, visitors report a preference for the institution they are visiting, over other settings or facilities, for the recreational activities they most enjoy. Such responses, along with those to other items, portray a sense of belonging and loyalty to individual institutions among visitors.

These entry characteristics provide a starting point for developing, designing, and reimagining conservation messaging and programming at Z/A. With such a strong predilection toward and connection to specific institutions—coupled with the high level of trust in the institution—visitors appear to be primed for conservation

[3] Findings in this section, except where otherwise cited, are from the WZAM3 studies, primarily those of the Center for Research and Evaluation (CRE) and Oregon State University (OSU).

[4] Percentage of respondents attending at least one time/year museums (90.3%), gardens (82.6%), music performances (79.7%), historical sites (72.1%), theatre performances (68.6%), and dance performances (52.4%).

messaging. Yet, the how and when of those messages, which may be the most important elements, remain less clear in terms of specific steps forward.

The Visit Itself Three aspects of interest emerged from the WZAM studies related to the visit itself:

1. Responses indicate that visitors enter with a plan for their visit, including the time allotted. For example, nearly half (49.4%) of the visitors to zoos planned 3-to-4 h for the visit, with 31.7% planning less than 2 h. Upon exit, 50.5% reported spending 2–4 h. The total number of visitors who spent 3 or more hours was a combined 70.6% of visitors and aquariums for 3 h plus was 54.5%.
2. When asked at entry who would likely make the group's decisions about content, directionality, and length of the visit, about half of the visitor groups were balanced between adult- and child-directed plans; the other half reported a combination of adult- and child-led groups, working in collaboration.[5] This held true across the visit and was corroborated by observations and self-reports.
3. As people move through the institution, they tended to fall into one of three patterns: (1) 'following the path;' (2) having certain things they wanted to see or do, but beyond that, just wandering; or (3) making intentional choices or decisions as they proceeded.

These visit characteristics have important implications for how Z/A, as institutions, can better serve and connect with visitors. Entering with an initially strong preference for and intuition on how to move through a facility or exhibition can impact how decision-making and/or wayfinding resources, such as maps, can and should be organized so that they are not easily thwarted by faulty assumptions. Recognizing that visitors are not monolithic in how they prefer to move through a visit helps educators, facility managers, and conservation professionals overall consider the ways in which to effectively design a visitor experience, and in particular one that may have a desired conservation-behavior outcome. Yet, the reality that such dominant patterns exist suggests ways in which institutions might consider providing a limited range of options that, in effect, allow each visit group to self-satisfy, while also providing gentle guidance. One critical goal for conservation behavior-focused learning, in alignment with the social marketing frame discussed earlier, is to remove unnecessary barriers to message obtainment. Another goal is to provide opportunities for modeling the desired actions and allowing visitors to practice their skills and develop efficacy, in line with the Health Belief Model. In this way, the likelihood of visitors undertaking the behavior and message actually being sustained, or 'sticking,' is increased.

[5] Entry and exit both had a slight preference for adults leading the group (CRE: 4.79 and 4.72 with a median for both of 4 on a 7-point scale of completely adult-led (1) to completely child-led (7); In Oregon State University's exit interviews, people reported that about half their decisions as they moved through the Z/A were deliberate and were more often shared decisions between adults and children, and about half were made unconsciously, following the crowd or path (Riedinger & Storksdieck, in review).

Observations and reports on visitor activities during the visit support what has been learned over the years both in practice and in published research. People experience the social aspect of the visit, have a pleasurable experience, and see animals. Digging deeper, we know that visitors' conservation behavior ties closely with seeing animals in a naturalistic environment; having opportunities for up-close, face-to-face encounters with wildlife; observing animal behavior; and engaging emotionally with the experience. These are often achieved through using persuasive communications techniques, including connecting with prior knowledge and experiences; linking everyday actions with conservation goals and outcomes; and providing incentives and activities that directly support desired behaviors and behavior changes among visitors (Ballantyne et al., 2007). Additionally, the very nature of the social experience in the context of the zoo or aquarium provides these supports for conservation intention. By design, Z/A set up structures that demonstrate and facilitate modeling behaviors for visitors appropriate to supporting group-learning settings and fostering collective agency (Bandura, 1986; Ardoin, 2009).

A visit is not divided into discrete components as established by the design of the facility. Rather, it is treated holistically, as a unified experience. Just as a visitor's experience is but a component in their learning scape that blends with other aspects of their daily life (Ardoin, in review), a visit to the zoo or aquarium fosters conservation talk and learning occurs in, between, and across experiences.[6] As part of this holistic experience, visitors may, and certainly will, have varied learning pathways: Individuals leverage different supports (signs, videos, plaques, posted information, maps, docents) and draw on learning resources in a range of ways to craft a personalized learning journey and ecology (Barron, 2006; Nasir et al., 2020). The route of information exchanged, and shared within a group, is not unidirectional, but rather is fluid. Individuals within a group--and certainly those between groups—are likely to be at different points in the conservation behaviors they enact: They may be contemplating undertaking a behavior, have tried something, are already doing it habitually, or have given up on a behavior (Prochaska & DiClemente, 2005).

Considering what a visitor gains from a visit overall, rather than considering only discrete pieces, might provide more helpful, key insights for what messages—as well as where and when in a visit—most effectively motivate and support conservation behaviors. A stronger use of messaging, therefore, may be to provide the supports and affective response needed, as well as the resources and structure, for the cognitive knowledge that underpins action. Through such a multi-part process, Z/A can create conditions and weave together experiences that support behavioral messaging with more unified outcomes of conservation knowledge, attitude, and behaviors.

Observations and reports on what visitors do during the visit support what has been learned over the years both in practice and in published research. People experience the social aspect of the visit, they have a pleasurable experience, and they see animals. But digging deeper, we know the factors that have been tied to

[6] This section of narrative is built on findings found in Timko, 2020.

conservation behavior intention in visitors include observing animals in a natural environment, having opportunities for close encounters with wildlife and opportunities to observe animal behavior, engaging visitors' emotions, connecting with visitors' prior knowledge and experiences, using persuasive communication, linking conservation goals and everyday actions, and providing incentives and activities to support visitors' behavior change (Ballantyne et al., 2007). The very nature of the social experience in the context of the zoo or aquarium provides these supports for conservation intention.

Post-visit In terms of the institution *doing* conservation, as visitors leave, they report a strong perception that Z/A collaborate well with other conservation and animal advocacy organizations. They overwhelmingly agree that Z/A care about the well-being of animals in their care, providing those animals with medical attention and facilities that meet the animals' needs.[7] Visitors also report leaving with a strong sense that the Z/A provided clear direction and advice on how to conserve energy and water.

Upon exiting, visitors also reported that they learned something, including information about conservation. Depending on the institution, topics may have included water, energy, and material (waste) conservation. More widely, visitors report gaining insight into animal habitats and species-related facts. Without prompting, they can recite facts, such as specific information about an animal and a larger concept about a species or an environmental issue gained during the visit, although much of this 'knowledge' may have been held prior to the visit. The tactile and embodied experience, however, coupled with discussing and processing immediately post-visit, likely brought the knowledge to the fore.

What is less evident in these immediate post-visit findings are shifts in affect and skills-based learning that research demonstrates are vitally important for behavior. In interviews reflecting on zoo and aquarium visits over the years, additional insights indicate that the visit itself can indeed be memorable and/or meaningful. Particularly memorable experiences usually include up-close animal encounters; experiences with some element of novelty, including learning or seeing something for the first time; and family time together. Connecting some aspects of the experience with personal and daily lives, as well as seeing those aspects reflected in their group, also was demonstrated to increase interest and memorability over time, as was a shared experience of seeing specific animal behaviors and watching each other's reactions to animals. Visits appear to increase perceptions that Z/A model positive, environmental stewardship and animal conservation.

Importantly, research documented that another impactful element of visits occurred when discussions started during a visit to a zoo or aquarium and continued post-visit (e.g., in the car, on the bus) as well as at home, sometimes for days. Learning about conservation, animals, and the intended messages of Z/A occurs not

[7] On a 7-point scale, post-visit visitors scored as strongly positive: collaborate well with conservation and animal advocacy groups (6.10); care about animal well-being (6.49), meet medical (6.41) and emotional (6.33) needs, and have facilities that meet animal needs (6.19).

during a visit, but *across* visits, which connects with another important finding: A great opportunity exists for messages and experiences to be layered, with complexity and challenge increasing as visitors gain understanding, curiosity, and sophistication as they return repeatedly, especially to facilitate the awareness of new information available or messages not noticed in prior visits. At many institutions, a large proportion of visitors attend more than once per year (see Khalil & Ardoin, 2011, echoed in the WZAM3 study). As visitors notice new aspects of the Z/A, they make deeper connections, ask more complex questions, and spark more animated dialogue.

Conclusion

Z/As are conservation organizations, driven in the twenty-first century by a vision of thriving ecosystems of wild species in wild spaces (Fa et al., 2011). Part of this vision requires a reimagining and understanding of the world as an integrated social-ecological system rather than humans as disconnected from wild places "out there." In this context, the role of Z/A can be seen as essential to conservation in several ways. One is as a stopgap measure, in terms of protecting these unique, special species that may disappear quickly without intensive, focused intervention. Another is that these institutions provide the opportunity for a range of audiences—particularly and most often those who may not otherwise do so—to interact directly, in a face-to-face way with such creatures. In today's primarily virtual world, having such personal experiences with wild creatures can be life-changing (Clayton & Nguyen, 2018).

Indeed, research documents repeatedly the power of such first-hand interactions for a variety of people, in a range of contexts, in these analogous settings (Young et al., 2018; Wheaton et al., 2016). Such experiences can be so memorable and powerful that they support shifts in knowledge, attitudes, beliefs, and sometimes even behavior—not only immediately following the experience, but even for a sustained period, with appropriate supports. Such direct, powerful, and moving experiences can encourage visitors to reflect on their place in the world while also bolstering their sense of responsibility and motivating impactful behavioral change.

Yet for these and other positive outcomes to manifest, certain conditions are essential. As discussed, research has documented the need for appropriate supports and learning scaffolds to develop pro-environmental and conservation attitudes, knowledge, skills, and behaviors, and especially for them to persist. Ideally, a Z/A not only encourages visitors to undertake wildlife-friendly actions on site at the institution, but also models how they might pursue such behaviors in their everyday lives as well as in the community, thus helping engender supportive, connected conditions to ensure those behaviors thrive (Abrahamse & Steg, 2013).

As conservation organizations working internally and externally, Z/A pursue a range of actions—from 'green' operational practices, to in situ habitat restoration, to ex situ species-focused efforts. Moreover, and directly relevant to visitors and

communities, in addition to modeling and embodying conservation, many of these institutions provide direct opportunities for engaging in—and practicing—conservation in myriad ways. They do so through pro-conservation interpretive messaging, food choices offered in on-site cafes, explicit messaging soliciting conservation-related donations, and providing tools (e.g., reusable bags and cups, shower timers, community connections) to support visitors undertaking conservation behaviors at home. The key to connecting the visit experience to everyday life is to focus on the home, considering always: What is the relevance of this conservation ask for visitors' day-to-day lives? How might institutions demonstrate that they have leveraged the affordances of their own setting in a way similar to how visitors might do so at home?

Remembering that, for visitors, a zoo and aquarium visit may not be the center of their world, but may be a special one-off experience or even a four or five visits per year experience is important. In this uniqueness, it can, and WZAM studies show it does, represent a catalyst—an affective up-close-and-personal motivator for reinforcing what one is already doing, as well as encouraging taking that desired extra step. Such visits connect, and re-connect, visitors to others who care, demonstrating how one's actions effectively contribute to a larger whole. In this way, the constituency for conservation transforms from individuals to a movement of many, leading to impact and change.

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Chapter 4
Understanding the Visitor

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Introduction

To launch evaluation and visitor studies efforts, many informal education programs, marketing efforts, or membership decisions start with similar questions professionals have used before. While these questions may feel comfortable, they could have limited utility, especially given how often they are studied and the consistent responses found across institutions. These questions include the following: What are the demographics of our visitors? Did they enjoy their visit? What did they learn from their visit? How did they hear about our facility? While exploring these questions may not seem damaging, professionals in these settings often have finite resources to conduct evaluations and visitor studies and, even more importantly,

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have limited time with guests to answer questions. Often, the answers to these questions only change on the rare occasion that new programs or new audiences are evaluated. If we knew the answers that have generally been consistent across zoos and aquariums regardless of region or size, we could instead ask questions more critical to program improvement and institutional performance. Furthermore, we could better serve the zoo and aquarium field by addressing some of the critical questions in the Social Science Research Agenda for Zoos and Aquariums (see Chap. X), including those related to the evaluative work in our institutions (Mellish et al., 2019) and questions that help us better understand the complexities of the visitor and the experience (Dawson & Jensen, 2011).

The Why Zoos and Aquariums Matter 3 (WZAM3) studies offered the opportunity to answer some of these questions in a more definitive way. In this chapter, we present generalized findings across the industry for which answers have been consistent over time. Finally, we raise questions from the field that emerged as we collectively thought about what we have learned and what we believe could benefit from the renewed attention of researchers and practitioners. We frame this chapter knowing that there are scores of evaluation and research studies that have asked some of the questions we raise. But the lack of access to these reports, whether through peer-reviewed or grey literature, is also a consistent barrier to the field and continues the field-wide frustration of reconciling anecdotal evidence with systematically collected data.

Who Visits and Why?

Who visits? People tend to visit zoos and aquariums in social groups. Though group size and the presence of youth vary greatly, most visiting groups approximate a family group structure—multi-generational and intact (meaning already-formed before the visit). We know that although adults with children are the dominant configuration, up to one third of the visitors come as single adults or with one or more other adults. Nearly a quarter of visitors have only one child in the group—which means over half of the visiting groups come with one or fewer children. On the other end of the spectrum, 3% of visitors have seven or more children under 18 in their group. Zoos differ from aquariums with slightly more adults attending without children; regardless, we have a promising opportunity to better serve adult-only groups through tailored programming and other offerings.

After years of asking, we[1] know that the "average" visitor has the following characteristics: female, 38 years old, college graduate, parent, established in a full-time career, white, moderately liberal, and has a household income between $75,000

[1] Throughout, the collective authors use "we" as in we know or we believe to refer to the concepts or findings from other studies we have conducted, read, and used over many years.

and $10,000,[2] which is between 9% and 45% higher than the median national household income. While this has been a consistent profile of the average visitor across multiple studies, nuances to these characteristics are worth examining.

While we continue to ask about gender identity and sexual identity, the traditional ways of asking are rapidly changing. The findings from WZAM3 parallel most prior studies, and rarely are these data used except when a program is targeted toward a particular population. While a majority of respondents identify as female, there is a response bias—when a group is asked to complete a questionnaire, females generally respond. Visitors tend to have more formal education than the broader public, with 9.7% having an associate's degree, 29.1% a bachelor's degree, and 29.1% postgraduate study. Slightly more than half of visitors (55.6%) are employed full-time with another 15.5% working part-time. Another 9.7% are retired, and 14.2% are stay-at-home caregivers. There is a slight majority who call themselves suburbanites, but nearly equal numbers say they are rural as those who say they are urban.

In terms of career stage, 18.9% of visitors are exploring possibilities, and 20.6% are early in their careers. The plurality of visitors are in established careers (35.3%) and a tenth are retired. Caretakers of others and stay-at-home individuals comprise another 15.3%. We also know that most visitors tend to be moderate or liberal, followed by conservative, very liberal/progressive, very conservative, and Libertarian; these findings parallel those of Fraser and Sickler (2009) that the non-visitor, anti-zoo population tends to be more conservative, religious, and older, or college age and very liberal. Well over half of visitors say they enjoy food and travel, spending time with family, nature, music and reading. Visitors to a zoo or aquarium feel the visit engages them mentally (40.5%), physically (39.7%), and, to a somewhat lesser degree, spiritually (20.0%). A multitude of visitors think that nature is spiritual or sacred in itself (45.0%), while 31% believe nature is sacred because it is created by a higher power. Lastly, 15.3% feel nature is important, but not spiritual or sacred.

These data tell us that, while we have a dominant profile of an "average" visitor, there is great diversity beneath that profile. Zoos and aquariums attract people across the demographic categories and often in proportions higher than those present in the area when compared to census data or other estimates of population distribution (Morgan & Hodgkinson, 1999; Davey, 2006). Demographics, however, are not the primary unifier of our visiting populations. In the following section, we will discuss psychographic measures that offer a deeper understanding of our visitors.

For all we know about our visitors, there are still meaningful and impactful questions that we need to address. *Here are some evaluation questions from our discussions that we feel would serve our field*:

[2] The findings in this chapter are from the COSI Center for Research and Evaluation study using matched entry/exit questionnaires from 26 zoos and aquariums participating in study. Data were gathered in each season with a total of 2854 paired responses from the total of 5842 individuals who completed at least one instrument: CRE Study Methods and Instrumentation STEM Matters.pdf

- The questions that remain are not "who is not visiting," but more "why are some groups of people not visiting?" How do we reach these audiences to determine this information?
- How well do our audiences reflect the communities surrounding the zoos and aquariums? How do we connect with those who are not engaged and committed to us or our missions? Are zoological institutions inclusive—for whom are we trying to do conservation? How are we successful and where are we failing?
- How do we manage our bias and/or privilege when targeting our non-visitor audiences?
- How do we adjust our messages and marketing to reach non-visitors?
- How do we drive more adult visitation? Why does the societal privilege given to groups with children drive the way information, programs, and shows are constructed and presented? Is there an effective way to integrate more adult-centric engagement, or is there a way to truly integrate cross generational learning that engages adults without children or youth present?

Why do people visit? Forty years ago, a study showed that adults tend to choose activities and attend educational programs and places for three primary reasons: first, for the social experience; second, to support the institution or an individual; and third, to learn something new (Cross, 1983). Since then, we continue to ask the question "why do people visit" only to find out that the dominant reason is to spend time with family and/or friends. The second and third reasons—either because the zoo and aquarium are seen as fun places to visit or a good way to spend time in nature and with animals—finally reflect the purpose of the institution. A 1998 study at the Cleveland Metroparks Zoo found that family togetherness, enjoyment, and novelty seeking were the top three reasons for a visit (Holzer et al., 1998). This was echoed in the first Why Zoos and Aquariums Matter study (Falk et al., 2007), in numerous other studies and reports (e.g. Falk, 2005; Roe & McConney, 2015), and definitively, in the WZAM3 study of visitors to zoos and aquariums.

This tells us that visitors prioritize a social, enjoyable experience. Attention theory and other audience-specific research tell us that people hold a set of prior experiences, beliefs, values, and ideas that shape both what they expect and where they dedicate their attention (Berlyne, 1951, 1954; Feather, 1982; Read et al., 1997). We also know that if visitors' entry expectations are met, they are more open to the messages that are being shared with them by the educator or during the experience (Deci et al., 1996; Paechter et al., 2010). This also held true for when people *leave* the zoo or aquarium—what they wanted from their visit shifted subtly to the following: (1) they saw animals/fish, (2) they relaxed and felt rejuvenated, and (3) they learned something new. This supports what is known in the learning sciences research: pleasure and fun are highly correlated to learning in some contexts (Ballantyne et al., 2007; Tews et al., 2017). To increase visitors' openness to conservation messages, zoos and aquariums must provide the support for social engagement within groups and facilitate social needs satisfaction. As educational institutions, we want people to be aware of their learning in the enjoyment of the visit as we know that

metacognitive awareness around learning leads to greater insights and critical thinking (see, for example, Dawson, 2008).

We understand generally why people visit and that the perceived purpose of their visit changes through the course of the experience. But this leads us to ask the bigger questions:

- What are the documented strategies for engaging visitors appropriately across the array of subtle variations in why people visit?
- What are tested strategies to transcend the assumption that if something is fun or pleasurable, learning cannot happen?
- How do we reinforce the relax/rejuvenate motivation to increase the ability for visitors to receive messages?
- How can we turn the visit's learning into conservation action?

What Do Visitors *Know* About Zoos and Aquariums?

Mission. Visitors understand the mission of zoos and aquariums. In terms of animal care, they believe zoos and aquariums have the facilities and expertise to meet the physical and emotional needs of animals in their care. Visitors understand that zoo and aquarium professionals care about their animals' well-being and provide animals with proper medical care. Through another measure, we see that visitors very strongly agree that the purpose of zoos and aquariums is to educate about and connect people to wildlife, offer pleasure and enjoyment, provide economic and cultural benefits to the community, and take care of animals. These insights are consistent with other studies that have explored what visitors know about zoos and aquariums (e.g. Patrick et al., 2007; Money & Heimlich, 2008).

Visitors largely hold zoos and aquariums as trustworthy sources for information on environmental issues, wildlife conservation, and animals and endangered species. Nationally, there is a high level of trust in zoos and aquariums amongst the American public, as discussed in Chap. X. For the visitor, the trust level is even higher. The summated scores of visitors for trustworthiness were 6.33 and for accuracy 6.31 on a 7-point scale. As we saw in Chap. X, the movable middle—people who are neither zoo/aquarium goers or supporters nor strongly anti-these institutions—gives authority to zoos and aquariums on some topics. Visitors to zoos and aquariums give even more authority to these institutions and see them as having tremendous influence on issues related to the conservation mission.

As we discussed earlier, visitors very strongly agree that a visit to a zoo or aquarium is fun and that the institution provides a valuable space for learning or discovering new things (6.43 and 6.24 respectively on a 7-point scale) and these two elements are statistically significant and strongly correlated ($r = 0.594$, $p < 0.001$). This supports the findings of Ballantyne et al. (2007) who found that learning and fun are highly related as the educational components are interwoven with the social and pleasurable experience.

Visitors also believe that zoos and aquariums are valuable cultural institutions in their communities. They also recognize that zoos and aquariums have changed over the years and are significant players in worldwide conservation efforts. They know that zoos and aquariums give funding and engage in actions that support and protect species conservation around the world, and they feel that the conservation efforts of the host institution are particularly well-articulated.

These institutions provide opportunities for family or group bonding during the visit. Across the findings, we see acknowledgement of the missions of zoos and aquariums: they are conservation organizations; they are educational; and they are caretakers of their collections. Visitors *get* what zoos and aquariums are for and about—they value the role these institutions play in society. We believe some of these questions can be set aside by individual institutions so that questions more like these can be studied:

- How best do we connect mission and messages to motivation for visitation?
- What is the contrast between marketing and education/conservation messages for visitors? Does this reflect the tension or the balance among entertainment, education, and engagement?
- How can we learn more about the outcomes of zoological institutions and do a better job of sharing those outcomes?
- In what ways does the conservation and education mission of zoos and aquariums drive visitation? To what degree do people choose to go to a zoo or aquarium because it is a conservation and education institution?

What Are the Conservation Learning Outcomes from a Visit?

What do people learn from a visit? The concept of conservation at zoos and aquariums is not limited to animals, wildlife, and habitats. Visitors acknowledge and can share examples of how the institution itself engages in wildlife and habitat conservation; people report learning about animal care, animal habitats, and information about specific animals which is consistent with many prior studies (e.g. Adelman et al., 2010; Clayton et al., 2017; Yalowitz, 2004). They also report learning about energy conservation, sustainable shopping practices, and more. These reports were not just self-reports, but all voluntarily stated with specific examples in open-ended questions asked of hundreds of visitors as they were exiting the institutions. Further, these examples were echoed in deeper interviews with members of five different zoos and aquariums. In these interviews, we learned that what makes a visit *memorable* is the animals, a novel or unusual experience, learning something new or seeing something for the first time, and family time together. What makes a visit *meaningful* is being able to experience and spend time together as a family, connecting some aspect of the zoo or aquarium experience with their personal and daily lives, seeing family members increase their interest in animals, seeing specific animal behaviors, and the reaction of those in their group to animal behaviors.

Thousands of comments show us what people learn from their visits to zoos and aquariums. They reveal the breadth of what they learn about conservation by sharing thoughts such as the following:

- *This place has an impact on our opinions and decisions to be more eco-friendly.*
- *It is a cumulative effect—trying not to use straws at home, just being really mindful. We tend to recycle more and whatnot, but…the awareness of how precious our environment is, our natural environment.*
- *I plant flowers to attract butterflies because of the butterfly garden here.*
- *It makes me more aware of my single use of plastic consumption. They teach you here about the repercussions of plastic having long term impacts for hundreds of years.*
- *One of the things that we do as a result of coming to the aquarium is that all the time we're really conscious that we each try and pick up extra trash that's not ours.*
- *We come away knowing that we have to make good choices, continuing to make the choices that we are making that are beneficial to the environment.*

These interviews provided insight into all the different types of conservation lessons people take away from their visits: water, energy, wildlife, consumption, and habitat conservation were all included across the institutions. Our messages support people in their own conservation growth. But it does not happen in one visit—growth occurs over time, and these institutions are an important reinforcement to the messages our visitors also hear elsewhere in their lives. The messages from our institutions have greater resonance when framed in the context of the animal experience.

There is consistent evidence that conservation messages do resonate and accumulate over time and that visitors place high value on learning about conservation actions they can take (Roe et al., 2014). However, there are questions we could ask toward a more existential inquiry: what specifically can we do to maximize the positive impact of our visitors on animals and their habitats?

- What are the exhibit elements that are tested and effective, and how can we capture and codify the evidence that resides in individual institutions?
- What are the educational practices that are tested and effective? Can we collect the implicit and held knowledge of the expert practitioners and the shared experiences across institutions to better our collective practice?
- What are the impacts that live animal collections have that are different or more impactful than what people may experience on videos or at natural history museums?
- What behavioral outcomes can aquariums and zoos accomplish? In what ways do we influence those behaviors?

Conclusions

We know a lot about our visitor, and we know there is much more to learn about them. Issues of demographics, visitor motivations, and general themes around visitor learning have been well-established and reinforced over decades of research. In this chapter, we hoped to provide insight into the extensive work that has been done to understand zoo and aquarium visitors. While individual situations may call for iterations of this work to be conducted in zoos and aquariums, the limited time and resources available to both researchers and practitioners require us to be more intentional in our approach to evaluation and social science research.

Through synthesizing these findings, we hope to move the conversation about our visitors to a critical next level. Along with the Social Science Research Agenda for Zoos and Aquariums, we advocate that institutional evaluations and studies address the additional types of questions articulated here. These evaluation questions, however, are only a starting point meant to inspire further creative avenues for exploration. In this period of tremendous opportunity, zoos and aquariums have much to learn from novel research topics related to visitors; indeed, the answers may help usher in a new era for these institutions. Further, there is much knowledge by and within institutions that would benefit the field through being accessible on an existing platform such as the Center for Advancement of Informal Science Education (CAISE)'s website informalscience.org. We encourage researchers and practitioners to continue sharing their work broadly and creating actionable implications for practice that turn what has been learned into lessons for zoo and aquarium professionals. In achieving this, we can continue to elevate our conversations to advance our collective work.

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Chapter 5
What Is the STEM Learning Ecology and Where Do Zoos and Aquariums Fit in It? Insights from National Studies of the Public's Engagement with Science, Technology, Engineering, and Math

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Introduction

This chapter draws on research conducted through the National Science Foundation-funded initiative, STEM Matters: Investigating the Confluence of Visitor and Institutional Agendas (DRK-1612729 and DRK-1612699), led by researchers from three institutions – Knology, a research and evaluation think tank, Oregon State University's Center for Research on Lifelong Learning, and COSI's Center for Research and Evaluation. The research sought to determine how visitor agendas, behavior, and learning relate to the conservation and environmental education agenda of most zoos and aquariums (Z/As), and where the public situates this type of informal science education institution in the STEM learning ecology.

To answer this question, the researchers used a psychology-driven framework to explore the process of experiencing STEM concepts during a Z/As visit or from hearing about them through different media content. The chapter shares Knology's research into the public's perceptions of Z/As and what characteristics they assign to these institutions. We explored how people situate Z/As in the STEM learning ecology and how they perceive these institutions as a source of STEM information. We begin with a brief overview of prior research relevant to the STEM learning ecology. The next section summarizes research from two Knology studies documenting public perceptions of that ecology – a qualitative exploratory study

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with Z/A members and a confirmatory quantitative survey study with a representative sample of the US public. Next, we present the implications of these findings for the Z/A community, staff, and leadership. We close the chapter by reflecting on how this research advances our understanding of the complex ways that Z/As provide STEM experiences for the public.

What Is the STEM Learning Ecology?

We initiated our research by reviewing the existing literature on past studies that have explored the various contexts where people have opportunities for STEM learning. One relevant framework is the STEM learning ecosystem that encompasses the diverse settings where structured learning experiences related to science, technology, engineering, and math occur for children and young adults, typically at home, schools, after school/summer programs, and cultural institutions (Traphagen & Traill, 2014; Allen & Peterman, 2019). Beyond the ecosystems where youth engagement in STEM has been studied, the framework of a STEM learning ecology allows examination of the spectrum of physical, social, and cultural contexts where all members of the public can learn STEM (Bevan, 2016). That is, the ecology situates the multiple ecosystems where STEM learning is possible. This broader lens is especially important because it is inclusive of the learning experiences of people of all ages and offers a way to conceptualize relationships between different settings and the ways they promote STEM learning.

Building on the metaphor of natural ecosystems, learning ecologies have physical boundaries where interactions occur between social systems, values, and cultural histories carried by people over time. Bevan (2016) points to programs across institutions and places that offer different opportunities for individuals to engage with topics associated with specific STEM disciplines (science, technology, engineering, and math). These opportunities include aspects of formal learning, nonformal learning, informal learning, incidental learning, and everyday learning (Mocker & Spear, 1982; Bevan, 2016; Heimlich, 1993; Heimlich, personal communication, 2017), as indicated in Table 5.1.

The broad definition of ecology provides a useful segue to consider STEM learning opportunities that the public encounters in cultural and science institutions such as zoos and aquariums. More generally considered as informal learning settings, they provide opportunities for adults and children to engage in “free-choice” learning, where they have agency over how and where they engage with topics like STEM (Heimlich & Falk, 2009). Though these spaces draw people in for other reasons, social involvement and enjoyment can lead visitors to discrete learning experiences (Falk, 2005; Heimlich & Horr, 2010; Gupta et al., 2019). In fact, the learning occurring in these environments can be more compatible for individuals with different physical and cognitive abilities and learning styles, facilitating learning and confidence in their abilities (Melber & Brown, 2008; Reich et al., 2010).

Table 5.1 Types of learning

Types	Description	Citation
1. Formal	Most closely associated with elementary and secondary education and most degree and certificate programs offered by colleges and universities	Mocker and Spear (1982)
2. Non-formal	Facilitated by an educator who is responsible for the outcome, the methods, and the setting and includes all programmatic, structured, organized learning efforts outside formal education, such as shows, programs, workshops, lectures	Heimlich (1993) and Heimlich, personal communication, June 30, 2017
3. Informal	Learning opportunities are present and typically self-directed, but may or may not have clear and explicit learning objectives associated with them. These include interpretive programming, signage, and in-person interpreters	Heimlich, personal communication, June 30, 2017
4. Incidental	Mediated learning when individuals construct meaning from a definite message, with the caveat that what people "learn" is incidental to their engaging with specific kinds of media (TV, movies)	Same as above
5. Everyday	Learning from conversations, random exchanges, and overheard things that happen during everyday life	Same as above

What Is the Role of Z/As in the STEM Learning Ecology?

We conducted qualitative and quantitative studies to broadly examine what the ecology of STEM learning might look like, and where Z/As fit into it.

The research questions that guided us are as follows:

1. How does the public perceive the STEM learning ecology?
2. Where are Z/As situated in the STEM learning ecology?

Qualitative Exploration of the STEM Learning Ecology

We conducted a qualitative exploratory study with members of six Z/As located across the US (Gupta et al., 2019). These comprised three zoos, two aquariums, and one combined zoo and aquarium facility in the Northeast, Southeast, Southwest, and Midwest. Pairs of researchers conducted six interactive workshops with a total of 47 Z/A members.

We asked participants to define the acronym STEM and then to answer the following questions:

1. What is STEM learning?
2. At the [name of Z/A], what are some of the STEM learning experiences you have had in programs?

3. At the [name of Z/A], what are some of the STEM learning experiences you have had from exploring the Z/A?
4. Broadly speaking, in what settings, outside of K-12 or higher education classrooms, do you feel you are engaged in STEM learning?

We began analysis of the open-ended discussions by identifying the range of settings, modalities, and topics that the participants felt were part of their STEM learning experience. We used these major themes to organize the findings in the following sections. The analysis process was iterative and additionally drew from discourse on different types of learning (Table 5.1), Gardner's (1993) theory of multiple intelligences, and the Framework for Evaluating Impacts of Informal Science Learning (Friedman, 2008). We used Gardner's theory to explore the multifaceted ways in which people process and engage with information (e.g., verbal-linguistic, logical-mathematical, visual-spatial, and bodily-kinesthetic). We used Friedman's framework to identify categories of impact (knowledge, interest, attitudes, behavior, and skills) at Z/As.

Settings

Participants described STEM experiences in various environments including in structured, institutional settings such as science centers. They described these informal science education institutions (ISEIs) as a particularly valuable source of STEM experiences: "[The science centers] have educational standards…and the things in the exhibit are aligned with those standards… You could do a math activity based on the exhibit. There are ways to take the topic and you can still tie it into learning."

One workshop group felt that these institutions cater to different learning styles (e.g., children with attention deficits) who may have difficulty with traditional learning approaches. Additionally, they felt that online resources (e.g., live streaming footage of bald eagle nests), broadcast news, TV programs, informational newsletters, and YouTube videos could provide STEM experiences. Participants also described places to encounter STEM learning without necessarily focusing on it (e.g., maintenance and auto repair shops, IT shops, hospitals, pharmacies, biomedical shops, grocery stores, and restaurants). They also highlighted interactions with local ecology, such as during nature walks or participating in cleanups at a local river site, as providing opportunities for STEM learning.

Learning Modalities

Participants recognized that informal learning settings present information strategically to engage visitors. We provide specific examples of how participants described Gardner's learning modalities in their experiences.

Interpersonal: Interpersonal learning occurs through interaction with other people such as through non-formal learning facilitated by instructors or staff at nature centers (e.g., public programs) or more casually (e.g., conversations).

Visual-Spatial: Z/As, for example, use signs by animal enclosures to engage visitors visually or through interactive media experiences (e.g., navigating Google Earth).

Intrapersonal: Intrapersonal learning occurs through introspection. Such learning was described in relation to how the content in signs can provide information about animals in Z/As that visitors can reflect on.

Bodily-kinesthetic: Participants described opportunities for kinesthetic learning in informal learning contexts (e.g., science, aerospace, and natural history museums) that interactively engage the body (e.g., manipulation of objects through touch, and using other senses, like smell).

Compared to other informal learning settings, participants perceived Z/As to have slightly different roles in supporting STEM learning. The unique experiences at Z/As are described in greater detail next.

Learning at Zoos and Aquariums

Participants' experiences at Z/As aligned with Friedman's framework on the impacts of informal science learning settings and overlapped with learning modalities from Gardner's (1993) framework. The themes that we inferred indicate that participants differentiate Z/As from other ISEIs.

Knowledge growth: Participants felt that learning at Z/As primarily focused on providing content about animals and their habitats at exhibits. This includes learning things like the scientific names for animals and their natural habitats (science-focused), or information about human and animal population growth (math-focused). They also felt that flora at zoos, especially in constructed garden areas, built awareness of engineering (e.g., via landscape design). This learning could be supplemented through technology (e.g., phone apps), or engineering (e.g., describing how animal habitats were built), or math (e.g., counting animal interactions).

Attitudes: Participants felt that encounters with animals at Z/As can make certain species less scary. For example, one participant described an aquarium combining "scary shark music" with its dolphin exhibit and using cheerful music with sharks to demonstrate how sensory experiences can shape attitudes. Seeing live animals fostered emotions such as empathy, and motivated people to engage in environmental protection actions.

Interest: Interactive experiences with animals at Z/As seemed to help children engage with STEM concepts. Additionally, they encouraged reflection on the role of human actions on ecosystems.

Behavior: Participants linked learning about animals to learning about conservation and the role of Z/As. To capitalize on this link, one participant suggested that

restaurants at Z/As share information about food sources to encourage conversation about sustainable consumption.

Skills: Participants described skill development at Z/As as either general (e.g. questioning or inquiry) or specific (e.g. measuring dissolved oxygen levels in water). Participants also acknowledged the value of skills from engineering (e.g., to create plans and drawings), technology (e.g., to ensure water availability and climate control), and math (e.g., calculating space needed for people or animals).

Confirmatory National Study of the US Public

We used the results of the qualitative research to design a study with a representative group of the US public to understand the prevalence of similar themes (Gupta et al., 2020). We recruited a sample of 1461 members of the public using the survey-panel service Soapbox. Based on U.S. Census (United States Census Bureau, 2016) data for race and ethnicity, African-Americans, Asian-Americans, Native Americans, Pacific Islanders, and others were well represented in the sample; in comparison, fewer people identified as Hispanics, more mentioned being White, and more reported multiple races.

How Does the Public Perceive the STEM Learning Ecology?

We identified three aspects of the STEM learning ecology to understand where, what, and how the public engages with STEM. We constructed a data representation that captured the frequency with which the public encountered STEM in 22 settings (based on findings of the qualitative research), the S/T/E/M topics the public described learning in these settings, and the modes through which they engaged with STEM. We mapped the different settings, and situated Z/As among groups of similar settings.

How Often Do People Encounter Each STEM Discipline in These Settings?

How frequently participants selected the 22 settings and how often they encountered S/T/E/M in each setting was similar. No single STEM discipline dominated the public's experience of the STEM learning ecology. Figure 5.1 shows the relative frequencies of encountering S/T/E/M across settings with thematically comparable informal learning environments – science centers, natural history museums, botanical gardens, and back and/or front yards. It underscores that people conceptualize science centers as the prototypical setting for encountering S/T/E/M, while Z/As are most associated with science and engineering.

Participants mentioned *Science Centers* in their top three STEM learning settings; in other settings, which was selected by 622 participants (43%). About 286 participants (20%) chose the next most frequently selected setting – *Home*. The next

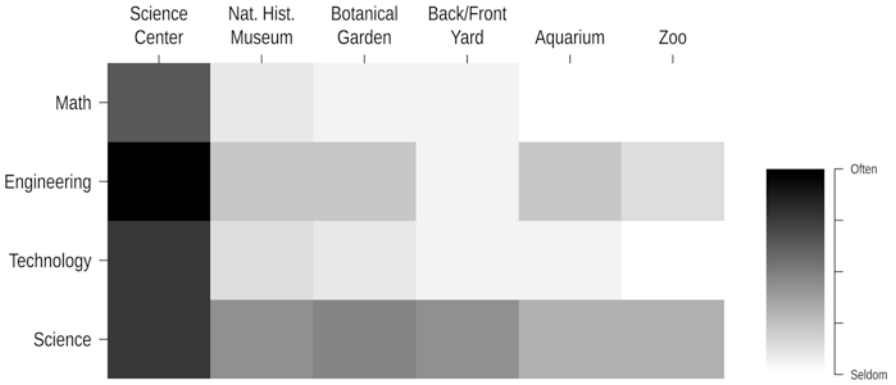

Fig. 5.1 Relative frequency with which respondents selected Z/As and similar informal learning environments for the top three settings where they encounter S/T/E/M, weighted by the relative frequency of encountering S/T/E/M at those settings

most frequently selected setting, Aquariums, *Zoos*, was selected by 199 (19%) of participants, while *Zoos* were selected by 174 (12%) participants.

What STEM Topics Do People Learn in These Settings?

In Fig. 5.2 below, we show the relative selection frequencies of the topics that participants encountered in informal learning environments, including Z/As and other similar ones. The topics they learned depended on the setting and S/T/E/M discipline. People were exposed to the broadest selection of topics at science centers – participants were 35% more likely to engage with any given topic at science centers, compared to zoos or aquariums, for example. We also observed several statistically significant co-occurrences between some specific topics and settings: animal behavior at zoos, aquariums, and back/front yards; geography at natural history museums; species names and reproduction at zoos and aquariums; and water quality at aquariums.

What Modalities Do the Settings Offer for STEM Learning?

In the figure below, we report the relative frequencies with which the public encounters various learning modalities in informal learning environments including Z/As. The modalities in the figure depict specific examples that emerged from the qualitative study using Gardner's theory. The figure shows that the modalities depended on the type of and the S/T/E/M discipline. The public reported employing the broadest selection of learning modalities at science centers. Compared to zoos or aquariums, participants were 72% more likely to encounter any given modality at science centers. We also observed several statistically significant co-occurrences between learning modalities and settings: observing animals at zoos, aquariums, and back/

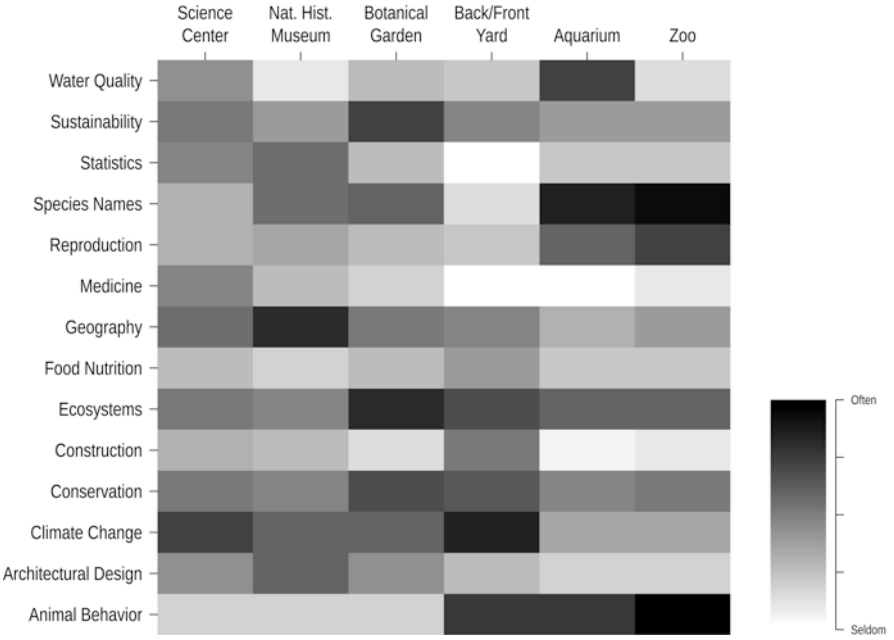

Fig. 5.2 Relative frequency with which respondents selected topics they learn at the top three settings (plus zoo and/or aquarium) where they encounter S/T/E/M

front yards; exploring plants at botanical gardens and back/front yards; and hands-on activities and using senses with back/front yards (Fig. 5.3).

Mapping the STEM Learning Ecology

We combined the datasets from the previous three figures into a single data representation of the learning ecology. The combined data is shown in Fig. 5.4 below. Each row of the representations in Figures 1, 2, and 3 provides a strongly it was associated with each STEM discipline, topic, and learning modality. We analyzed these profiles to find groups of similar settings. We identified six groups composed of multiple settings, plus the single-setting, Science Center group. In the map of the learning ecology below, ellipses mark the groups of settings. *Science Center* offers a comparison point for other types of settings. The distances between settings on the plane illustrate the conceptual [dis]similarities in their profiles.

Where Zoos and Aquariums Fit in the STEM Learning Ecology

As Fig. 5.4 above shows, Z/As group together with Back/Front Yard (the "ZAY" group). They are characterized by the topic of *Animal Behavior* and use the learning modality of *Observing Animals*. Our analysis revealed that within these settings,

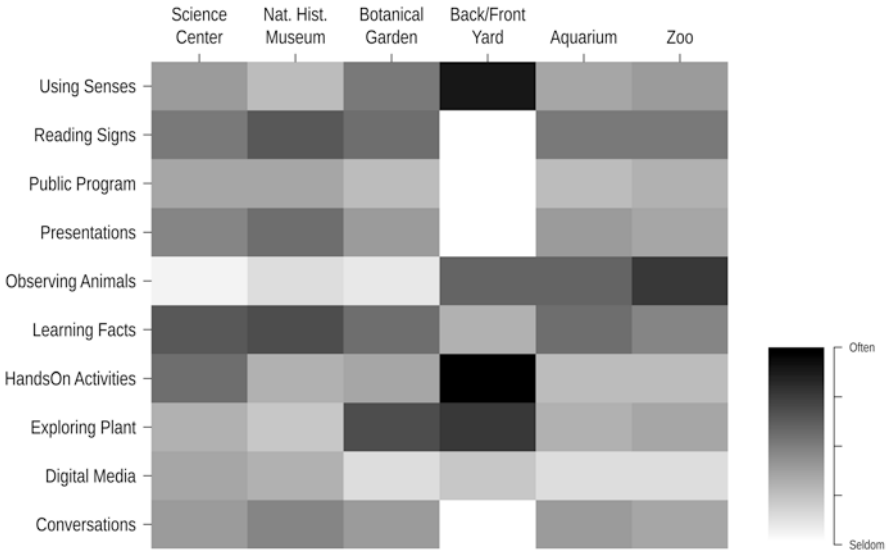

Fig. 5.3 Relative frequency with which respondents selected learning modalities (based on Gardner, 1993) available at the top three settings (plus zoo and/or aquarium) where they encounter S/T/E/M

people experienced each STEM discipline similarly. That is, they were as likely to encounter science in a zoo as they were in their backyard or at an aquarium. However, the odds of selecting the topic, Animal Behavior, were more than seven times higher for the ZAY group than for the average of the other groupings. Other likely topics for the ZAY group included species names, reproduction, ecosystems, water quality, conservation, sustainability, and climate change. We also found that the odds of selecting the Observing Animals learning modality was almost 10 times higher for the ZAY group than for the average of the other groupings. Other likely learning modalities included exploring plant, public programs, using senses, and reading signs.

There were differences within the ZAY cluster that aligned with the differences in the physical, social, and natural infrastructure in these three settings. Compared to back/front yards, participants were more likely to associate learning about several topics with Z/As including species names, reproduction, animal behavior, ecosystems, statistics, and water quality. Participants were also more likely to associate the following learning modalities with Z/As: reading signs, conversations, presentations, public programs, learning facts, and observing animals. When we compared zoos and aquariums directly, participants were more likely to select the topic of animal behavior and the modality of observing animals for zoos than they were for aquariums. Simultaneously, they were more likely to select the topic of water quality and the modality of digital media for aquariums rather than zoos.

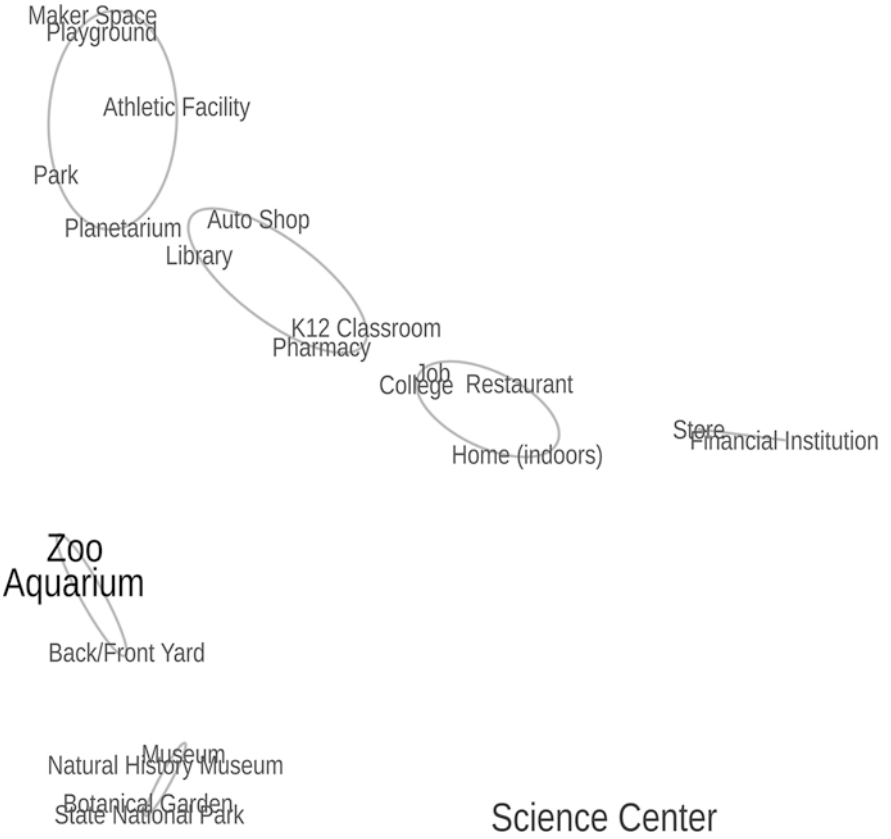

Fig. 5.4 STEM learning ecology from a cluster analysis of data about STEM learning settings. Note that the location of the Science Center falls outside this plot and has been moved closer for easier viewing

We also looked at whether having a predisposition to STEM (interest in STEM and value placed on STEM) was linked to participants' perceptions of STEM learning in their lives. We didn't find a relationship between these individual-level characteristics. It suggests that these settings enable STEM learning for everybody whether or not they have a pre-existing interest in STEM.

Implications for Zoos and Aquariums

This research broadens our understanding of the nuanced ways that Z/As can advance STEM learning for the public. The public accords unique authority to zoos and aquariums within the broader STEM learning ecology. This positions them as leaders in providing a multitude of opportunities to learn STEM. Even though participants likened these institutions to thematically similar contexts, such as science

centers, they drew some clear distinctions. Through specific topical foci relating to animals (e.g., reproduction and behaviors), Z/As engage visitors in exploring science. As they inform the public about climate change and conservation, Z/As, compared to other ISLCs, do so through the lens of impacts on animals and their habitats. Our national survey study reinforced the qualitative research findings – that STEM learning at Z/As tends to focus on science learning related to animals and the ecosystems they depend on (Gupta et al., 2019).

Both studies have implications for Z/As as they strategize about their mission and direction. There are opportunities to be introspective about visitor engagement that explicitly incorporates STEM and aligns with Z/As′ overarching goals to connect people and animals. For example, conservation topics can be used to facilitate explicit connections between different STEM disciplines, advancing the dual goals of engaging visitors in STEM learning and aligning with AZA's (2019) priority on conservation.

Within the larger STEM ecology, the role of science centers in exemplifying STEM learning is promising for general STEM advancement and for strengthening the informal science learning field. Z/As could explore opportunities to complement their pedagogical approaches with those used by science centers to engage their visitors. This has been fruitful in the past, when an animal cognition exhibit, Wild Minds, was co-hosted at science centers and zoos in two cities (Fraser et al., 2013; Gupta & Plemons, 2012).

Our studies showed that the public feels that animal encounters at Z/As offer opportunities to highlight the role of STEM in different aspects of the animals' lives. Beyond science, they also see opportunities for technology, engineering, and math topics to be part of the story Z/As convey to the public. Moreover, we found that people associated the animal-focused learning that takes place at Z/As most closely with STEM experiences in their back and front yards. This finding affords an opportunity for Z/As to explicitly connect STEM engagement that occurs within their institutions to people's domestic lives, extending the learning experience beyond a mere visit. Drawing attention to how people can continue to engage in similar learning at home can also reinforce STEM learning through ongoing intergenerational interactions. Despite the differences in the topics and modalities of learning between yards and Z/As, the former may be the best simulation of STEM learning experiences at Z/As outside of their institutional boundaries.

We make the case that Z/As have much to contribute to a more holistic public engagement around STEM. We have evidence that STEM opportunities that go beyond the usual science focus will be received and imbibed by the public, and this has the potential to push these institutions' agendas forward in mission-relevant ways.

Proposed Strategies for Zoos and Aquariums

The following recommendations for Z/A staff and leadership are based on the implications outlined in the previous section and grouped by the common themes they represent.

Consider the Breadth of STEM

1. Strategically discuss how TEM concepts relate to their exhibits, collections, and programs in addition to science. They can explicitly highlight the complex relationship between STEM topics, modes of engagement, and learning that may be possible at a specific animal exhibit. For example, they could highlight an aquarium's sophisticated life support systems to spark a conversation about technology. We note here that individual institutions have to decide if a focus on TEM concepts is worth pursuing.
2. Focus on learning associated with the unique areas of expertise that they provide in the public's eyes. For example, zoos might focus on STEM learning around animal behavior rather than on water quality which is a more relatable concept for aquariums. TEM concepts could also be leveraged to highlight conservation efforts in which they are engaged and the diverse disciplines that can create solutions.
3. Link experiences in a yard to learning that occurs during a Z/A visit. This would help people gain a more holistic understanding of nature that encompasses the Z/A experience, home experience, and everything in between and beyond.

Build Staff Capacity

4. Investing in building staff capacity to engage more effectively with the public on STEM is a fruitful strategy for zoos and aquariums. This includes the following:
    (a) Train staff and volunteers to describe how S, T, E, and M features in purposefully selected exhibits, with the goal of expanding to a larger selection of exhibits in the institution.
    (b) Create interpretation that directly links S, T, E, and M and with hands-on activities and the sensory experiences that are available for visitors.

Collaborate with Other ISEIs

5. Consider Z/As as collaborators with other cultural institutions. The unique authority of Z/As on animals and habitats can complement other institutions' areas of authority.
6. Explore opportunities for Z/As to complement their pedagogical approaches with those used by science centers to tailor programs for visitors to Z/As.

Conclusion

Together, these two studies comprise one of the first in-depth examinations of how members of the public experience and engage with the broader landscape of STEM disciplines. It shows that informal learning settings, like Z/As, can engage the public in a multitude of STEM learning opportunities through various modes and topics. It is especially promising that the opportunity to engage with STEM in informal learning settings is available for all in a democratic way, regardless of their personal interest or affinity towards STEM. We have identified steps that Z/As can take to broaden the scope of STEM learning. We also see the need for further research to understand perceptions of equal opportunities for all in informal learning settings.

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Chapter 6
Why We (Still) Do Not Know the Educational Impact of Zoos and Aquariums: Assessing Current Evaluation Methods and Ways to Improve Them

Sarah Louise Spooner, Eric Allen Jensen, Louise Tracey, and Andrew Robert Marshall

Introduction

Over 700 million visits are made to zoos and aquariums (Z/As) in a typical year (Gusset & Dick, 2011). While it is questionable whether education per se is the most valuable way for Z/As to contribute to pro-conservation outcomes (e.g., Jensen et al., 2017), conservation education is the primary focus of Z/A's activities aimed at engaging the public with biodiversity and conservation. Indeed, conservation education is a fundamental theme in most Z/A mission statements (Patrick et al.,

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2007) and has been identified as supporting the United Nations Aichi Biodiversity targets (Barongi et al., 2015; CBD, 2011). These targets aim to increase public awareness of biodiversity and of how individuals' actions can impact both positively and negatively on the environment. If Z/As can successfully engage their vast audiences about biodiversity, conservation issues, and actions, their potential public impact is substantial. This potential is what has animated much of the impact evaluation literature available on their educational outcomes. In this chapter, we provide an overview of this literature, highlighting how impact evaluation in Z/As can be advanced in the future to more effectively inform conservation education practice (e.g., see Jensen & Gerber, 2020).

First, we must define 'impact'. In the context of Z/A education, impact can be understood as a change in an individual's interests, emotional responses, knowledge, or behavior as a result of an intervention. Crucially impacts can be positive (e.g., increased conservation awareness) and/or negative (e.g., misinterpretation of the intended learning outcome). In terms of educational impacts, these range from relatively easy-to-measure 'knowledge' changes to attitude and emotional changes, which can be complex to capture (e.g., Jensen, 2020). A recent focus on behavioral impacts additionally requires monitoring over an extended period or reliance on self-reported or intended behaviors. As individuals' learning is affected by a range of factors, isolating the influence of one experience is challenging. In the wider impact measurement literature outside of Z/A studies, this kind of assessment is typically achieved using either experimental designs (with random assignment to treatment and control) or repeated measures designs (going back to the same individual at least pre- and post-visit).

Successful Z/A education, based on their mission-related criteria, is achieved if audiences improve their biodiversity understanding or move closer to supporting conservation efforts. Evaluation studies within informal learning settings, such as Z/As, can be technically and logistically demanding (Jensen, 2014; Jensen & Lister, 2017), requiring expertise in survey design and administration linked to the ability to successfully integrate evaluation into a non-formal leisure experience. Unlike in classroom settings, there are no formal assessments of learning, and some audiences may be reluctant to participate in research in the midst of a leisure experience. Additionally, many Z/As struggle to complete any form of evaluation due to shortfalls in time, expertise, and resources (Jensen, 2015a).

Learning is influenced by many factors including past experiences (Land et al., 2020; Piaget, 1998; Vygotsky, 1978). Evaluations that are designed to test visitors' existing states (knowledge, emotions, behaviors, or attitudes) and measure change as a result of the experience itself could allow for greater comparative utility for the field.

Despite a plethora of visitor experience studies in Z/As (Schram, 2013), few gather empirical data robust enough to overcome the variation in learning outcomes that could provide conclusive evidence of educational success (Marino et al., 2010; Moss & Esson, 2013). The studies which do exist generally agree that such visits have a positive educational impact on visitors. Yet, their many methodological and

theoretical limitations mean caution is required when interpreting results (Dawson & Jensen, 2011).

The focus of this chapter is to consider what we know about the impacts of Z/As, after the methodological rigor of existing research on this topic has been taken into account. To achieve this, we consider common methodological issues and how some studies have addressed these. As a contribution to future research in this domain, we also consider how Z/As can avoid these pitfalls in their own research regardless of study size.

Longstanding Limitations in Z/A Educational Evaluation

The general problem of traditional Z/A education research is most strikingly and comprehensively captured by a decisive rebuttal of the best-funded study to date (with more than $1 million awarded by the US National Science Foundation). Falk et al. (2007) conducted a large-scale study involving 12 American zoological institutions (n = 5500), collaborating with the US-based Association of Zoos and Aquariums (AZA) to investigate the impact on conservation attitudes and understanding. The study claimed that Z/A attendance prompts visitors to reconsider their role in environmental issues and see themselves as key to solutions. The study also claimed long-term knowledge gains from a Z/A visit. Although never published in a peer-reviewed article, the study was widely circulated and hailed as the first large-scale research to evidence positive long-term impacts from a Z/A or aquarium visit. It was used by the AZA to publicize the industry's success. Falk et al.'s (2007) study faced criticism for its methodological and theoretical approach (Marino et al., 2010) because the project employed 'retrospective pre-tests' collected on exit and had survey design issues. While Falk et al. (2010) responded to the methodological critiques, the concerns raised may limit the certainty of Falk and colleagues' impact claims. The 'identity-related-motivations model' used by Falk et al. (2007) to divide visitors into groups was also criticized by Dawson and Jensen (2011). They argued that Falk et al.' (2007) model was too reductive and did not discuss the implications of visitors to fall into multiple categories. Moreover, Falk and colleagues' model also did not address potentially important demographic characteristics (Dawson & Jensen, 2011; cf. Jensen et al., 2011). Falk and colleagues responded to criticisms by stating that the study was not designed to prove visitors' perceived value of Z/As and was intended as a descriptive study (Falk et al., 2010). Falk et al. (2010) also state that because their study supports findings from other Z/A research, their claims of educational success stand. However, as many of the other Z/A studies share similar methodological approaches, we believe this raises concerns about the degree to which these results can be confirmed through other types of study. Reviews of Z/A evaluation research align with more general methodological issues throughout the social sciences, for example, the replicability concerns raised by Dietlan et al. (2020) in their call for more rigorous open science standards for communications research.

Luebke and Grajal (2011) found that most US Z/A evaluations (97 zoos) measure educational success using attendance figures, rather than whether learning outcomes have been achieved. Attending a learning experience is not a guarantee that messages will be received by all audience members. Accordingly, attendance measures inflate levels of reported learning. Roe et al. (2014) demonstrated that the problem is an international issue, with current Z/A education evaluation dominated by claims based on anecdotal evidence (reported visitor learning and visitor satisfaction) and by assuming that the number of people taught equates to the number of people who have learned. This problem may be exacerbated by Z/A licencing requirements which measure a Z/A's educational impact through the number of formal education facilities available and the number of individuals enrolled in programs rather than the quality and type of teaching delivered (DEFRA, 2012).

Luebke and Grajal's (2011) review also identified a lack of direct knowledge testing using pre-post-measures. Testing before (pre) and after (post) an experience is known as a repeated measures design. This, repeated testing, is important as it allows changes in visitor knowledge or attitudes to be tracked precisely and claims of educational impact to be evidenced against a specific intervention rather than just being a reflection of the individual's overall opinion (Jensen, 2015b). Instead, many Z/A evaluation studies have used retrospective pre-testing. Retrospective pre-testing asks visitors after an experience (e.g., when exiting a zoo) to predict how they would have responded prior to that experience (Falk et al., 2007; Wagner et al., 2009). The argument for this method is that it is easier to administer (it requires only one survey, which is administered post-visit) and that response-shift bias or priming (e.g., looking for answers after being asked an initial question) can be avoided (see Falk et al., 2010 for methodology references). Critiques of the method argue that retrospective testing inflates estimates of learning (Donaldson & Grant-Vallone, 2002) as individuals tend to say they have learned something to avoid negative associations with failing to learn and in order to please the researcher. As learning is influenced by many factors, it can be difficult for visitors to isolate experiences and accurately recall what they knew before a visit.

Although repeated (pre-/post-) testing may be favorable in many contexts, it can be challenging in an informal learning setting as visitors may be reluctant to answer multiple questionnaires, and this can lead to small sample sizes and challenges in retaining respondents in the study. An alternative is to use repeated measurement with randomly selected independent (unmatched) pre- and post- groups. This has demonstrated similar findings to repeated measures with matched samples while avoiding the risk of respondent bias found in retrospective pre-testing. Bruni et al. (2008) combined both unmatched pre-/post-groups and repeated pre-/post-measurement and found similar increases in conservation concern as a result of a zoo visit, demonstrating the similarities between methods. This similarity was also confirmed by Spooner et al. (2021a). General improvements in audience learning can be identified and inferences drawn about the population using this kind of approach. Increased knowledge of threatened species and conservation concerns were seen in both Balmford et al.'s (2007) study and Clayton et al. (2017) using an unmatched pre/post-visit sample. The main downsides of unmatched pre-/

post-measurement are that (1) knowledge change cannot be directly tracked at the individual level using this approach, (2) this approach can be less sensitive to real differences between pre- and post-visit, and (3) it can be logistically challenging to ensure a probability-based (randomized) sample without research-trained staff.

Single Zoo Studies

An assessment of the educational outcomes research at Z/As published prior to the turn of the millennium was found to be based on small-scale evaluations or isolated case studies (Dierking et al., 2002). Attempts by individual sites to evaluate their education provision, in accordance with the requirements of Z/A professional associations (Thomas, 2020), have resulted in most zoo evaluations being based on findings from single sites (Spooner et al., 2021b). Although producing any form of evaluation is laudable, there remain challenges in survey design, implementation, and interpretation, which have all affected the reliability of past research (Jensen, 2015b). Improved social research skills training has increased the quality of more recent studies; however, there are still equity and diversity concerns about the most robust research studies of zoo educational impact coming from a handful of well-funded, well-equipped organizations.

Smaller-scale studies are easier to implement than multi-institution research and may provide more practical guidance for individual organizations. Consequently, these studies do have practical value. Continued support in training smaller institutions to conduct high-quality, robust research is vital to avoid repeating the methodological and conceptualization errors of the past. Unfortunately, even with robust methods, it is hard to generalize findings from individual zoo studies unless viewed collectively with other similar studies via systematic reviews or aligning survey instruments and protocols in advance (e.g., zoowise.org). For this reason, research that is coordinated centrally and applied across multiple sites tends to produce more generalizable findings and stronger evidence of impact.

Large-Scale Studies

Large-scale studies require specialist skills in cross-cultural survey design, data management, coordination across sites, language translations, and standardized evaluation measures. This level of professional research capacity comes at a cost that many zoos feel they simply cannot afford. The logistics alone can feel daunting: each zoo must gather data using parallel methods for such studies to work. While a large organization may be able to afford digital technologies to enable direct visitor input onto an online survey, smaller zoos must use print surveys and either manually input data or scan responses, both of which require staff availability and follow-up. Once collated, data must be analyzed in a way that takes into account variations

across zoos, which requires analytical expertise. For these reasons, large, international studies are not common in the Z/A audience research literature.

Of those which exist, a series of large-scale international studies by Moss, Jensen, and Gusset (Jensen et al., 2017; Moss et al., 2015, 2017a, b) have provided a comprehensive baseline evaluation of the impact of Z/A visits on biodiversity knowledge and long-term understanding of conservation actions. This set of research papers was designed to assess the United Nations Aichi biodiversity targets, which are highlighted by the World Zoo and Aquariums Association (WAZA) as being directly linked to its mission to educate the public about biodiversity conservation and inspire pro-conservation action. Aichi Target 1 focuses on knowledge transfer to promote biodiversity understanding amongst the public. According to Target 1, the public should also gain awareness of conservation actions to prevent further biodiversity loss.

These studies used repeated measures testing across more than 30 zoos, asking the same respondents both before and after their visit, and follow-up repeat testing to measure the long-term impact. Moss et al. (2015) provided evidence of Z/As meeting Aichi Target 1 when they identified improvements in aggregate biodiversity understanding and the ability to state conservation actions as a result of a single Z/A visit. These large-scale, international studies published in top conservation science journals such as *Conservation Biology* and *Conservation Letters* provide credible evidence of Z/A success as they track knowledge changes by repeated measurement of individuals across a large sample.

However, whilst these studies address the overall claims of educational impact, they only offer a preliminary picture of the features within the Z/A visit that predict learning impacts. In particular, it is clear that communication interventions, in various forms, can boost learning over and above what is feasible for unguided and uninterpreted Z/A visits. Understanding more about the impact of experiences within the Z/A visit is also required to gain greater insights into what factors lead to improved learning (Clayton et al., 2017).

Weiler and Smith (2009) found that Z/A experiences may have an additive effect on visitor learning. That is, a greater frequency or variety of learning experiences can increase the overall learning that occurs. Therefore, research on both the individual and combined effects of Z/A experiences is required. As external factors, such as the way an institution is perceived, may influence learning (Patrick, 2016), it is important to consider visitor learning in different types of Z/A settings.

One solution is to combine the findings of smaller studies which share methodology. The Gupta et al. (2019) study is a good example of how case studies from several Z/As can be collated to provide a deeper understanding. The study considers a series of workshops and discussions at six Z/As designed to capture the collective views of visitors and Z/A members about STEM learning. Through qualitative analysis using guided discussions, a deep awareness of visitor perceptions was gathered, which provided ideas on how to tackle STEM subjects within Z/A teaching, including identifying potential problems. That study laid the foundation for a large-scale national survey (see Gupta et al., this volume).

Signage

One of the most prevalent sources of educational content in Z/As is signs. Observation studies suggest that around 30% of visitors can be observed engaging with content on signs (Clayton et al., 2009). Moss et al. (2015) found that people who 'saw or heard biodiversity information during their visit' (including signage and other communication content) were more likely to develop positive impacts on biodiversity understanding, attitudes, and practical knowledge of pro-conservation actions.

Many audience studies focusing on signs have used 'dwell time', the amount of time spent reading, as the key outcome measure and an index of learning (Arndt et al., 1992; Bowler et al., 2012). However, time is a poor learning indicator, among other reasons, because individual reading speeds differ (Sanford & Finlay, 1988) and looking at content does not show learning outcomes have been achieved. Other sign studies are museum or science-centre based (Bitgood, 2006; Bourdeau & Chebat, 2003; Wandersee & Clary, 2007), meaning that the context is not fully reflective of the Z/A setting.

In order to conduct robust studies of sign design, a more experimental approach is required. This may involve offering alternative choices of signs to visitors and evaluating the impacts of each. For example, Parker et al. (2018) tested the presence and absence of alternatively worded 'do not feed' signs on visitor behavior, finding reduced feeding in the presence of signs but with a limited effect of the design style. Alternatively, the increasing affordability of eye-track technologies means tracking visitor reading and engagement with signage is now possible. However, only one Z/A based eye-track study has been published with a very controlled audience that could only make limited claims (Heim & Holt, 2022). The lack of this type of study is predominantly because these technologies still require relatively high time commitment, skill with the equipment, and at this writing are generally still considered cost prohibitive. Furthermore, sign designs and their locations tend to be unique to each exhibit, making findings hard to generalize.

Z/A Live Programs, Talks, and Educational Sessions

Animal presentations and keeper talks are frequently used by Z/As to convey information. Approximately a quarter of visitors are thought to engage with live animal shows (Spooner et al., 2021a) and over 75% of global Z/As offer some form of animal ambassador encounter where visitors can come into close contact with an animal (D'Cruze et al., 2019). Despite their prevalence, there is a limited public record of research to indicate the educational impact of these types of experiences.

Animal-visitor interactions in the form of animal programs, keeper training presentations, and close contact experiences are generally supported by the Z/A community (see Rowe et al., 2022). The American Association of Zoos and Aquariums

(AZA) describes ambassador animals as 'powerful catalysts for learning' (AZA, 2020), although it uses limited evidence to back these claims.

Live animal displays have been shown to increase dwell time at exhibits (Anderson et al., 2003; Miller et al., 2013; Povey & Rios, 2002). Spooner et al. (2021a) found statistically significant learning impacts (knowledge gains) from live animal show attendance, but weak impacts on awareness of conservation actions. This study indicated that animals performing trick-type behaviors caused audience confusion regarding scientific information about natural species adaptations in the wild. Based on that study, the authors recommended that live animal shows emphasize natural behaviors with a central message focused on conservation action in order to deliver the best educational outcomes. Miller et al. (2013) found that visitor encounters with dolphins elicited significantly higher knowledge, attitudes, and behavioral intentions than non-encounter participants, and demonstrated that these gains were retained over 3 months. Although a relatively robust empirical study, Miller et al. (2013) acknowledge a potential confounding factor was that visitors involved in animal encounters spent significantly longer talking to an expert than individuals in the non-encounter groups and noted that it may be the presence of an educator rather than the animal itself that led to increases in learning outcomes.

Educator presence has been shown to be an important positive factor in learning in several studies and can lead to greater knowledge gains compared to when an individual explores alone. The Z/A environment itself may have an additional impact on learning by creating a novelty effect (Boeve-de Pauw et al., 2019). Wűnschmann and colleagues (2017) compared children's learning about reptiles while they were in school with children who learned in a Z/A. Despite similar baseline knowledge across groups and the same educator delivering sessions, the Z/A group scored higher post-experience. This finding was supported by Farmerie's (2018) doctoral thesis, which found similar advances in knowledge in Z/A animal encounter groups compared to a control. However, like Miller et al. (2013), the greater exposure time of the encounter group to expert knowledge may have had an important role that was not measured in the study.

A systematic review of the impacts of animal ambassador encounters revealed only eight peer-reviewed studies focused on educational impacts between 1995 and 2020, with a further eight studies found in conference proceedings and unpublished thesis (Spooner et al., 2021b). Of the published studies, only two tested knowledge change using repeated measures testing (Wűnschmann et al., 2017, Miller et al., 2013). The other studies used interviews (Kisiel et al., 2012), ethnographies (Lloro-Bidart, 2014), reported knowledge (Cater, 2010; Ogle, 2016), and visitor conversations (Kisiel et al., 2012; Kopczak et al., 2015). While these other methods have value in providing a deeper contextual knowledge, without comparative data before and after an intervention, it is difficult to attribute outcomes specifically to the venue effort, or the role of prior knowledge and group knowledge that emerged based on the stimulus. For example, conversational data can be analyzed in different ways, to reveal what appear to be contrasting outcomes. Kisiel et al. (2012) found that touch pool exhibits developed basic scientific reasoning, while Kopczak et al. (2015) analyzed the same data and revealed that more complex ecological conversations occurred infrequently.

Measuring Learning

Despite the focus of the Z/A conservation education mission and a primary focus on behavior change, very few studies take a theoretical approach to their evaluation. Learning occurs at different levels, and it is crucial that what is being taught matches what is being measured (Crowe et al., 2008). Applying learning theory approaches could help practitioners and researchers to be more reflective, as well as focus objectives and measures around the central Z/A mission (Matiasek & Luebke, 2014).

Using a learning taxonomy can successfully highlight weaknesses in educational provision. A learning taxonomy is an outline of steps or levels that the learner passes through as they develop their understanding. Generally, these steps progress in order of complexity and can be considered on a single plane, such as developing cognitive understanding, or form a broad understanding where various aspects of emotional, cognitive, and behavioral understanding are evaluated. There are many examples of learning taxonomies each with their own focus, and grounded in different learning theories, however, all provide a basis for evaluating learning against.

Patrick's (2014) study examined the level of questioning engaged in during Z/A visits. She found that 60% of visitor-visitor questions were at the lowest level of learning (recall of information). Visitors rarely engaged in deeper concepts such as applying conservation actions to their lives. This finding supported that of Clayton et al. (2009), who found that over 50% of visitor statements were purely descriptive (n = 3117). Awareness of the level of provision allows targeted improvements, for example, by promoting more complex questioning which encourages debate instead of recall.

Many theories highlight the importance of sociocultural influences on learning and behavior (e.g., Hines et al., 1986; Hungerford & Volk, 1990; Oreg & Katz-Gerro, 2006; Vygotsky, 1978) and can serve as a valuable factor if they are included in an evaluation. WAZA's Social Change for Conservation Strategy (Thomas, 2020) acknowledges the need to recognize sociocultural influences and initiate community capacity building. That recognition, therefore, suggests that effective evaluation seeks to describe impacts in the context of the local sociocultural context. The focus should be on behavioral actions that are locally achievable and within the capacities of the visitors.

Z/A's ultimate mission of achieving pro-conservation social change and behavior change cannot be achieved through knowledge increase alone (Hines et al., 1986; Hungerford & Volk, 1990). To address this challenge, there is a growing movement within Z/As to adopt a conservation psychology-based approach and to use methodological approaches from social and health sciences (see Kubarek et al., this volume). To meet this call to action, Z/As can target and measure behavioral change and other key indicator outcomes in addition to knowledge and understanding (Pearson et al., 2014; Smith et al., 2012), ideally placing emphasis on actions that can contribute to wider social change.

Godinez and Fernandez (2019) found that a majority of the studies they reviewed had assessed visitors' knowledge of conservation action rather than measuring

actual behavior. They noted that those that did explicitly measure behavior change demonstrated success in raising visitor awareness of practical conservation issues and solutions (Esson & Moss, 2014; Pearson et al., 2014; Smith et al., 2012). However, tracking behavior changes beyond the Z/A gates, for example, by following up a repeated measures survey administered before and after a Z/A visit are still rare (cf., Jensen et al., 2017). One example, The Penguin Promises Campaign (Mann et al., 2017) tracked visitor behavior through pledge postcards where visitors were contacted a year after their initial pledge to assess whether an action had been undertaken. Although a significant step toward measuring behavioral impact, follow-up studies that employ self-report measures remain prone to response bias, most notably social desirability bias. More recently, Kelly and Skibkins (2020) modified and applied the Integrated Model for Behavior Change to measure onsite and offsite behavioral actions as a result of visiting the Tiger Trek exhibit at Taronga Zoo. That study included a large sample of independent (unmatched) pre-surveys of visitors' general pro-environmental behaviors followed by post-surveys immediately, 6 weeks, and 6-month post-visit. By applying a behavioral theory approach to the research, the authors were able to identify potential barriers to conservation engagement. The study also highlighted how misconceptions about conservation issues can be difficult to change, especially as conservation decisions are rarely straightforward.

Understanding visitor attitudes toward conservation is critical for impacting behavior. Comparing attitudinal responses before and after an event can indicate the emotional impact of such an activity. In one recent publication preceding this chapter, Whitehouse-Tedd et al. (2020) developed and validated a new psychometric scale that could effectively assess wildlife interaction research to determine attitudes and tolerance toward wildlife (Whitehouse-Tedd et al., 2020), in addition to those presented elsewhere in this publication (see Lerner et al., this volume).

The Progression of Educational Impact Evaluation Research

Z/A audience research has come a long way and is still making great progress (Fig. 6.1). In the 1980s and 1990s, Z/A audience research focused on small-scale Z/A-led studies. These provided information for the Z/As themselves but often remained unpublished. Many of these studies also suffered from methodological weaknesses, failing to offer robust scientific evidence. This context led to the United Kingdom's Royal Society for the Protection of Cruelty to Animals (RSPCA) producing an animal welfare report (RSPCA, 2011), which criticized Z/As for lacking peer-reviewed evidence to support their expansive educational claims about the benefits of seeing live animals. Meanwhile, the launch of the UN Convention on Biodiversity Aichi targets offered a clear connection between the Z/A mission and the wider global need to engage the public with biodiversity (CBD, 2011). Since 2011, Z/A research has increased its focus on conservation and biodiversity and is using a more robust methodology to evidence impact (Moss et al., 2015, 2017a, b).

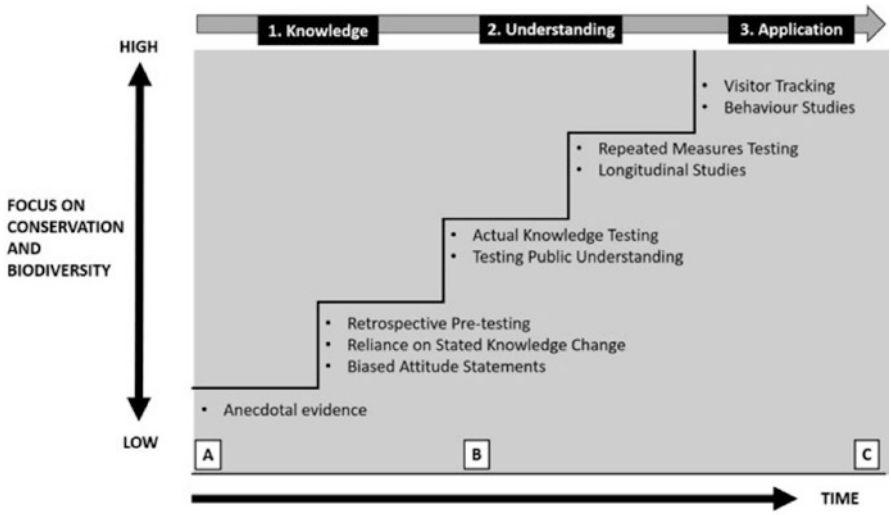

Fig. 6.1 Zoo and aquarium research staircase and shifting focus over time. (**a**) 1981 Zoo Licence Act. (**b**) Aichi biodiversity targets established (2011), RSPCA 'the welfare state 2005-9' published (2011). (**c**) 2020 target date for Aichi biodiversity targets to be achieved

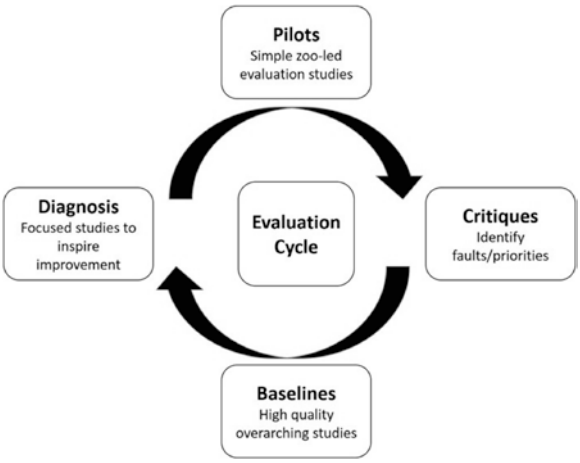

Fig. 6.2 Modes of the educational impact evaluation cycle for the Z/A field: Each step in the cycle feeds into the next step with the goal of continual improvement. Note: 'zoo' in this figure refers to zoological institutions, including both zoos and aquariums

Studies are also moving from testing audience knowledge to measuring behavioral intentions and reported actions, although intent itself cannot guarantee action (Hines et al., 1986).

Z/A research and evaluation practice continue to grow and professionalize, with each era building on the prior findings. At the time of writing, the work has evolved from isolated institutional commissions that focus on local impact to more robust comparative data from multiple institutions that can address the shortfalls of an isolated, small-scale study (Fig. 6.2). These efforts not only are consistent with the

professionalization of the field but also may have been an effort to respond to the critiques that questioned the foundational research or methods used to substantiate the impact claims of Z/As (e.g., RSPCA, 2011; Marino et al., 2010; Roe et al., 2014). In Europe and the United Kingdom, a series of baseline studies were created using large-scale studies, avoiding issues highlighted in the critiques and providing overviews of impact (Moss et al., 2015, 2017a, b; Jensen et al., 2017). That foundational work is now being followed by a new wave of single-site continuous data gathering and analysis that builds on the baseline data and contributes to a more informed and robust shared dataset. At the time of writing, the focus of research is moving higher up the ladders of learning taxonomies, examining behavioral changes and conservation actions. However, to ensure the value of these studies as evidence of impact, advanced training in research skills is required alongside standardized, methodologically robust methods to enable multi-site comparisons and analytical support.

Research Paradigms

This chapter has primarily focused on the use of the quantitative methodology for the purpose of building an understanding of the broad strategies for understanding representative and comparative impact on general populations. It is not intended to discount the utility of qualitative research for understanding the cultural complexity of an issue in a local context, the needs of cultural groups, or the value of a mixed-methods paradigm for triangulating outcomes in a sociocultural or socio/ecological setting. Rather, this chapter offers our perspective on the value of large-scale quantitative empirical research and the findings that have flowed from that investment. We acknowledge that it is impossible to create the perfect study which addresses every bias and captures all aspects of research questions in the real world (e.g., see Jensen & Laurie, 2016; Kennedy et al., 2021).

Conclusion

The existing peer-reviewed literature makes clear that Z/As play an important role in educating visitors about biodiversity and conservation. Reports of educational successes appear throughout the research literature, but rarely employ large-scale quasi-experimental designs or randomized controlled trials. Reliance on retrospective pre-testing, self-reported learning, and the risk of biased instrument design, sampling, or data collection approaches can limit what can be claimed (Khalil & Ardoin, 2011; Godinez & Fernandez, 2019; Matiasek & Luebke, 2014; Roe et al., 2014; Spooner et al., 2021b; Wagoner & Jensen, 2014). We offered one example of a series of international studies that provided robust overarching evidence of Z/As contributing to the United Nations Aichi Biodiversity Target 1, raising public

awareness of biodiversity and conservation actions. Z/A evaluation studies have increased in sophistication over time, and study quality continues to improve as institutions invest in research upskilling. The trajectory is positive, but further attention is needed to ensure that small-scale institutional evaluations that serve local needs also continue to add to larger datasets so the combined data can be analyzed and published in the scientific literature. This commitment to shared outcomes can improve the quality of the evidence feeding Z/A decision-making, and build the quality and diversity of an overall body of knowledge for best practices in Z/A education. We believe that increasing standardization and availability of validated evaluation instruments and datasets will help organizations that lack resources find the opportunity to contribute to collective knowledge bases.

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Chapter 7
Zoo and Aquarium Visitors' Wildlife Values and Ethics Orientations

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Carol D. Saunders died before publication of this work was completed.

Introduction

At the turn of the millennium, a consortium of US zoos and aquariums collaborated with the Association of Zoos and Aquariums to start a series of studies to better describe the value ascribed to their parks; to understand how prior knowledge, attitudes, and visiting behaviors could be attributed to conservation learning outcomes (see Dierking et al., 2002; Falk et al., 2009), and how the perceptions of these institutions afforded them legitimacy to advocate for a conservation ethic in their communities (see Fraser & Sickler, 2009). These studies, collectively known as AZA's Why Zoos and Aquariums Matter (WZAM) program, eventually led to the first association-wide social science research agenda (Fraser et al., 2010; Kubarek et al., this volume).

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The professional discourse, however, remains an open discussion on how different types of activities might lead to more conservation behavior change by their visitors (Clayton et al., 2017; Fraser & Wharton, 2007; Fraser & Switzer, 2020; Grajal et al., 2017; Moss et al., 2015; Sattler & Bogner, 2017; Smith et al., 2008). Furthermore, none of these studies identified whether there were unique psychographic characteristics of zoo and aquarium visitors (henceforth "zoo visitors") that might suggest a predisposition for some types of social action over others.

Unique discourses related to environmental protection have been broadly grouped and categorized as coherent belief systems and social narratives by Dryzek (1997, 2013) and those who have built on his work (ie: Carter, 2018; Doyle et al., 2016). One such study investigated whether belief in the intrinsic value of environmental entities is necessary for support for conservation policy (Meyers, 2002). By the turn of the millennium, coincident with the rise of AZA's WZAM program, the question was also on the minds of wildlife management agencies. It had become commonly known that how people develop or express concern for animal and nature rights tends to be linked to their predisposition to be willing to protect those environmental entities (Herzog & Galvin, 1997; Jamieson, 2006). With a desire to help wildlife management agencies understand how these predispositions could apply to various policy initiatives, a series of studies coordinated at Colorado State University developed a scale for measuring wildlife value orientations (WVO) as a way of characterizing how residents in the western United States might express concern for types of environmental management strategies (see Manfredo et al., 2009, 2018; Manfredo, 2008; Teel et al., 2005; Teel & Manfredo, 2009). The predictive tool became a useful comparative tool for easily gathering a simple characterization of the diversity of values people hold toward wildlife, their support for the policy, and the interactions between human behaviors and the conditions impacting wildlife's futures. WVO measures represent a foundation to better understand more specific cognitions, attitudes, and behaviors and how we might anticipate people will react to a host of wildlife-related topics. Manfredo, Teel, and their many colleagues over the years have undertaken various examinations of how these orientations are changing at a societal level and suggested possible implications for wildlife policy planning.

WVOs are measured by classifying people into four groups based on mean scores on both domination and mutualism scales. *Utilitarians* score high on the domination scale and low on the mutualism scale, prioritizing human mastery of wildlife for human well-being over wildlife protection, and tend to regard hunting as a positive humane endeavor. *Mutualists*, those scoring high on mutualism and low on domination, are more likely to have an egalitarian ideology that views wildlife as part of an extended family, capable of living in relationships of trust with humans and deserving of rights. *Pluralists,* with the name coming out of Tetlock's (1986) Value Pluralism Model, are more likely to endorse values that change based on the specific context. The fourth category, labeled *Distanced,* tends not to support either a mutualist or domination orientation and lacks a well-formed orientation or concern for wildlife-related issues (Manfredo, 2008; Teel et al., 2005; Teel & Manfredo, 2009).

At the time of this writing, the refined WVO tool has been translated into many languages, deployed internationally, and found to be demonstrably useful for predicting policy support in a variety of contexts.

In this report, we draw on three studies, two conducted in the mid-2000s and a third conducted in 2019. The first two were initial explorations of the issue of the wildlife values of zoo visitors that produced convergent results, and the latter was a follow-up study more than a decade later which demonstrates the consistency in the data as wildlife values continue to evolve. We note that the methods and questions in the first study use different constructs than in studies 2 and 3 and that study 3 uses an updated and refined survey tool. For ease of reading, we report the methods and findings for each of the three unique studies, followed by a discussion of all of these studies to understand what has been learned and the implications for practice.

The Present Studies

The origins of this study began in the mid-2000s and coincide with the early research into understanding competing values related to wildlife conservation. During the early development phases of WVO, an author of this chapter was exploring how local zoo visitors might be psychographically distinct from non-visitors in their service community. At this time, two important conceptual questions were emerging. The first included the proliferation of questions regarding distinct wildlife values and the role of environmental identity in predicting support for policies at that time. The second was the emerging question within the zoo field of whether a spate of new anti-zoo animal rights publications suggested that understanding zoo visitors' wildlife values might be valuable for understanding the legitimacy of zoos in order to shift public attitudes through their education programs for visitors. After the completion of two exploratory studies, 10 years passed before an opportunity arose to undertake a nationally representative study to investigate the generalizability of the early findings. We report all three studies here for the first time.

In all three studies, we sought to identify the degree to which zoo visitors have concern for animal rights, support environmental policy, and the likelihood that they might share the conservation concerns of these institutions more than those in the broader populace. Following a 12-year gap after the first two studies, the third nationally representative study offered the opportunity to explore a more fully rounded picture of how WVO might reveal distinct psychographic variations between zoo visitors and others in their community (see Table 7.1).

Study 1: In 2004, we applied a new measure (Meyers, 2002) for characterizing wildlife and environmental values for visitors at two urban zoos, comparing the results to those of the study population used to develop the scale.

Study 2: In 2007, we conducted a second comparative study for a single large metropolitan area using the WVO instrument in collaboration with the team who developed the original scale.

Table 7.1 Participants and settings for the studies

	Sample size	Locations sampled	Year conducted	Recruitment method	Instrument used	Survey format
Study 1	296 251	Brookfield Zoo (Chicago) Bronx Zoo (New York City)	2004	In-person solicitation by zoo docents	Meyers (2002)	Paper
Study 2	2947	New York City demographic marketing area	2007	Email	Manfredo (2008)	Online consumer panel
Study 3	358	47 Zoos and Aquariums	2019	In-person survey on-site	Manfredo et al. (2018)	Tablet data entry or paper

Study 3: In 2019, we deployed a nationwide in-person intercept study of zoo visitors using the updated 2018 WVO instrument (Manfredo et al., 2018) and were able to compare data with national results reported by the scale developers.

These three sequential quantitative studies test whether (1) zoo visitors are more likely than the broader U.S. populace to afford rights, consideration, and care to individual species and groups of species; (2) zoo visitors have a higher proportion of the WVO category of mutualists than respondents to the survey living in their same community; (3) frequency of zoo visiting correlates with a more mutualist orientation on the WVO scale; and (4) our preliminary regional findings are stable over time and applicable on a national scale. We present the methods and findings for each consecutive study in sequence for clarity.

Study 1 Are Zoo Visitors Motivated by Moral Concerns to Protect Animals and Environmental Entities?

Methods (Study 1)

The study was conducted simultaneously in August 2004 at the Brookfield Zoo in suburban Chicago and the Bronx Zoo in New York City. A total of 547 adults were intercepted using a random start with a sequential ask (every third adult) and asked to complete a written survey by zoo docents trained to administer surveys. The demographic distribution of male/female and member/nonmember indicated that survey participants were generally representative of the typical visitor attendance at both parks (Supplemental Table S1). No other data to assess the representativeness of this convenience sample was collected.

Meyers (2002) created and validated an instrument for measuring comparative environmental ethics that can distinguish ethical beliefs along 12 psychometric and inter-related scales that were predictive of willingness to support conservation policy. The instrument offered a number of opportunities for exploring the nuance in

belief in intrinsic value because the initial validity studies demonstrated that nearly 95% of those sampled supported stronger conservation policies but varied greatly in their beliefs in different types of intrinsic value. For this study, the instrument was used to characterize beliefs concerning a range of animal types like *lions and tigers*, and a set of natural systems descriptors such as *rocks, soil, and water in streams* (e.g., riparian areas), units commonly targeted for environmental protection. We modified the word *wildness* to read *wilderness* to avoid confusion with the zoo animals at the survey site. Our survey sought to directly determine whether zoo visitors were motivated by their moral concerns for just the animals they might encounter at a zoo or if the results were more generally ascribed to all natural systems. The Meyers scale operationalized this issue with two separate scales, one focused on the group level and the other, directly asking about individual species. Two versions of the instrument were deployed, with questions sequenced in a different order, and analyzed to confirm there was no sequence effect (F tests for difference, $p < 0.001$).

Beliefs were measured using a seven-point Likert-type scale (1 = "strongly disagree" to 7 = "strongly agree"; see Tables S2 and S3). Ethical orientation scores were computed in a two-stage process. The first stage grouped questions into a basic belief dimension, tested for internal consistency using Cronbach's alpha test, and then assigned a basic belief dimension score based on the mean of all items within that dimension. The second stage explored reliability scales across the basic belief dimensions about wildlife, wildlife management, and environmental systems (Table S3).

After completing these within-subjects assessments for the zoo participants, we then compared the results from the two different zoos, to the responses of the 181 participants used to develop the scale from Meyers (2002). The Meyers study population consisted of undergraduate students in general education classes, housekeeping/service staff at The Ohio State University, and attendees at the North American Association for Environmental Education's 2001 Annual Conference in Arkansas.

Results (Study 1)

Zoo visitors at the Bronx and Brookfield zoos reported strong beliefs that animals and the environment have the capacity to mentally suffer (mean 5.5, Tables S2 and S3), animals and the environment are of use to humans (mean 6.3), and they care that animals and the environment exist (mean 6.6). The element of caring had the highest mean score of all scales, while scores on willingness to consider individuals or groups of animals and the environment were neutral (pop. mean 4.0 and 4.2, respectively). Not surprisingly, respondents agreed that it is morally acceptable to keep animals in zoos (mean 6.2), that laws should exist to protect individual animals or groups (mean 6.5), and reported the lowest values for the dimension of consideration of animals and environmental entities in their own lives (mean 4.0 individual animals/environment, mean 4.2 groups of animals/environmental settings mean).

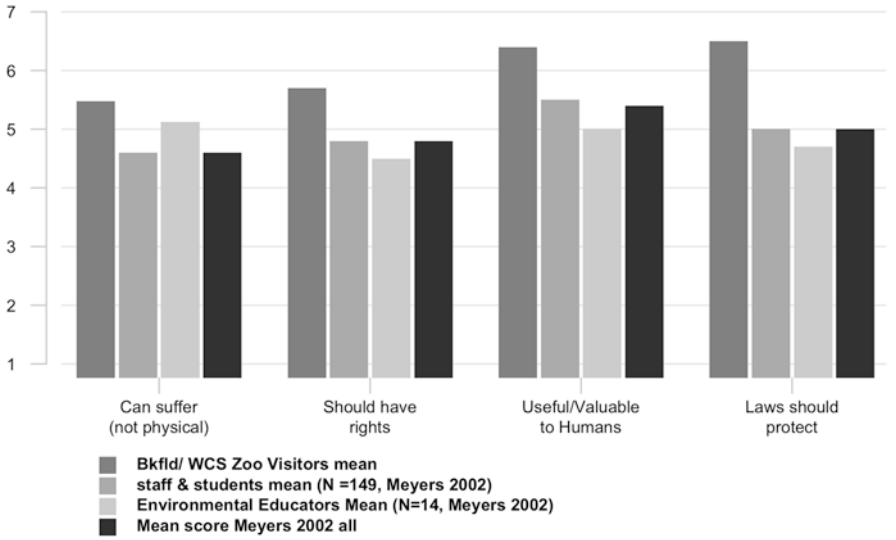

Fig. 7.1 Comparison of ethical belief dimensions for zoo-goers in Study 1 with Meyers (2002). ANOVA tests of Meyers (2002) subpopulations of environmental educators and university staff/students were found to not be significantly different ($p < 0.01$). Individual samples t-test (2-way) between combined zoo populations and the combined Meyers group show populations were different ($p < 0.001$) for the summary statements shown above (see supplementary data for results of three other items assessed in this study)

Individual samples t-test (2 way) between combined zoo respondents and Meyers (2002) respondents were different ($p < 0.001$) with the exception of rights for birds, reptiles, and amphibians ($p > 0.05$) (see Fig. 7.1). Thus, Bronx and Brookfield Zoo visitors were more likely than college students, employees, *and* environmental educators to believe in the capacities of animals and the environment to perceive physical and mental suffering, with one exception: environmental educators rated trees and plants more highly than zoo visitors (mean 5.3 vs. 4.8). Bronx and Brookfield Zoo visitors were also more likely to afford rights to groups of species (mean 5.7 vs 4.5) than the other sampled populations.

Study 2

Methods (Study 2)

Study 2 employed an early version of the WVO scale (later published as Manfredo 2008 and revised in Manfredo et al. 2018) to explore whether there were proportional differences in the value types of residents in the New York City metro region and the subset of that community that visits its zoos. We added an additional variable of *frequency* of zoo visitation to see if that dimension further increased the presence of any value orientation group.

Participants were recruited from the New York Demographic Marketing Area (DMA) by email as part of an online consumer panel (n = 2947) and in-park paper surveys of DMA residents at the five zoos and aquariums (n = 423) for a total sample of (N = 3280). Both the online and intercept surveys asked about zoo visitation. The zoo visitation frequency variable was then collapsed in a manner consistent with other research (Holzer et al., 1998), grouping three higher visitation categories of visitors as *frequent visitors* more than twice/year, *occasional visitors* as once per year or less than once per year, and *infrequent visitors* as having not visited a zoo in more than 5 years, since childhood, or never.

The demographic information provided by respondents demonstrated that the participants were ethnically representative of the broader population and visitors' responses closely matched the zoo's demographic data.

WVO categorization is determined through a two-stage process. Basic belief dimension scales were coded on a continuous level based on responses to a series of Likert-type seven-point scales (strongly disagree to strongly agree), with items grouped together according to the reliability analysis (Table S2). After computing the mean of items within each belief dimension, respondents were given an overall score for each "belief dimension." Next, an overall value orientation score (e.g., mutualism, domination, pluralism, or distanced) was assigned based on the mean of corresponding "belief dimension" scores (Manfredo et al., 2018).

A crosstabs analysis used a χ^2 test statistic to determine statistical significance and a Cramer's V to determine the effect size (Vaske, 2008). A series of ANOVA analyses were conducted, treating zoo visitation frequency as the independent variable and scoring on basic belief dimension scales as the dependent variable in order to test the hypotheses and advance an explanation for differences in WVO scale scores based on zoo visitation frequency. The means were compared for infrequent, occasional, and frequent zoo visitors with regard to domination scale items of appropriate use and hunting, mutualism scale items of social affiliation and caring beliefs, basic belief scales of concern and safety, and environmentalism. F-values are reported to indicate statistical significance at the $p < .05$ level, and eta is reported to indicate effect size (Table S5).

Results (Study 2)

Reliability results for the value orientation scales indicated high internal consistency of item clusters (Table S4). Consistent with other research (e.g., Manfredo et al., 2018), findings revealed the four expected value orientation types both between zoo visitors and the general population ($\chi^2 = 45.46$, $p < .001$, Table 7.2) and increased visitation frequency in respondents being more likely to report mutualistic values followed by pluralistic. The effect size was minimal (Cramer's V = .09, Table 7.2).

Results from a one-way ANOVA analysis did not support the hypothesis that frequent zoo visitors are more likely to score lowest on the domination scales,

Table 7.2 Study 2 percent of individuals included in four wildlife value orientation categories by frequencies of zoo visitation compared to a general population survey of the New York City metropolitan area (NYC Metro) and the New York demographic area (NY DMA)[a, b]

Wildlife value orientation	Zoo visitation frequency			NY DMA	NYC Metro
	Infrequent visitors	Occasional visitors	Frequent visitors		
Mutualist	36.1	40.2	46.3	38	42
Pluralist	15.2	18.0	22.5	20	15
Distanced	25.4	21.1	15.6	19	24
Utilitarian	23.3	20.6	15.6	23	19

[a]Likelihood ratios are reported in this table
[b]$\chi^2 = 45.46$, $p < .001$, Cramer's $V = 0.09$

followed by occasional visitors and infrequent visitors (Table S5). Mean WVO scores for different visitation frequencies also did not differ significantly at the $p < .05$ level for appropriate use ($F = 0.22$) or hunting ($F = 0.84$).

The hypothesis that frequent zoo visitors are more likely to score highest on the mutualism WVO scale for caring followed by occasional visitors and infrequent visitors (Table 7.2) was supported ($p < .05$, $F = 15.96$). Mean WVO scores for the social affiliation scale, however, only differed significantly between infrequent or occasional visitors vs frequent visitors ($p < .05$, $F = 20.70$, Table S5). Effect sizes were minimal for social affiliation beliefs (eta = 0.12) and even lower for caring (eta = 0.07).

Infrequent and occasional visitors did not differ from the general public on mean environmentalism scale scores (Table S5), but frequent visitors did differ significantly between these two groups ($p < .05$, $F = 18.41$).

Synthesizing Results from Studies 1 and 2

Results from both studies 1 and 2 cannot be considered representative of larger cultural trends since the first exploratory study used an opportunistic intercept sample at two conservation-oriented zoos, and the second focused only on the New York City area, regions expected to skew toward a high proportion of mutualists.

Study 3

Methods (Study 3)

The survey employed in this study was an updated version of the Study 2 WVO scale (Manfredo et al., 2018), which eliminated seven questions addressing attraction, concern for safety, and environmentalism. The updated WVO scale added

three criterion items (not asked in study 2) that query the attributions people make about wildlife (Waytz et al., 2010) to measure the extent of anthropomorphic tendencies. We did not collect demographic information about participants. WVO types (i.e., mutualist, pluralist, traditionalist, and distanced) were calculated as described in study 2 above, following the same procedures.

In 2019, participants were recruited during the high visitation season by 47 zoos and aquariums participating as data collection sites for the WZAM studies. Participants completed either a self-complete tablet or paper version of the survey. The 47 zoos and aquariums were considered representative of the AZA membership, varying by size, location, and type of institution. A total of 330 of the 358 participants completed at least 80% of the survey, sufficient to be included in these analyses.

A discriminant function analysis (DFA) tested if the three new criterion items are reliable predictors of WVO type. The percent of responses that agreed with each criterion statement was summed for comparison with other datasets.

The location of the zoo/aquarium where data was collected was used to evaluate differences among the four US geographic regions represented in the dataset. For each of the four regions and the overall combined totals, we tested the proportion of each WVO type against those observed by Manfredo et al. (2018) for the US population using the Exact Binomial Test.

We conducted a bootstrap analysis of calculations of reliability (using Cronbach's α statistic) to determine whether the data collection in study 3 yielded reliabilities on the WVO subscales and found these data to approximate those observed in Manfredo et al.' (2017) study (Table S6).

Results (Study 3)

Zoo visitors surveyed in this nationwide sample in 2019 (i.e., study 3) were more likely to report mutualistic values, followed by pluralistic views, than were reported in study 2 or in the nationwide total population (Manfredo et al., 2018, Fig. 7.2). The combined proportion of mutualists and pluralists was highest for zoo visitors (85%), followed by frequent zoo visitors (69%, study 2), which far outpaced the value for the US populace as measured in 2016–2018 (56%, in Manfredo et al., 2018).

For zoos and aquariums in the Northeast and West, the proportion of mutualists were significantly higher (63% in both cases; $p <= 0.05$) than found in the general US populace (35%, Manfredo et al., 2018), while in the Midwest and South, the proportion of mutualists were not significantly higher (45% and 40%, respectively). The proportions of Pluralist visitors in the Midwest and South were significantly higher (42% and 36%, respectively) than in the overall US populace (21%).

Aggregate data, however, does not represent the wide regional variation in priorities and values that impact policy across the USA. We partitioned the data into nine subregions within the United States and a separate subregion representing both Mexico and Canada because of small sample sizes (see Fig. 7.3). The smaller

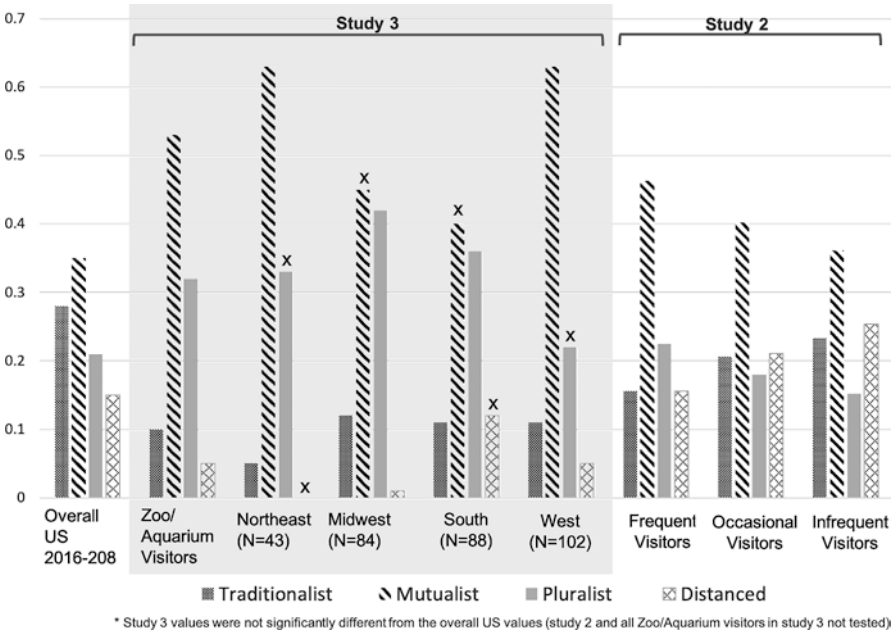

Fig. 7.2 Wildlife value orientations for zoo/aquarium visitors compared to the US population measured by Manfredo et al. (2018). Note: Xs signify Study 3 values that were not significantly different from the overall US values reported by Manfredo et al. using the Exact Binomial Test

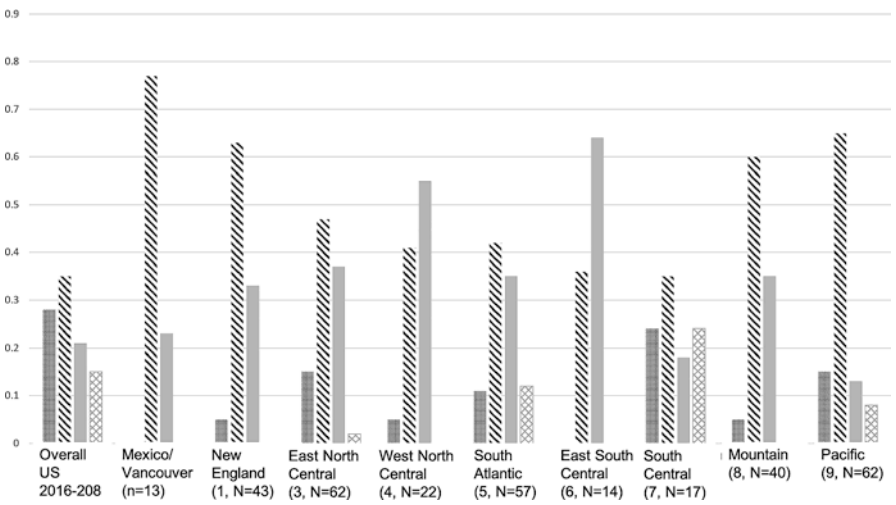

Fig. 7.3 Wildlife value orientations for zoo/aquarium visitors by subregion compared to the US population measured by Manfredo et al. (2018). Due to small sample sizes, significance values were not calculated

sample sizes per category preclude drawing strong conclusions from this analysis but suggest that the WVO measure is proportional to the public data from those regions, with zoo visitors trending toward higher numbers of mutualists and pluralists, accompanied by a lower frequency of distanced and traditionalists. Because the proportion of mutualists versus pluralists varies at the subregional level, these data confirm that regional and subregional data are more useful for institutional action.

Discriminant function analysis (DFA) showed that all three criterion items are reliable predictors of WVO type (Table S7). The average ratings are shown graphically in Fig. 7.4, and the distinct shapes of the responses are shown in Fig. S1. For the most part, the shapes differentiate mutualists and pluralists from traditionalists and the distanced WVO type, with only subtle differences between traditionalists and the distanced WVO type. Differences between mutualists and pluralists are not visible, and both of these types more frequently responded affirmatively to the criterion item questions, as was seen in Manfredo et al. (2018). These subtleties explain why the DFA model returned a poor classification error rate of 45% (where ≤20% is "good").

Findings noted one distinct variation across these data from the national WVO data, indicating that zoo visitors are more likely to believe that animals are emotionally sentient and intentional than the general population, irrespective of their overall WVO categorization (Table 7.3 and Fig. 7.4). This finding is particularly important for zoo professionals because it suggests a unique characteristic of zoo visitor values.

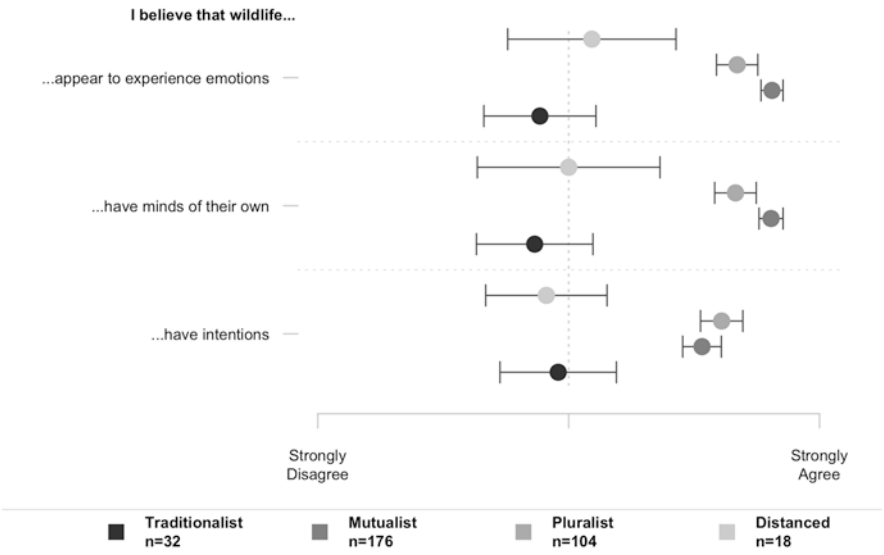

Fig. 7.4 Mean ratings of wildlife attributions by WVO type (whiskers illustrating 95% CI) measured on a seven-point rating scale (strongly disagree = 1 and strongly agree = 7.0)

Table 7.3 Responses to criterion attribution items from Study 3 and Manfredo et al. (2018)

Questions	Agree (strongly to slightly)	
	Study 3 (N = 329)	Manfredo et al. (2018)
I believe that wildlife have intentions (n = 326)	72.1%	53.5%
I believe that wildlife have minds of their own (n = 329)	83.3%	68.3%
I believe that wildlife appear to experience emotions (n = 329)	83.9%	65.0%

Discussion

These studies consistently demonstrated that zoo and aquarium visitors represent a psychographically distinct subpopulation in their community. Visitors are more likely to have a higher degree of caring for the environment and wildlife and to be more likely to view wildlife and wilderness as part of an extended family that has the capacity to suffer and deserves legal rights for protection irrespective of the benefits those protections afford to people. While visitors believe in the moral acceptability of keeping animals and environmental entities in zoos, they also believe that animals have the capacity to suffer both mentally and physically. These data confirm the results related to how the public assesses trust and a zoo's ethics of care (See Gupta et al., 2020; Gupta et al., Chap. 5, this publication).

The proportions of mutualists and pluralists are known to vary by region and are increasing in the general population over time (Manfredo et al., 2018). We note that these two WVO types remain significantly overrepresented in zoo visitors in both of our studies, a result demonstrated by region as well (although *which* type is overrepresented varies by region in our data from study 3). However, these data and the data from Study 1 indicate that zoo visitors are more likely to believe in animal sentience or belief in animal mind (BAM), an area of research that describes how these beliefs are implicated in expectations for the care of animals under the control of people (Higgs et al., 2020; Knight et al., 2004, 2009; Morris et al., 2012) and how anthropomorphic assignment of animal cognition can be useful or misconstrued (Mitchell et al., 1997). The implication of these data is that zoo professionals can leverage these concerns as distinct values held by their visitors that can support concerns for the protection of endangered species on empathetic grounds but should also take care with how they report their own care for the physical and emotional needs of the animals at the zoo or aquarium. These data are consistent with numerous other studies on trust (ie: Dwyer et al., 2020; Rank et al., 2018).

In reporting these values, the high rate of belief in animal mind was consistent between those reporting frequent and infrequent attendance, despite their demographic similarity and social concerns on other topics that they share with non-visitors. Zoo visitors also describe a greater interest in environmental protection than is witnessed in other members of the public. These data would seem to suggest that zoo and aquarium audiences are more likely to share the conservation values

that these institutions seek to promote. This alignment suggests three ways to leverage these values to increase conservation outcomes. Visitors appear more likely to be willing to advocate as partners with the zoo rather than needing to experience a change in beliefs during their visit. Visitors may need encouragement or nudges to increase the likelihood that they will support public policies that benefit wildlife because they may not realize that others in their community do not share the same wildlife values orientation as they do. And visitors are likely to already accept the conservation of nature and may welcome reinforcement that they are the advocates for change, rather than using general public data regarding environmental compliance as a baseline that they are likely to outperform. More simply, zoos and aquariums need to ensure they are not preaching to the choir and instead focus on activating the choir to pursue public advocacy.

Each study demonstrated that zoos and aquariums draw a psychographically distinct audience that is more likely to support policies and behaviors that lead to wildlife conservation for its intrinsic rather than utilitarian value. Conservation communications that focus on wildlife services or direct value to people may not be as readily accepted by the majority of visitors, while messages that speak to protecting whole ecosystems or relationships between species will resonate well with zoo visitors.

Conclusions

Visitors arrive at zoos or aquariums with wildlife value orientations that align with the conservation goals of these institutions but are also psychographically more conservation-oriented than others in their community and the nation as a whole. They are receptive to environmental conservation messages, share the ethical beliefs espoused by zoo organizations, and are an audience that are primed to support legislative advocacy that is the explicit goal of the zoo profession. To advance the wildlife and wild places conservation mission, these organizations should place more emphasis on leveraging their visitors as an affinity group by appealing to their shared values and encouraging local and regional public advocacy that may not be as commonly accepted as a message by non-visitors in the community.

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Chapter 8
Believing Zoos and Aquariums as Conservation Informants

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Introduction

Cultural institutions such as museums and libraries, among others, play a fundamental role in lifelong learning. Judging from at least 30 years of US Federal funding commitments (e.g. the Center for Advancement of Informal Science Education at the National Science Foundation), this is especially evident for institutions (science centers, state and national parks, etc.) that address science, technology, engineering, and math (STEM) and STEM-adjacent topics, such as climate change and public health. This chapter focuses on how the US public perceives the role of zoos and aquariums (Z/As) as informants on the conservation of wildlife and wild places.

Z/As first appeared in European capitals in the mid-1800s (cf., Baratay & Hardouin-Fugier, 2002; Kisling, 2001). Like the royal menageries these institutions replaced, Z/As were established to entertain the public and satisfy human curiosity about terrestrial and aquatic wildlife. At the same time, these institutions also served as sites for informal science education, creating and disseminating zoological knowledge. That educational role has expanded in recent decades (Rabb, 2004), during which Z/As have increasingly played a pivotal role in wildlife conservation and in educating the public about the importance of maintaining wildlife and wild places.

While Z/As have chosen to educate the public on conservation topics, it is the public who confers that authority on Z/As to speak on conservation topics (that is,

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epistemic authority; Kruglanski et al., 2005). More than a half-century of research on communication and persuasion argues that the perceived credibility of a message (primarily its perceived accuracy; Tsfati & Walter, 2019) depends on the epistemic authority people ascribe to the messenger (Pilditch et al., 2020). Ascriptions of epistemic authority, in turn, derive from people's judgments about the trustworthiness and likeability of the information source, as well as feelings of affinity toward the information source (Hovland et al., 1953; Kruglanski et al., 2005). Here, we apply these arguments to institutional sources, specifically Z/As as informants on conservation topics. To what extent do people's judgments of Z/As as trustworthy, likeable, and affinitive predict ascriptions of epistemic authority to these institutions on conservation topics? The answer to that question will help educators and administrators at Z/As better understand and cultivate their role in lifelong learning and provide a foundation for examining the epistemic authority of other lifelong learning institutions.

In this chapter, we begin to answer the above question by sketching out the nature of the relevant constructs—trustworthiness, likeability, and affinity—as these apply to Z/As. In each subsection, we recap how we measured these constructs with two surveys administered online to representative samples of the US population (Rank et al., 2018; Dwyer et al., 2020). Hereafter, we will follow the convention set by Dwyer et al. and refer to the data first reported by Rank et al. as Survey 1 and the data first reported by Dwyer et al. as Survey 2. Next, we assemble these measures into a model of epistemic authority and show how it explains the attitudes expressed by these representative samples of the US public. We follow up with a section on the implications of the findings for educators and administrators at Z/As. We conclude the chapter with some thoughts on how other lifelong learning institutions could use this research as a foundation for examining their own epistemic authority.

Trust Toward Zoos and Aquariums

Trust, at its most intuitive level, is the expectation that the people one encounters will behave cooperatively (or at least not uncooperatively). This is the type of trust one requires to "risk" moving through everyday life. At deeper levels of social engagement, when one must "risk" relying on another person or an institution for some personal benefit or common good, trust requires an assessment of trustworthiness (cf. Caldwell & Clapham, 2003). To illustrate, imagine the so-called "trust fall" that one might encounter as a team building exercise.

> *You are standing with your back to another person, who has promised to catch you if you fall backwards. In order to decide whether to take the fall, it would be wise to ask yourself several questions:*
>
> *Do I believe the other person…*
> *…is capable of catching me? (Competence)*
> *…is reliable in keeping promises? (Reliability)*
> *…was sincere in making the promise? (Sincerity)*

…is committed to catching me? (Integrity)
…cares about my well-being? (Benevolence)
If the answer to all these questions is an unequivocal "yes," then fall; otherwise forfeit the game.

Some combination of these five criteria of trustworthiness judgments—competence, reliability, sincerity, integrity, and benevolence—underlies trusting relationships between people, between people and institutions, and, even, between people and robots (for reviews see Malle & Ullman, 2020; Schoorman et al., 2007; Mayer et al., 1995).

Applications of Trustworthiness Judgments to Zoos and Aquariums

As described in Rank et al. (2018; Survey 1), we translated these abstract components of trustworthiness into survey questions that assessed opinions about particular duties of Z/As—as a source of conservation knowledge, as a site for social interaction, and as a provider of animal care. Results from a representative sample of the US population (N = 341 individuals) suggested that survey participants based their responses on the five criteria of trustworthiness judgments and two criteria assessing Z/As as attractions. Statistically speaking, Rank et al. (2018) summarized the correlations between responses to the 102 survey items with seven principal components. A principal component can be understood as a unifying statistical representation of various manifestations of an abstract concept. For example, people judge the benevolence of a Z/A based on multiple impressions of how these institutions treat their animals, their staff, and their visitors. Dwyer et al. (2020; Survey 2) confirmed these criteria (Principal Components) with a larger representative sample of the US population (N = 1329 individuals) and a more focused subset of (44) survey items. Table 8.1 provides examples of survey items that characterized the five criteria of trustworthiness judgments (the full

Table 8.1 Trustworthiness criteria illustrated by characteristic survey items

Criterion	Survey item
Competence	The Z/A has strategies to maximize safety for the animals living there
Reliability	Shares how the Z/A is helping conserve that species in the wild
Sincerity	The Z/A shares information about their animals' welfare/Well-being
Integrity	The Z/A informs the public how to practice energy conservation
Benevolence	The Z/A cares about their animals' welfare/Well-being

text for both Survey 1 and Survey 2 is available for download: https://bit.ly/2EgNLNN).

As described in Dwyer et al. (2020), one can use the individual survey-item weights generated by the Principal Components Analyses to calculate a score for each respondent on each of the components. This process combines and rescales the rating values from correlated groups of the 102 survey items into summary variables (components). The scores on these summary variables have an average value (arithmetic mean) equal to 0 and a standard deviation equal to 1. This allows for easy comparison between summary variables, where the constituent items might be on different rating scales (ratings scales with numeric values from 1 to 7 or 1 to 5). For our analysis of epistemic authority, we use the participant component scores from both prior studies as the variables that represent how much each participant relied on the five criteria of trustworthiness when judging Z/As.

Favorability Toward Zoos and Aquariums

For institutions, one can recast likeability as favorability, a facet of organizational reputation (Lange et al., 2011) that captures positive and negative feelings people have toward an organization (also avoidance-approach, or repulsion-attraction; cf., Posner et al., 2005). As evident from the large number of people who visit Z/As, the U.S. public appears attracted to these leisure venues and informal science-learning facilities (Falk & Dierking, 2000). More to the point, studies over the past several years have documented consistently high favorability toward Z/As (Fraser & Sickler, 2008) with respondents citing the important role these organizations play in conservation and animal care (Falk et al., 2007). Nevertheless media depictions of zoos and aquariums that emphasize the stresses of captivity for certain species (e.g., Mason, 2010; Morgan & Tromborg, 2007) while downplaying ongoing efforts to eliminate or mitigate those stresses (Shapiro, 2018; Swaisgood, 2007) can erode favorability toward these institutions.

For our analysis of epistemic authority, we use the favorability ratings (on a scale from very unfavorable = 1 to very favorable = 7) from the surveys used in both prior studies. Data from Survey 2 includes the full range of favorability ratings, increasing the chances of capturing the opinions of those who might have been exposed to negative portrayals of Z/As. Data from Survey 1 excluded prescreened respondents who reported feeling either very unfavorable or very favorable (respectively, ratings of 1 or 7, on the 7-point scale) toward Z/As. Consequently, the combined data better represents the impressions and opinions of the "moderate majority" and prevents those with strong preconceptions about Z/As from overwhelming our understanding of epistemic authority.

Affinity Toward Zoos and Aquariums

Affinity toward places has been variously described in the environmental psychology literature as place attachment, place meaning, place identity, or place dependence (Nelson et al., 2020). At the core of these various labels are three feelings: feeling attached to the persons with whom one interacts in the place, feeling attracted to the (symbolic) experiences offered by the place, and feeling that the place contributes to one's self-esteem and self-efficacy (Gifford, 2014). These feelings toward places provide people with a sense of security, belonging, continuity, and restoration.

Affinity toward zoos and aquariums was evident in data recently collected by the authors and colleagues from 397 visitors at 53 Z/As across the United States. All visitors reported feeling that their local Z/A was iconic for their area or town, contributing more to the reputation of their locality (with a mean rating of 8.5 on a 10-point scale, from very little = 1 to very much = 10) than the local sports team (with a mean rating of 6.8). Likewise, visitors also reported that their home institution performed better than other Z/As (with the mean scores ranging between 2.6 and 2.8 on a 3-point scale: worse than others = 1, about the same as others = 2, better than others = 3) on seven of the trustworthiness items included in Surveys 1 and 2.

Both Surveys 1 and 2 asked participants to rate the importance of affinity-related reasons (social bonding, esteem, restoration, and security) in choosing to visit a Z/A. For both data sets, a single principal component summarized the correlations between responses to the four survey items, from which we calculated an affinity score for each respondent. We use these affinity scores for the present analysis of the epistemic authority ascribed to Z/As.

The Credibility of Conservation Messages from Zoos and Aquariums

Z/As seek to educate the public on conservation topics. Fulfilling this educational goal hinges on the perceived accuracy of conservation messages coming from Z/As. As found repeatedly in the context of journalism, the perceived accuracy of a message is the ultimate criterion for message credibility (Tsfati & Walter, 2019), yet accuracy judgments depend on the credibility people ascribed to the messenger (e.g., Pennycook & Rand, 2019, on detecting so-called "fake news").

Unreported data from both Surveys 1 and 2 included two sets of message-related ratings. First, respondents rated how much they rely (on a scale from not at all = 1 to a great deal = 5) on Z/As for information on four high-level conservation topics: endangered species, wildlife conservation, animal well-being, and environmental issues. In Survey 2, respondents also rated their reliance on Z/As for information on the high-level topic of science.

Second, respondents rated the accuracy (on a scale from not at all = 1 to completely = 5) of information on those topics from Z/As. A single principal component summarized the correlations between the two sets of ratings (reliance and accuracy) for Z/As, from which we calculated a message credibility score for each respondent. We used these credibility scores as the outcome measure for analyzing how much the epistemic authority ascribed to Z/As contributes to the credibility that people ascribe to their conservation messaging.

The Epistemic Authority of Zoos and Aquariums: An Hypothetical Model

Figure 8.1 above shows how the constructs discussed in the preceding sections come together in a model that represents the ascribed epistemic authority of Z/As as informants on conservation topics. The icons represent the summary measurements of the constructs, and the paths (arrows) represent the hypothetical relationships between those constructs. As shown, trustworthiness is an indirectly measured "latent" variable that combines the directly measured scores for competence, reliability, sincerity, integrity, and benevolence. Reading the hypotheses represented by the model simply involves following the paths from icon to icon. The rectangle

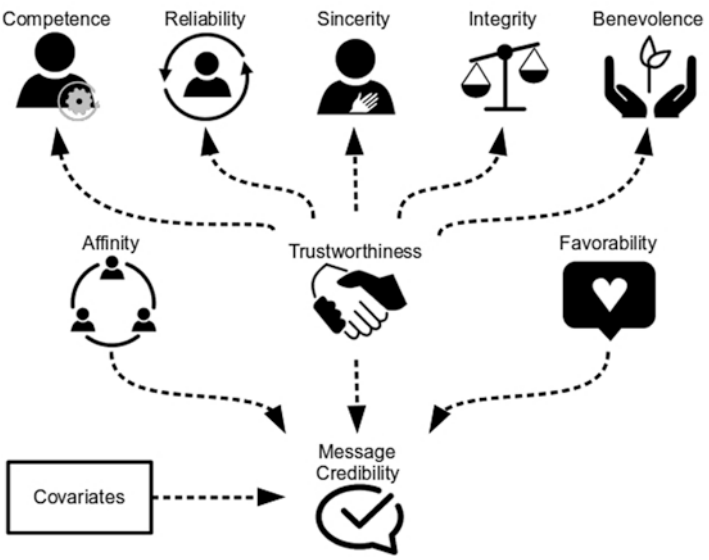

Fig. 8.1 A hypothetical model of how aspects of the ascribed epistemic authority of Z/As contribute to the ascribed credibility of their conservation messages

labeled "covariates" represents variables that are outside the scope of the main hypotheses but that may contribute to ascriptions of message credibility. The covariates include up to four categorical variables: one that summarizes the demographic data for respondents to both surveys (the Participants section, below, enumerates the demographic measures), a second that accounts for the framing of the survey (perceptions of how well Z/As perform their duties versus the importance of those duties), a third that records membership at a Z/A (member versus non-member), and a fourth that assesses the overall interest in the various conservation topics (high versus low; available only for Survey 2).

Method

As described above, the data for our analysis come from two surveys: Survey 1, parts of which were first reported by Rank et al. (2018); and Survey 2, parts of which were first reported by Dwyer et al. (2020). The full text (including theoretical justifications for survey items) and data for both Survey 1 and Survey 2 (including the summary scores used here) are available for download (https://bit.ly/2EgNLNN). Here, we focus on describing data and analyses that are unique to modeling the epistemic authority ascribed to Z/As.

Participants

We fit the model of the epistemic authority that people ascribe to Z/As using data collected from 1627 individuals—341 respondents to Survey 1 and 1286 respondents to Survey 2. The surveys queried several demographic characteristics, including their age, gender, education, income, number of children in the home, area of residence, political views, as well as the recency of their last visit to a Z/A. Summaries of these demographic characteristics are reported in part by Rank et al. (2018) and Dwyer et al. (2020) and are available for download (https://bit.ly/2EgNLNN). The intersections of these various demographic characteristics often predict how a person is treated by others in social and institutional settings (Hall et al., 2018) and, consequently, predict their attitudes toward those social and institutional settings (cf. Gopaldas, 2013). While this analysis does not test any intersectional hypothesis about epistemic authority, we accounted for any influence of intersectional identities by using a categorical covariate that grouped participants with similar demographic characteristics into nine intersectional categories (categories discovered using mixture modeling, Harring & Hodis, 2016).

Analysis

We used structural equation modeling (SEM) to test how well the hypothetical model of epistemic authority fit the responses to Surveys 1 and 2. A SEM includes multiple regression models that are tested simultaneously. Beyond the relationships represented in Fig. 8.1, the SEM also accounted for the relationships between the components of trustworthiness (competence, reliability, sincerity, integrity, and benevolence) and between the aspects of epistemic authority (affinity, favorability, and trustworthiness). After testing the overall model, we further tested whether different groupings of participants—e.g., members vs. non-members—start from different points when judging the credibility of conservation messages from Z/As. Details on how to interpret the numeric output of the SEM appear inline with the results reported below.

Results

Contributions of Epistemic Authority to the Credibility Conservation Messaging

Our fully-specified model of the epistemic authority that people ascribe to Z/As as conservation informants fits the data. Moreover, the model provides a fuller explanation of the credibility people ascribe to conservation messages from Z/As. It is not enough to consider only individual aspects of epistemic authority. Figure 8.2 shows the amounts that each aspect of epistemic authority *contributed* to the credibility scores. To understand the numbers in Fig. 8.2, it helps to remember that all of the variables used in the model are principal components. The components serve as summary variables which combine and rescale multiple item ratings into single summary scores with an average value (arithmetic mean) equal to 0 and a standard deviation equal to 1. For example, the average credibility score is roughly equivalent to saying that conservation information from Z/As "*might* be accurate," and a unit increase in standard deviation is roughly equivalent to saying simply "accurate." Thus, the *contribution* of each aspect of epistemic authority to credibility ascriptions is how much the credibility score changes with a unit increase in the score for each aspect.

All three aspects of epistemic authority contribute to the credibility score for conservation messages in amounts that cannot be attributed to chance occurrences ($p < 0.001$). Affinity contributes the least: the credibility score increases by 0.11 with a unit increase in the affinity score. A unit increase in the favorability scores yields an increase of 0.23 in the credibility score. Trustworthiness contributes the most: the credibility score increases by 0.34 with a unit increase in the combined scores for trustworthiness. Individually, no single aspect of epistemic authority accounted for qualitatively noticeable increases in message credibility scores.

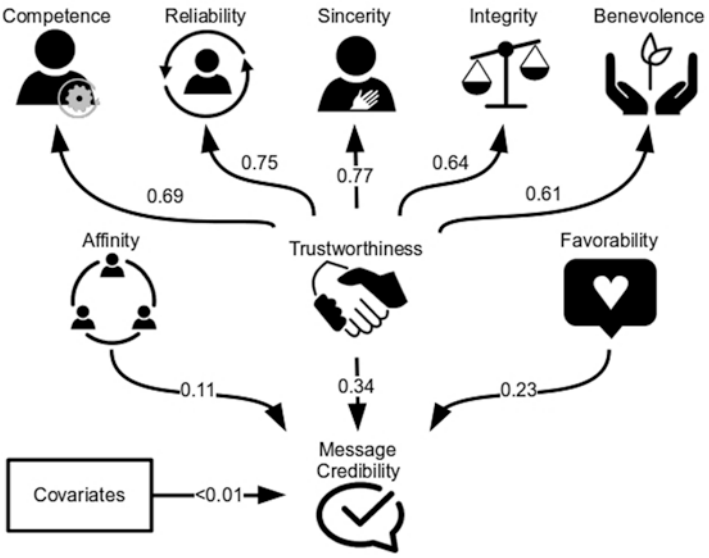

Fig. 8.2 An estimated model of how aspects of the ascribed epistemic authority of Z/As contribute to the ascribed credibility of their conservation messages

Message credibility depends on all three. Altogether, a unit increase across the three aspects of epistemic authority—i.e., trusting a bit more, liking a bit more, and feeling a bit closer—yields an increase of 0.68 in the credibility score. This increase moves the ascribed credibility most of the way from "*might* be accurate" to simply "accurate."

Different Starting Points for Message Credibility

Up to now, we have been using "*might* be accurate" (message credibility score = 0) as the starting point in reporting how message credibility increases with increasing epistemic authority. That starting point came from the model estimates when the scores for favorability, affinity, and trustworthiness were set to zero: neither liking nor disliking Z/As; neither feeling close to nor distant from them; and judging them as neither trustworthy nor untrustworthy.

Different people, though, may start from different points when judging the credibility of conservation messages from Z/As. The data included three groupings of people whom we expect to have different starting points. One grouping is based on the framing of the survey—whether participants were asked to rate their perceptions of how well Z/As perform their duties versus the importance of those duties. A second grouping is based on membership at a Z/A—member versus non-member. A third grouping is based on the overall interest that participants reported concerning

Table 8.2 Comparing groupings of participants on starting values (intercepts) of message credibility scores and contributions (standardized coefficients) of the three aspects of epistemic authority

		Credibility	Trustworthiness	Favorability	Affinity
Overall		0.00	0.34	0.23	0.11
Framing	Performance	0.20	0.58	0.17	0.03
	Importance	0.16	0.34	0.22	0.12
Membership	Member	0.80	0.45	0.22	−0.02
	Non-member	0.09	0.35	0.23	0.13
Interest	Lower	−0.02	0.30	0.16	0.13
	Higher	0.50	0.26	0.33	0.11

the various conservation topics (high versus low; available only for Survey 2). These three groupings were represented as covariates in the overall model reported above. There, we saw that a unit change in the numeric representations for these groupings (e.g., member = 1 and non-member = 0) contributed very little to the credibility score. Reimagined in terms of the formula for drawing a regression line on a Cartesian plane—$Y = a + b*X$—each covariate had a negligible value for the slope ($b < 0.01$). Nevertheless, the values for the starting points—i.e., the intercepts (a =?)—might be statistically different for different groups. Different groups may also rely more or less heavily on different aspects of epistemic authority. Here we test whether estimating separate starting points for different groups better fits the patterns of responses in the data.

Table 8.2 shows the results of estimating the models using each of the three groupings of survey respondents. In each case, estimating different starting points (intercepts) for each grouping better fits the patterns of responses in the data. The different groupings had different starting points for credibility (note that grouping the data changes the distribution of the credibility scores and can result in group-level scores that might both be higher or lower than the overall average, as observed here) and relied more or less heavily on different aspects of epistemic authority.

We see that the framing of the survey questions matters: while the difference in starting point was small, accounting for survey framing reveals the outsize role of trustworthiness judgments in ascribing message credibility. We also see that membership matters: Z/A members have both literally and figuratively "bought into" the credibility of conservation messages from these institutions. Their ascribed credibility starts more or less at "accurate" and, while membership subsumes the contributions of affinity in those ascriptions (i.e., the contribution of the affinity score drops to near zero), trustworthiness judgments contribute much to credibility. Finally, interest in conservation topics matters: those with a high interest in conservation topics start halfway between "*might* be accurate" and "accurate," but, for them, feelings of favorability contribute more to message credibility than any other grouping of survey respondents. In sum, our choice to account for shared situational cues and participant characteristics reveals compelling differences in both the starting points for credibility judgments and how respondents weight the evidence of epistemic authority in making those judgments.

Implications for Zoo and Aquarium Leadership

We conducted this study to understand the extent to which people's judgments of Z/As as trustworthy, likeable, and affinitive can predict ascriptions of epistemic authority to these institutions on conservation topics. This research continues, with new refinements as it expands into other domains of science communication: such as climate communication and health communication. That work is beyond the scope of this chapter. Here, we hope to help educators and administrators at Z/As better understand and cultivate their role in lifelong learning.

All Aspects of Epistemic Authority Matter

Analysis of survey data from the general public shows that no single aspect of epistemic authority accounts for why people ascribe credibility to conservation messages from Z/As. For conservation messages to be seen as credible, Z/As need to pay attention to all three aspects: trustworthiness, favorability, and affinity. Of the three, trustworthiness matters more than favorability or affinity. This means that messages that appeal to liking and belonging will not be enough to foster credibility. Our research also shows that trustworthiness is multidimensional and must be cultivated on at least five dimensions: competence, reliability, sincerity, integrity, and benevolence.

Our research also showed that people start at different thresholds of credibility and use different evidence of epistemic authority when ascribing credibility:

- **Framing matters:** People judge the performance of Z/As (usually first-hand during a visit) by looking for evidence of trustworthiness: Competence, Reliability, Sincerity, Integrity, and Benevolence.
- **Buy-in matters:** Z/A members approach conservation messaging with an assumption of credibility on the part of their institution. Although they are invested in the institution, these individuals still need to see evidence of trustworthiness. This may be true for repeat visitors as well, whose knowledge and conservation interest grow over multiple visits (Pearson et al., 2013) and reinforce their ascriptions of trustworthiness. We elaborate on this in the next section below about interest.
- **Interest matters:** Some people have a strong interest in conservation topics, others less so. People with a strong interest in conservation topics were more ambivalent than Z/A members: squarely between "might be accurate" and "accurate." People who are strongly interested in conservation topics needed to decide whether they liked the Z/A before making the choice to ascribe credibility to their conservation messages.

In general, we know that visitor perceptions of Z/As can shift based on their experiences while visiting (e.g., Godinez & Fernandez, 2019). The Z/A experience

in its entirety, including interactions with exhibits, exposure to animals, and engagement with staff, can influence what is communicated about animal welfare. Consequently, this may shift visitors' relationships with animals and also how they view the institution and its commitment to taking care of animals. These insights align with our suggestion for leadership to ensure that different components of trustworthiness are conveyed through the multi-faceted Z/A experience. We make the following specific recommendations based on these findings to support institutional leadership in continuing to engender trust among the public.

Recommendations for Cultivating Trustworthiness

Our analysis showed that trustworthiness contributed most to the credibility people ascribe to Z/As. Trustworthiness depends on evidence more than feelings and is, therefore, the aspect of epistemic authority on which Z/A leadership can exert the most influence. To that end, we offer the following recommendations:

Provide Evidence of Competence Messaging should describe the experts involved in caring for animals, like animal psychologists and veterinarians, so audiences get a sense of the expertise guiding the work, demonstrating competence. Messages can cover a range of information such as the animals' perceptual worlds, meeting animals' emotional needs, and having facilities that are appropriate for each species (especially relating to the size of habitats). These messages can additionally feature the ways that technology and engineering are integral to the functioning of Z/As; this can provide a more comprehensive account of the sophisticated STEM-based workings of these institutions (see Gupta et al., 2020).

Provide Evidence of Reliability Messaging should describe the collaborative work of Z/As with external organizations and experts. Conservation-minded segments of the public understand that the work of preserving wildlife and wild places extends beyond the animals under care, requiring coordinated efforts locally, nationally, and globally. These collaborations around common conservation concerns and environmental priorities (e.g., Kisiel, 2010) show that the institution is a reliable change agent for society.

Provide Evidence of Integrity Messaging should describe the unified principles that inform the work of Z/As as change agents for society. Survey respondents often said that they expect Z/As to provide guidance on a range of conservation topics beyond wildlife, including reducing pollution and plastics, conserving energy, and mitigating climate change (Rank et al., 2018; Dwyer et al., 2020). Messaging across such topics provides evidence of unified principles—i.e., integrity—concerning conservation as a whole. In this way, unified messaging across conservation topics may increase message credibility, especially for conservation-minded segments of the public with tepid feelings toward Z/As.

Provide Evidence of Benevolence Messaging should describe how the institution respectfully treats animals, audiences, and workers. All survey respondents across all segments placed the highest value on the good will of Z/As (Rank et al., 2018; Dwyer et al., 2020). This was equally true for the animals under care as for facility staff and visitors. Z/As can address this concern with more transparent messaging about how the organization creates a caring environment. Z/As can clearly indicate the ethical standards they follow. For instance, refer to AZA standards and be explicit that they exceed the requirements of US government regulations.

Provide Evidence of Sincerity All the previous recommendations can be read as suggestions to be transparent about particular activities Z/As undertake as part of their work. Each instance of transparency can contribute to convincing people that Z/As are sincere in their role as a conservation informant. But a habit of transparency serves as the best evidence of sincerity. Not every person will like everything that Z/As are saying about conservation and their approaches to promoting it, but few can dispute that a transparent organization is an honest organization.

Conclusion

This study looks in-depth at how the public ascribes credibility to the conservation messages and missions of Z/As. Analysis of survey data from the US public showed that no single aspect of epistemic authority explains why people ascribe credibility to conservation messages from Z/As. For conservation messages to be seen as credible, Z/As need to pay attention to all three aspects: trustworthiness, favorability, and affinity. We also show that trustworthiness is cultivated along five dimensions: competence, reliability, sincerity, integrity, and benevolence. Our ongoing work tests the model directly with a growing variety of cultural and lifelong learning institutions.

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Chapter 9
Visitor Behavior and Talk at Zoos and Aquariums: Tracking Visitor Groups with GoPro Cameras

Kelly Riedinger and Martin Storksdieck

Introduction

The mission of zoos and aquariums (Z/As) over the past decade has shifted to a conservation-oriented focus, with corresponding interpretive practices centered on conservation education and prompting pro-environmental actions among visitors (Patrick & Caplow, 2018; Patrick & Tunnicliffe, 2013; WAZA, 1993). However, visitors' agendas do not always overlap with the conservation and environmental education missions of Z/As. While some visitors may have agendas that align with the conservation education mission of the institutions, for others, these goals are secondary or even in direct conflict with their agenda and expectations of the visit. Visitors to zoos and aquariums may be more focused on seeing animals and enjoying a social experience (Ballantyne & Packer, 2016), and if they focus on learning, their learning agenda might be deeply intertwined with a leisure agenda that foregrounds enjoyment and pleasure (Packer, 2006). A study by Linke and Winter (2011) concluded that visitors identified entertainment as a primary driver for their visit rather than conservation or education goals. However, this does not necessarily mean that visitors' and institutional agendas are at odds. A study by Falk et al. (2007), for example, revealed that almost half of visitors believed zoos and aquariums play a role in conservation education. Although these studies provide initial insights, we still know relatively little about the overlap between visitor and institutional agendas. The *Why Zoos and Aquariums Matters* (WZAM3) project represents one of only a few studies that explores whether the conservation learning mission shared broadly across Z/As is understood, embraced, and acted upon by visitors.

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Why Zoos and Aquariums Matter Project

Our team from the STEM Research Center at Oregon State University (OSU) collaborated with Knology, the Center for Research and Evaluation at COSI, and the Association of Zoos and Aquariums for the third iteration of the Why Zoos and Aquariums Matter (WZAM3) project. The WZAM3 project used a design that explored the full visit cycle to investigate how the public thinks of Z/As at different times – before the visit and thinking about what people **bring** with them to the Z/A, during the visit and what they **do** there, after the visit and what they **take** with them, and in between visits in their daily life when they **integrate** what they learned and **assign** value to Z/As (Fig. 9.1).

In short, WZAM seeks to understand how Z/As function within a person's lifecycle and how visitor preconceptions, agendas, behavior, and learning relate to the conservation education agenda of most Z/As. Conversely, WZAM3 understands an individual visit to a Z/A as one component of a connected learning experience (NRC, 2015) with recursive character, that is, where one visit is the precursor of another one, and is influenced itself by prior visits or perceptions of visits to the institution that may be shaped by other influences (Falk & Dierking, 1992, 2000; Storksdieck, 2006).

Falk and Storksdieck (2005) conducted a study at the California Science Center's World of Life Gallery on not only what people learn during a museum visit but also which elements or set of elements were most associated with indicators of learning. Using Falk and Dierking's Contextual Model of Learning (1992, 2000) as a guiding framework, the study also included interpersonal communication as a factor that may influence what visitors take away from a visit to an informal science learning setting. In our study, we took a similar approach toward understanding the visitor experience, particularly with a focus on when and where within their stay visitors made meaning. Specifically, our team at OSU focused on the "do" aspect of the full visit cycle and investigated the research question: *What are the entry characteristics*

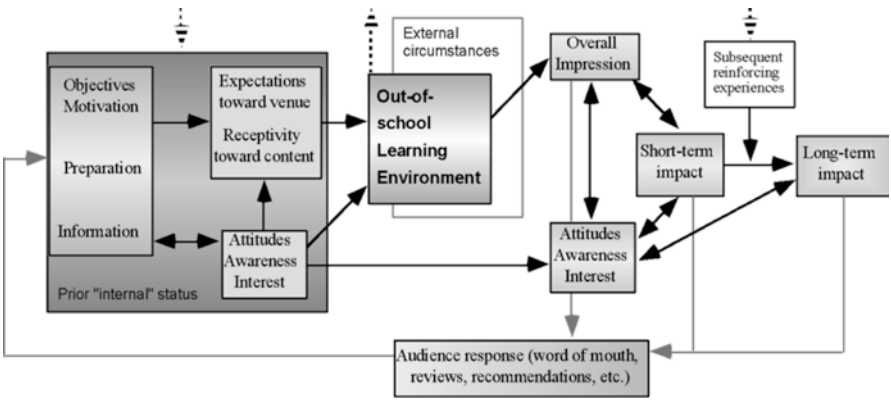

Fig. 9.1 Full visit cycle

of visitors to Z/As and how do these characteristics inform behaviors and outcomes during a Z/A visit? We explored this question through video observations of visitors using GoPro cameras, and this data was complemented by entry and exit interviews with visitors.

Theoretical Framing

The Contextual Model of Learning (Falk & Dierking, 2000; Falk & Storksdieck, 2005) and the Integrated Experience Model (Storksdieck, 2006) provided useful theoretical contexts for investigating visits to Z/As and how entry characteristics link to visit and meaning-making behaviors. The former model emphasizes that learning is a process and product of three overlapping contexts over time: the personal, the sociocultural, and the physical. The model captures the complexities of factors that contribute to the meaning-making process and learning outcomes for visitors. The *personal context* recognizes that learning is a highly personal experience that is influenced by an individual's prior knowledge and experiences (e.g., visit motivations, expectations for the visit, prior interest). The *sociocultural context* acknowledges that learning is a socially mediated process influenced by the cultural value placed on learning in settings such as Z/As and the cultural context of the Z/A in society. The *physical context* refers to elements of the physical space that visitors react to such as the presence of advanced organizers, exhibit design, wayfinding tools, and reinforcing experiences outside the Z/A. This study focused on the personal and sociocultural contexts and assumed that factors associated with the physical context (e.g., wayfinding tools, advanced organizers) would be subsumed by these two contexts. For example, the exhibit design would influence how long visitors remained at an exhibit, how they talked about the content, and the meaning they socially constructed within their group.

The Integrated Experience model builds on the Contextual Model of Learning, but focuses on environmental learning from a visit to informal science learning institutions. It specifies the reinforcing feedback loop between visits, and embeds specific factors associated with environmental learning, such as receptivity to the content of messages, expectations toward the venue (and the experience that might result), but also takes into account affective variables such as attitudes toward a (morally or ethically loaded) science topic (see Fig. 9.2).

To further explore visit motivations within the personal context, we used Falk's situated identity model as an additional theoretical lens. The situated identity model (Falk, 2006, 2009; Falk et al., 2008) suggests that visitors' identity-related visit motivations can elucidate why people visit museums and the relationship between these motivations and resulting visit behaviors and learning outcomes. Through interviews with visitors to museum-like settings, Falk and colleagues (Falk, 2006, 2009; Falk et al., 2008; Falk & Storksdieck, 2010) concluded that people choose to visit museum settings for different reasons that cluster into a few categories, referred to as identity-related motivations. The identity-related visit motivations tend to be

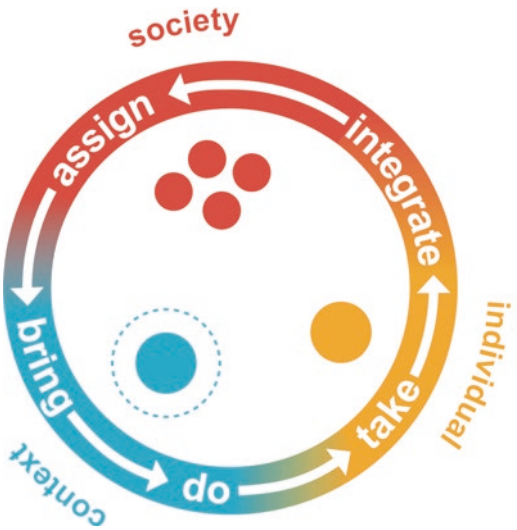

Fig. 9.2 The integrated experience model, a model of the various factors that influence the impact, and pedagogical value of visiting an out-of-school science learning environment, with a particular focus on ecological or environmental learning. Solid black arrows indicate influences of variables on one another. Gray dotted lines indicate communicative responsibilities of the informal learning environments, and solid gray arrows indicate information feedback that originates from the learning experience of the visitors. (From Storksdieck, 2006)

context-specific or "situated" and aligned with the visitors' entry narrative. In this study, the situated identity model served as a theoretical foundation for considering visiting groups' entry narratives and visit motivations and how these link to learning behaviors and outcomes at Z/As.

Study Design

We collaborated with three zoos and three aquariums across the United States that varied in terms of their geographic location, size, and annual visitation. The Z/A sites included: Oregon Coast Aquarium, Phoenix Zoo, North Carolina Aquarium at Fort Fisher, Naples Zoo at Caribbean Gardens, Columbus Zoo and Aquarium, and Mystic Aquarium. At each Z/A site, we used GoPro cameras mounted at the entrance to capture video of all visitor groups entering the zoo or aquarium over three to four full days. At each site, we intercepted around 150 groups for brief interviews about group composition (size, age of group members, gender, and race/ethnicity) and correlated those groups to our observations for reliability testing of observed features of the group (size, composition), and individuals within (approximate age, gender). Observation estimates were accurate, on average, 91% of the time.

As part of the intercept study, we recruited a selection of groups for a "timing and tracking" study (Serrell, 2020; Yalowitz & Bronnenkant, 2009) and asked one of the group members to wear a GoPro camera mounted on a hat during their visit in order to observe visitors' behaviors and conversations (Allen, 2002; Ash, 2003; Clayton et al., 2009; Patrick & Tunnicliffe, 2013). The GoPro camera included a microphone which allowed us to not only track groups during their Z/A visit (know where they went and for how long) but also record the experience of their full visit, including all of the conversations they had in their group during their visits. (Note that the presence of the camera/microphone did not seem to have influenced the dynamic of the visit, in line with previous findings from Serrell that cueing before observations does not seem to alter visit behavior after about 15 min of visit time (Serrell, 1998).) Using visitor-mounted high-definition cameras with a microphone allowed us to contextualize the visit and interpret the data by understanding what visitors brought with them to the visit – their entry characteristics – as well as their perspectives on what they took away from the visit, and, most importantly, the decision process that guided the visit and the full interpretive experience during the visit. The GoPro data was complemented by entry and exit interviews we conducted with each visiting group that participated in the study. Table 9.1 displays all of the data we collected as part of our study.

To ensure a systematic interpretation of our data, we developed a coding framework, informed by prior studies (Allen, 2002; Ash, 2003; Clayton et al., 2009; Tunnicliffe, 2000; Zimmerman et al., 2010), that allowed us to identify each group's demographic information such as the group size, composition, whether or not they were members of the Z/A, if they were locals or visiting from out of town, and how much prior experience they had visiting Z/As. The codes also helped us to understand how groups made decisions through the Z/A and the nature of their talk during the visit, especially as related to how they made meaning from exhibits and the extent to which they engaged in conservation-oriented talk.

The codes were also informed through conversations with Z/A professionals. As a research to practice project, the study included an advisory panel of Z/A professionals from AZA accredited facilities whom we engaged throughout the study to ensure our research was aligned with their practice and needs. We also shared details of the WZAM3 project and emerging study findings with Z/A professionals during committee meetings (e.g., Conservation Education Committee) at AZA conferences

Table 9.1 Data collected from video tracking study

Entry interview (n = 62)	Z/A observations (n = 70)	Exit interviews (n = 61)
Group characteristics Who do they typically visit with Motivation for the visit Plans for the visit Perceived mission of zoos/aquariums	Time at exhibits Time in transit Time engaged in meaning-making talk Decision-making conversations and behaviors	Remembered visit behaviors Extent to which group adhered to visit plan How decisions were made Learning about group members and about self Perceived mission of zoos/aquariums

to gather additional feedback and input. Animal welfare talk, for example, was identified by the Z/A professionals as a high priority and was therefore incorporated into our coding framework.

Table 9.2 shows the different categories of talk we identified in the videos and also shares examples of quotes made by visitors to illustrate each category. Prior to coding all the data, we established inter-rater reliability for our codes on smaller samples of visit data and revised codes until satisfactory (substantial agreement) inter-rater reliability was achieved.

What We Learned

The findings from our study help us understand how the entry characteristics of visitors and their agendas for the visit translate into visit behaviors and select visit outcomes. The results show the significance of interpersonal communication (or the talk they engage in and their decision-making processes) for meaning-making

Table 9.2 Learning talk and behaviors during Z/A visit

Type of talk	*Definition*	*Evidence from video data*
Conservation talk	Any talk related to visitors' understanding of the need to conserve the environment, wildlife, and the places where animals live. This included: Environmental and conservation issues, behaviors, actions, and values; global/interconnected views; connectedness to nature; understanding of nature's benefits and services; the role of Z/A in conservation efforts	*"Your zoo visit helps Florida panthers and other animals in the wild."*
Animal welfare talk	Any talk – Positive, neutral or negative – Concerning the emotional Well-being or mental state of the animal, the habitat or living conditions, the animal(s)' nutrition and health, and the human handling of the animals.	"*Why is their water so nasty*?"
Meaning-making talk	Talk where individuals construct understanding or make sense of new information or content presented in Z/A exhibits and programming. This included STEM conceptual talk, connecting talk, strategic talk, and perceptual talk (Allen, 2002; Zimmerman et al., 2010)	"*I see a zebra… what color is a zebra? It's black and white.*"
Decision-making talk and behaviors	Any comments or actions where an individual or a group makes a choice. The decision could be deliberately made through the use of wayfinding tools (e.g., maps) or discussion or could be an unconscious choice (e.g., a group is drifting or unconsciously following the pathways)	"*[the baby] is ready to move on. [the baby] wants to go through the tunnel.*" "*We gotta go this way* [points and shows location from map in hand.]"

during a visit, reinforcing the utility of socio-cultural theory (Falk & Dierking, 2000) in describing free-choice learning.

What Do Visitors Bring with Them to a Visit?

The OSU study focused on the "do" aspect of the full visit cycle. We wanted to understand what groups bring with them to a Z/A visit primarily to explore how group characteristics and visit motivation influence visit behaviors. We visually assessed incoming groups' (N = 1738) characteristics by categorizing groups and individuals based on the GoPro video stream from the entrance of our six Z/A sites. From this data, we learned that about two-thirds of the visiting groups to the sites during the observation periods were visiting with children, and roughly one-third were adult groups visiting without children or visiting alone. Groups of three were overall the most common, typically with a parent visiting with two children or two parents visiting with one child. While overall the most common group size was three, adult groups were usually two people, typically a couple or an adult parent visiting with an adult child. Surprisingly, larger groups did not dominate the visitorship, which contrasted with our initial prediction that visitor groups of four or more might be over-represented (based on US demographic data).

Comparing coded visitor characteristics with regional and local census data revealed (not surprisingly) that the typical Z/A visitor in our sample was more likely to be white and more likely to be female than expected. We also learned that the age groups 35–44, 25–34, 5–9, and under 5 were overrepresented in the visitorship during the observation days than would be expected from census data alone. These data are robust and confirm findings from previous studies (AZA, 2020; Bader et al., this volume; Dilenschneider, 2018, 2019).

Entry and exit interviews with visitors in the tracking study explored the groups' motivation and plans for the visit and were seeking to understand their perceptions of the mission of Z/As. In our sample of 68 visitors, the primary visit motivation of more than half of our groups (52%) falls into what Falk termed "experience seeker," suggesting they wanted to visit the Z/A because it was an experience or known destination to visit in the area. Falk (2009) suggests that "experience seekers" are motivated by having a social experience with friends and family. "Explorers" and "facilitators" were also common motivations for visiting groups to Z/As. "Explorers" are driven by a general interest in the topic of the Z/A or are driven by a specific exhibit or artifact, while "facilitators" are seeking to enable an experience for others in their social group (e.g., parents supporting their children's learning). Surprisingly, primary visit motivation did not differ between local visitors and tourists or out-of-town groups (we would have expected more experience seekers in non-locals and more explorers among local visitor). However, there were differences that resulted from the visiting groups' prior experience with each Z/A site. Groups that included a Z/A member or a group member with experience at the specific Z/A location were statistically more likely to be "explorers," while groups without prior experience at

the specific location were more likely to be "experience seekers," confirming our incoming assumptions about the connection of familiarity with visitor motivation (Falk & Storksdieck, 2010).

Not surprisingly, most visitors entered the Z/A with plans to "see animals," either in general or to see a specific animal. For instance, some groups to the Columbus Zoo and Aquarium were specifically visiting to see the new polar bear cubs, or groups visiting the Phoenix Zoo planned to spend their time exploring the Arizona trail and its associated wildlife. These responses were expected from Z/A visitors at the start of an interview conversation and confirm earlier work by Klenosky and Saunders (2007) and Sickler and Fraser (2009). The interview protocol then further explored visitors' plans, prompting them to articulate specific goals and plans for the visit.

Other dominant visit plans included spending time with family members or friends (social experience), having fun, exploring or foraging to see what the Z/A had to offer, attending a specific program or experience (e.g., IMAX, behind-the-scenes experience) and getting exercise through walking around "the park."

The interview questions that focused on visitors' perceptions of the mission of Z/As revealed that most visitors acknowledged conservation and education as key elements of the Z/A mission (Falk et al., 2007; Fraser & Sickler, 2009). Visitors also identified encountering nature and wildlife, improving understanding of science and providing an enjoyable experience as important to the mission of Z/As, and this confirms earlier findings from WZAM2 (Fraser & Sickler, 2009).

Collectively, the entry interview data suggest that visiting groups bring diverse backgrounds, experiences, motivations, and agendas for the visit that could be considered when Z/As plan for and develop interpretation strategies to a conservation agenda. Visitors to Z/As generally recognize Z/As as promoting conservation and education, but their visits are often socially motivated, and they expect to have an enjoyable experience where they spend time with family and friends. Conservation-oriented interpretation, therefore, does not constitute a "breach of expectation contract" (i.e., visitors would expect it or would not be surprised to encounter it) (Falk & Dierking, 1992; Sickler & Fraser, 2009), but it will not be the goal for most visitors to engage in conversation education or interpretation. In short, providing conservation messages is accepted by visitors, but not necessarily attended to.

What Do Visitors Do During Their Z/A Visits?

To explore this question, we asked visiting groups ($n = 38$) to select one member to wear a GoPro camera throughout their visit. The GoPro camera captured the full visit experience including where the group went throughout their time at the Z/A, how long they spent at exhibits and other areas of the Z/A and all of their talk during the visit. We were particularly interested in their interpersonal communication within the group (or, more simply stated, what they talked about during their visit)

in order to elucidate how visiting groups make meaning of the experience as well as the groups' decision-making talk and behaviors.

On average, groups spent a total of about one hour and 45 min visiting the Z/A and more than half of this time (55%) was spent engaged with "educational exhibits," by which we mean locations within the Z/A that not only allowed for observation of animals, but also featured interpretive signage or other interpretive support. The remaining time was spent in transit between exhibits (37% of the visit time) or at non-educational areas (e.g., carousel, playground) of the Z/A (8% of the visit time).

Visitor talk was coded for meaning-making, conservation talk, animal welfare, and decision-making talk, as highlighted earlier in Table 9.3. When we analyzed talk across groups at each site and for all types of talk, meaning-making talk was overwhelmingly the most common type of talk that visitors engaged in within their group. Meaning-making talk refers to the talk that visitors engage in within their social group to process the information and collectively make sense of the content presented. Below is an excerpt that exemplifies this type of talk:

Visitor 1: They [jellies] don't even look dangerous.
Visitor 2: They are, I promise.
Visitor 1: Are those hairs or tentacles?
Visitor 2: Tentacles… the hairs are harmless. That's just what helps them propel….
Visitor 1: There, like, there's nothing to em… like you can see straight through em….

This type of talk also includes making connections across exhibits at the Z/A or to a previous experience, such as remembering something that they learned at another Z/A or in school. For example, one visitor commented at an aquarium exhibit, "*Look at the seahorse. I almost bought one before, but they eat brine shrimp. They don't eat regular food.*" Our data revealed that meaning-making talk accounted for 70% of the overall talk that we coded for in the study.

An important, if not entirely surprising insight from our coding of the video data is that visitors' meaning-making talk is not limited to designed exhibits. For example, we observed instances of visitors engaging in meaning-making talk while in transit between exhibits, as the following example illustrates that was recorded while the group walked between exhibits:

Child #1: What does the octopus eat?
Child #2: It eats the squid.
Mother: It does?
Child #1: I think. I don't know for sure.

Table 9.3 Decision-making talk and behaviors

Decision type	*Evidence from video data*
Deliberate decision-making	"*Over here (points), everyone! I want to see the seals! Where are they?*"
Non-deliberate decision-making	*Group leaves the lobby and walks along path which leads them in to the shipwreck exhibit*

This is an important finding and resonates with the idea that learning is a socially mediated process (expressed in what is referred to as sociocultural learning). Conversations where groups discuss what they observed and learned as they leave an exhibit and transit to the next are important subsequent reinforcing events and suggest that visitor learning is not confined to intentionally designed experiences, but is infused throughout the visit and beyond (Falk & Storksdieck, 2010).

Animal welfare talk was one of the least common types of talk (less than 1% of comments) in our sample and was not always, as is often feared by Z/A professionals, framed negatively, but at times visitors were simply making neutral observations or even commented in a positive way. For example, one visiting group was observing a keeper cleaning an animal habitat and commented, "*Oh that's good they clean their cages out*." This suggests that while animal welfare issues may be a broader concern among the public, the topic does not appear to be salient as a conversation feature among the groups who visited Z/As in our sample.

Conservation talk was also minimal among the social interactions of groups in our sample, even at exhibits or programs intentionally designed to feature a conservation message. This does not suggest that these messages are ineffective, but rather that they do not appear to be the significant messages processed socially through conversation among visiting groups. In fact, groups commented at the end of their visit on the ways the study, especially the questions in the entry interview, focused on the Z/A mission, cued them to pay attention more than they typically would to the conservation messages throughout the visit. These findings confirm earlier work by Tunnicliffe (1995, 2000), who similarly found conservation talk to be limited among school and family groups.

The video data also captured groups' decision-making behaviors and talk. These included deliberate decisions that were made through discussion and use of wayfinding tools at the Z/A such as maps or non-deliberate decisions such as unconsciously following a path or the crowd.

During exit interviews, about half of the groups self-reported making deliberate decisions (for example, through the use of wayfinding tools) as a result of discussion about what to do or see next, while the remaining groups described non-deliberate decisions made by unconsciously following the crowd or path. However, when we observed and coded for groups' decision talk and behaviors, the data revealed a different pattern of groups more often making deliberate decisions (71.1%) as compared to non-deliberate decisions (29.0%). This was corroborated when we coded for decision action: a total of 60.3% of decisions coded were either "discussed" (22.4%) or "both discussed and enacted" (38.0%).

There was a difference in decision-making when comparing adult only groups to groups visiting with children: most adult-only groups made mutually agreed-upon decisions (86%), while in groups with children, only about a quarter (24%) engaged in collective decision-making while (58%) were driven by either one or multiple children and 18% were driven by a parent or adult.

The video data captured from groups visiting Z/As coupled with their exit interviews suggest particular patterns in visitors' talk and decision-making behaviors. Visiting groups, regardless of group characteristics, engage in meaning-making talk

with their social group, and this talk is not confined to designed exhibits. Meaning-making talk was also observed as groups moved from exhibit to exhibit and in non-educational places throughout the Z/A (e.g., gift shop, play areas). The data from our video observations suggests that both animal welfare and conservation talk are minimal, and this is consistent across groups. Decision-making talk and behaviors, on the other hand, vary across groups especially when comparing adult only groups to those visiting with children.

Discussion and Implications

In this section, we synthesize findings and discuss the implications of our study for Z/As, organized by the personal and sociocultural contexts described in the Contextual Model of Learning (Falk & Dierking, 2000; Falk & Storksdieck, 2005) and in the Integrated Experience Model (Storksdieck, 2006).

Personal Context

The personal context considers learning an individual experience shaped by characteristics such as background, prior experience, interest, motivation, and expectations for the visit (including setting, content, and social experience). The data we collected for our study highlights the diversity of groups and demonstrates that Z/As should not only plan only for families and groups visiting with children but also consider interpretive strategies for adult only groups as they represented a substantial portion (roughly 1/3) of visiting groups in our sample, and we have no reason to believe that our six sample sites or the times we sampled created a major bias in our data. The results of our study also suggest that visitors have a range of prior experiences with Z/As – some are visiting for the first time, while others are Z/A members or have extensive prior experience visiting Z/As. Our results also suggested that while visitors may not highlight conservation or animal welfare during their visit, most fully expect messages around conservation during their visit and they support the mission of Z/A in that regard. An unanticipated outcome of our research was learning that our pre-visit questions served as an advanced organizer that cued visitors to pay attention to conservation messages. Cuing visitors toward the mission using advanced organizers around mission-related content at the start of the visit might redirect their attention, a finding that confirms prior studies which showed the power of advanced organizers for focusing attention and learning from museums (Falk, 1997; Falk & Storksdieck, 2005; Koran et al., 1983). Collectively, these data suggest an opportunity for Z/As to develop multiple interpretive strategies that can be differentially used to accommodate the needs and experiences of multiple audiences.

The entry study which used GoPro cameras to track incoming groups suggested that the visitors in our sample were whiter compared to census data in each city, and there were higher proportions of females and some age groups (<5, 5–9, 25–34, 35–44 years old) as compared to city and national averages. While these data only represent six sites over 3–4 days in a particular season, the findings support earlier studies (e.g., AZA, 2020; Fraser & Sickler, 2009) but may not necessary reflect the complexity of who is and is not visiting, and why as noted elsewhere in this book (Khalil et al., 2022). These data suggest that there may be an opportunity to work with communities to build or deepen relationships and understand how to design the Z/A experience to meet the needs and backgrounds of all visitors, including potentially new audiences. This also suggests an opportunity for the Z/A field to consider how best to differentially convey conservation and STEM learning messages that align with visitors' backgrounds and agendas.

Finally, our study provided additional evidence to demonstrate that visitors are aware of the conservation mission of Z/As (Falk et al., 2007, Kahlil et al., this volume). This finding has been corroborated across studies, and we can now assume visitors understand the mission of Z/A, even if their agenda for the visit aligns more with having a socially engaging and entertaining visit. However, this suggests an opportunity for Z/A professionals to consider how to link mission-based activities and messages to the social and entertainment value of Z/As.

Sociocultural Context

The sociocultural context emphasizes the socially constructed nature of learning, which in this study was explored through conversations between individuals in the group to construct meaning of the experience and make decisions about the visit itself. Our data on talk throughout the visit demonstrated that visitors are spending a lot of time jointly constructing and sharing understanding of their experience. An important implication of this finding is, as a field, to consider what strategies might intentionally support and shape these conversations to include conservation-related topics.

The findings from our study suggest that meaning-making talk is the most common among visiting groups and includes making connections across exhibits at the Z/A and to previous experiences. This resonates with earlier studies in museums which demonstrated that families use prior experiences to make sense of science content (Ellenbogen, 2002; Zimmerman et al., 2010). Our study also represents one of the first of its kind to observe and capture visitors' talk using video throughout the entire visit, including away from designed exhibits and experiences. Through this approach, we learned that meaning-making talk happens in places beyond designed exhibits, and it may be helpful to consider how visitor talk can be supported as subsequent reinforcing experience during the visit itself.

The presence of animal welfare talk among visitors has been a serious concern across the Z/A field; our study suggests that it may be less of a concern for those

who are already visiting Z/As, as evidenced by the lack of (negative) animal welfare talk among our visiting groups. Previous research on cued timing and tracking (Serrell, 1998) suggests that the cameras recording will not likely have muzzled the frankness of within-group conversations, thus revealing that animal welfare is not a salient topic of concern among groups visiting Z/As.

Limitations

We recognize that certain methodological choices resulted in study affordances and limitations. Due to the complexity and richness of our video data collection approach, our study was implemented at six sites across the Z/A field. We did, however, strive to ensure these sites reflected diversity across variables such as location, size, visitation, and institute type. We also acknowledge the effect of asking visitors to wear a GoPro camera during their visit which may have influenced their behaviors and conversations as compared to a typical visit. Our video data does suggest, though, that many groups forgot about the cameras after some time, which is nonetheless a trade-off of our study approach.

Conclusions and Future Work

Our study aimed to understand what visitors "do" during a Z/A visit as part of a broader full visit cycle that incorporates what people bring with them, what they do while there, what they take away, and how they integrate what they learn and assign value to Z/As. Specifically, we addressed the research question: *What are the entry characteristics of visitors to Z/As and how do these characteristics inform behaviors and outcomes during a Z/A visit?* The study shares empirical evidence from video observation data and interviews to more fully understand visitors' entry characteristics as well as their behaviors and learning outcomes during the visit.

By exploring the question "What do visitors bring with them to a visit?" we learned that visiting groups were typically three people, more likely to be white and often over-represented in the 5–9, 25–34, and 35–44 age categories as compared to census data. Roughly two-thirds of groups are those visiting with children, while the remainder are adult-only groups. The study also confirmed findings from previous work, including the earlier WZAM projects, that visitors generally recognize and anticipate the conservation education mission of Z/As. Visitors who participated in the study acknowledged that the pre-visit interview questions focused on the conservation mission of Z/As prompted them to pay attention to these types of messages throughout their visit.

The question "What do visitors do during their Z/A visit" revealed that visitors engaged in different types of talk, predominantly meaning-making talk. Meaning-making talk happened throughout the visit and was not limited to designed exhibits.

Visitors used prior experience such as previous visits and earlier exhibits to make meaning of the content. Visitors also engaged in conservation-oriented talk and animal welfare talk, but it was relatively minimal in our sample. Finally, groups engaged in decision-making talk and behaviors, and there were differences noted between groups visiting with children and adult only groups.

The use of video data in this study resulted in a rich and in-depth account of each group's visit. Our coding process and analysis have focused on broad trends that emerged across visitors' talk and behaviors, but there is an opportunity in future work to conduct a more fine-grained analysis that could result in an even more nuanced model of learning in Z/As. Future studies could also explore what perceptions potential visitors have on what they are expected to "bring" to or "do" during the visit and how this might limit who visits.

Our study suggests a number of potential implications for Z/A practitioners to consider. Visiting groups bring diverse backgrounds, visit motivations, and agendas, and Z/As should plan for the full range of visitors while also reflecting on who is not visiting and why. The findings also confirm that visitors expect conservation messages at Z/As, suggesting that cuing visitors to the mission early in the visit through advanced organizers might be a strategy worth considering. There is also an opportunity to reflect on where learning takes place during a Z/A visit and support groups in making connections between exhibits and with previous experiences.

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Chapter 10
Family Talk at Live Animal Exhibits: From Biological to Ecological to Conservation Talk

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Introduction

Observational research has demonstrated that when families interact at live animal exhibits in zoos and aquariums (ZAs), they talk about a wide variety of things: They raise questions, make observations, draw comparisons, make connections, and tell stories; they talk about biology, ecology, and, to some extent, conservation. The research also demonstrates that under the right circumstances, the amount of biological, ecological, or conservation talk can be increased by directly engaging families in active meaning-making dialogue. But the question remains as to whether increasing these particular ways of talking or topics truly shapes environmental

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beliefs, values, identities, and ultimately actions. We argue that, in and of itself, it does not, but that it could if we took seriously how visitors themselves think about topics like conservation and create experiences that invite them into intentional, reflective, meaning-making dialogue.

To build this argument, we first draw on work started by the first two authors to document engagement at aquarium touch exhibits sparked by the fact that while the commitment (involving significant financial and person-hour costs) to this kind of exhibit appears to be motivated by their popularity and a general belief that the real experience of touching an animal will help create conservation awareness, research shows that these exhibits afford limited visitor talk related to ecology (an underlying concept for understanding conservation) or more directly to conservation (Kopczak et al., 2015). The *Examining Visitor Engagement at Touch Tanks* (EVEnTT) project began with an open-ended approach to the research based on video observation coupled with interviews of visiting family groups in order to document the interactional patterns in family activity and talk during touch interactions with live animals on display in four west-coast aquariums (Kisiel et al., 2012; Rowe & Kisiel, 2012). A separate line of inquiry also began to document cross-cultural similarities and differences in family dialogue and action in touch experiences at aquariums (Liu & Rowe, 2009, 2011). In subsequent years, EVEnTT supported further work on examining family ecological talk in touch experiences (Kopczak et al., 2015), docent-visitor interaction mediated by touch experiences (Good, 2013), connections to prior experiences these encounters generate as part of family talk (Galvan, 2013), and family conservation talk at touch tank exhibits (Rowe, 2018).

In this chapter, we report findings based on data from the original study not previously reported and cross-cultural comparisons of conservation talk at touch tanks and at dioramas across similar contexts in the United States and Brazil. We draw implications from these findings on biological, ecological, and conservation talk in order to rethink and enhance the experiences we facilitate in ZAs through intentional and reflective approaches that suggest next steps toward meaningful engagement.

Defining Family

Anthropologists, sociologists, and psychologists consider families to be the first and foremost learning institution in which a person engages. With this in mind, families are defined as multigenerational groups who regularly interact with each other "during developmental processes related to a specific activity" (Ash, 2003; Granot, 1998). For the three studies described here, families were multigenerational groups of at least two people visiting a ZA or museum together. The specific activity in this case includes both the group members' interactions with each other, as well as their interactions with live animals in museum exhibits, with a focus on zoos and aquariums. This definition removes from consideration accidental and serendipitous groups of strangers who happen to interact together at an exhibit as well as

same-age peer groups such as adult or adolescent pairs or small groups. This strategy for data collection and reduction is not meant to discount the experiences of peer groups (large or small) as visitors; rather, it is meant to help focus analysis on non-school-based groups where the development of identities, dispositions, values, and beliefs for youth and children is a component (intentional or unintentional) of the interaction and entire visit.

Touch Tank Engagement and Family Learning Outcomes

Talk that goes beyond everyday observations and time and behavior management is typical of most family interactions in informal learning environments of all types (e.g., Leinhardt et al., 2002; National Research Council, 2009; Patrick & Tunnicliffe, 2013). At touch tanks, families do talk about biology (Ash, 2003; Ash et al., 2008), and visitors may readily participate in different aspects of scientific reasoning (Kisiel & Rowe, 2012). As reported in 2012, video observation of families at touch tanks identified talk related to making and challenging claims, supporting claims with evidence, applying prior knowledge, and testing predictions—all without prompting from staff, volunteers, or labels. However, the study also suggested missed opportunities for further learning in these talk and activity-rich exhibitions. A closer examination of activities at touch tanks revealed that while touching was common, a pattern of "touch-debrief," in which there was some kind of dialogue relating to the touch experience (e.g., "It felt squishy," "Did you see how it moved?") seemed to support deeper engagement than either touching alone or observing touching.

In addition to this work on biological, ecological, and science talk at touch tanks, recent work has also investigated outcomes such as empathy (e.g., Young et al., 2018) and human health benefits (e.g., Sahrmann et al., 2016), highlighting the fact that touch tanks (and animal exhibits more broadly) can help visitors develop empathy and support the development of positive conservation attitudes (Clayton et al., 2009). Research on ZA visitors has also shown that visits do promote conservation awareness and action (Clayton et al., 2009; Falk et al., 2007; Weiler & Smith, 2009) and that explicit conservation messaging when tied to experiences viewing live animals correlates to specific environmental action (Hodak, 2008; Smith et al., 2008). That being said, from an exhibit developer/science educator perspective, understanding the extent to which visitors build on their knowledge of touch tank animals (sea stars, anemones, sharks, rays, sea urchins, etc.) remains a critical question for practitioners and researchers in order to support more engaging learning experiences. Additionally, we know that staff interaction with visitors (Idema & Patrick, 2016; Kisiel & Rowe, 2012) as well as dioramas and static displays of animals (Tunnicliffe & Scheersoi, 2015) can promote a wide variety of family interaction and talk, including conservation talk, but the question of whether marine animal exhibits that do not include live animals, but are built around realistic models or preserved specimens can also promote visitor conservation talk also remains open.

This investigation, based on data from the EVEnTT project sought to (1) identify common learning outcomes that result from engagement with a touch tank exhibit and (2) determine whether such outcomes can be correlated with particular activities observed during engagement.

While we recognize the diversity of ways that visitors interact with exhibits, we also hypothesize that certain activities may be more likely to lead to different types of talk, which in turn leads to different "take-aways" from the experience. Many studies at interactive science exhibits have shown that encouraging certain actions can facilitate dialogue and even metacognition (Gutwill & Dancstep, 2017; Hodak, 2008) and that such talk is also present in a variety of live animal exhibit contexts (Allen, 2002; Clayton et al., 2009). This re-analysis first addresses the question of what this looks like at touch tank exhibits in particular and second addresses the question of whether these findings also apply to marine animal exhibits that do not include live animals.

Capturing Family Dialogue

Recruited families (n = 23 groups, at two different sites in Southern California) were video- and audio-taped for the entire duration of their time at the touch tanks. Following the experience, families participated in a fifteen-minute, semi-structured interview to clarify their actions at the touch tank and their perceived gains from those experiences. Several open-ended questions were asked to ascertain family-defined learning outcomes including the following:

Did you discover anything new from visiting the touch tank today?
Was your visit to the touch tank what you had expected?
Sometimes people are surprised by what they discover at a touch tank. Were you surprised by anything today? (Tell us about that.)
Sometimes people are curious about what they see in the touch tanks. Were you curious? (Tell us about that.)

Video analysis defined common activities at the exhibit and began with a qualitative overview of each video (Rowe & Kisiel, 2012) which led to a list of key touch tank activities. To verify the relative frequency of key behaviors, each family encounter was re-examined as a sequence of minute-long segments. The presence or absence of particular behaviors or activities (as defined by the initial coding) was noted for each segment with no limit on the number of codes that could be applied in any given minute. These "minute snapshots" of the family encounter determined the frequency of behaviors over the course of a visit and estimates for the prevalence of activities. Given that a variety of things can happen over the course of a minute, we recognize the limitations of such an approach, but we believe it provides a fair estimation of which activities are more or less common at these settings. A qualitative analysis of visitor interviews, following a grounded theory approach (Strauss & Corbin, 1998), was used to identify recurring themes, leading to the identification of several learning outcomes, each of which was "tagged" to a particular family. For this study, the concept of "learning outcome" was defined somewhat narrowly in

terms of conceptual understanding or awareness rather than the development of thinking routines or new scientific practices or even changes in affect.

Reliability of video and interview segment coding was achieved through independent analysis of several of the same videos and interviews by two researchers. Comparison of the codes helped to adjust descriptions of segment codes and ensure consistency when coding the remaining video and interview data. The outcomes identified via family interviews were then linked with the video data to create a matched data set that provided, for each family, a set of activity frequencies for their visit as well as a list of espoused outcomes.

Families examined in this data set engaged in a wide variety of activities during touch tank experiences. The most common of these activities across the 397 one-minute segments coded included *asking questions (77% of segments)*, *pointing or pointing out (75% of segments)*, *touching (63% of segments)*, *naming* (63% of segments), *scanning* (67% of segments) the exhibits for different animals or features, and *describing* (58% of segments) animals or exhibit elements. Asking questions, as coded here, is a broad category including questions about animals and habitats, as well as procedures, rules, and agendas. Although there were questions directed at staff or volunteers, most originated with family members and were directed toward other family members. Staff interactions were a part of the experience, with almost 50% of segments involving listening to staff and 15% involving direct conversation with staff.

Analysis of participant interviews revealed several categories of learning outcomes, as reported in Table 10.1.

Table 10.1 Learning outcomes for touch tank interactions identified from family interviews (N = 23)

Category	Freq (N = 23)	Defined by
Basic physical characteristics	14	Described the physical characteristics of animals. (e.g., texture, size, color)
Challenged or changed conceptions	13	Observations or interactions conflicted with prior knowledge or expectations (e.g., visitor did not expect a particular reaction or texture)
Animal behavior	12	Described particular animal behaviors that were observed at the touch tank. This included self-driven behaviors (e.g., swishing tail) and behaviors resulting from being touched
Animal physiology	13	Described or showed interest in animal physiology. This included feeding techniques, life cycles (reproduction, growth, and death), defense mechanisms, etc.
Existence of animal	5	Indicated a new awareness of an animal (e.g., didn't know these existed, didn't know anything about them)
Ecology	4	Described an understanding/awareness of animal-animal or animal-environment interactions as a result of the visit (note that the word "ecology" was not used in any response)

Linking Activities and Outcomes

The most commonly stated learning outcomes (representing relatively low-level learning) were in the *basic physical characteristics* category. Examination of activity frequencies suggests that those who described this outcome were much more likely to *debrief* (following a touch) as well as more likely to have *listened to staff* compared to visitors who did not mention this category of outcome (based on chi-square analysis). The greater prevalence of these activities would seem to suggest the importance of talking about the touch experience (or perhaps listening to staff describe it) as a way to support basic, low-level learning outcomes. It is not clear from this data set, however, whether these activities (debriefing and listening to staff) need to be done in concert or whether they represent two different or supporting avenues for achieving a basic understanding of the animals on display. The fact that listening to staff is more prevalent with this group may also be a reflection of the interpretive goals and skills of the staff.

About a quarter of the sample made comments associated with the *existence* category, where visitors mentioned the discovery of a previously unfamiliar animal. Such comments were often, although not exclusively, related to an invertebrate such as a sea urchin or anemone. Those who described this new awareness of one or more of the animals had higher frequencies of several activities during their time at the exhibit, compared to groups who did not mention this outcome. More specifically, it would seem that the novelty of a creature might be leading to higher levels of activities related to focusing attention (*pointing out, demonstrating*) and sharing ideas (*debriefing, describing*). If novelty does play a role, it may also account for the high prevalence of *encouraging touching* activities. If a child is unsure or hesitant, especially when spying a creature she has not seen before, it follows that a parent or adult might encourage the child to touch, or even demonstrate how best to touch, as a way to engage the child in the "common practices" of the exhibit space.

Two of the categories, *animal behavior* and *challenged conception*, could not be linked to a higher frequency of any of the activities observed. *Challenged conception*s, as defined, would be related to the visitors' prior knowledge in addition to what they observed at the touch tank. The extent of these challenges to understanding could easily range from something as simple as "I didn't realize it was an animal" to "I thought sharks had to swim to stay alive." Such misconceptions might be challenged by a touch, an observation without touching, or a staff member's comments—it may be that no one activity (at least for this sample) was more or less likely to lead to this outcome.

Those who mentioned a more complex understanding of *animal physiology* were also more likely to have a higher occurrence of touching and talking with staff compared to those who did not report this type of outcome. It is likely that these more complex ideas (e.g., an animal's defense mechanisms or feeding techniques) were mediated in part by conversations with staff who either provided such information directly or engaged in deeper discussion with the visitors. It would also seem that for this outcome, the debrief, an activity linked to other outcomes, was not critical. In fact, a closer analysis of the activity patterns showed that this outcome was more likely to have touch incidences that were NOT accompanied by any debrief

compared to other outcomes. This may point to a different kind of interaction—one in which staff or volunteers were more likely to guide touch, followed by an explanation or related "animal fact," with limited opportunity for groups to engage in dialogue with each other.

The smallest percentage of outcomes in this investigation were linked to *ecology*. In this analysis, those who espoused ecological ideas tended to show higher levels of several activities including *asking questions, pointing/pointing out, scanning* and *seeking information*. Such activities suggest that these visitor groups looked to extend their learning experience beyond touching, seeking information from the entire exhibit, gathering information from signs and others. As such, this might be seen as a higher-level learning outcome, given the analysis of ecological relationships between components of the exhibit (animal-animal or animal-exhibit).

What Counts as Conservation Talk?

Identifying Conservation Talk

Building on this work which established that particular learning outcomes can stem from biological and ecological talk and interactions at touch tanks, the third author of this paper developed a multidisciplinary study (2018) at a touch tank experience in a West Coast aquarium/science center to examine what counts as conservation talk, both among families, themselves, and professionals working in conservation-related arenas using concept maps as visible thinking routines (Ritchart et al., 2011) and tools of data collection (Novak & Cañas, 2006). The intent of that study was to engage families (N = 10) and document if they see live animal exhibits as places to talk about conservation, if they talk about conservation at such exhibits, and ultimately how they talk about conservation when prompted. Additionally, she analyzed the talk of conservation-related professionals, both scientists and informal educators (N = 10), to understand what they expect conservation talk among families at live animal exhibits to look like as well as how they, themselves, talk when prompted to think about conservation. The first phase of that study generated an observation rubric for "what counts as conservation talk" from the point of view of the participating families and professionals (Table 10.2).

The rubric was then applied using the same "minute snapshots" method described above to the video-recorded live animal experiences of additional families ($n = 40$). The average time spent at the touch tanks by families in the sample was 12 min and 48 s, resulting in a total of 572 one-minute segments (see Fig. 10.1 below).

Conservation Talk in Different Designed Spaces

As part of exploring the relative value of live animal experiences in promoting conservation talk, the same rubric was applied to videotaped interactions of family visitors (N = 10) to a temporary exhibition, "Oceans," at an interactive science center in

Table 10.2 Discursive themes related to conservation identified in family and professional concept maps (N = 13)

Category	Freq (N = 13 maps)	Defined by
Solutions and strategies	10	Naming solutions and mitigation strategies to address perceived environmental problems and larger issues
Education	10	Identifying the need/importance of educational efforts and the places/institutions/organizations where environmental learning takes place
Larger issues	9	Mentioning broad environmental problems, issues, and threats, such as pollution, habitat loss, and global climate change
Environment	9	Mentioning the environment as an umbrella term or related to the basic natural systems that compose the environment
Animals at large	9	Referring to animals generally with respect to their well-being, needs, and threats
Animal species	7	Mentioning specific species as opposed to animals generally, including recognition of a particular species' needs and threats
Slogans	7	Including slogans and mottos related to the environment
Resource use and management	7	Referring to various uses of natural resources, strategies to manage such resources, and reasoning supporting management
Ethics/values	7	Talking about personal beliefs and assigned values, making connections and raising questions of an ethical (i.e., normative) nature and/or reflecting on value systems explicitly
Research and science	7	Referring to examples of research, scientific efforts, and platforms, placing value on them, or recognizing their role
Contradictions	7	Raising questions related to contradictory lines of thinking and concepts, and reflecting on contradictory information, values, and systems
Interconnectedness	3 (professionals only)	This was not a theme identified in family maps, but for professionals, interconnectedness referred to making general connections to nature, as well as personal connections to nature through reflection
Ecosystems	3 (professionals only)	Referring explicitly to the term ecosystem or systems thinking
Questions	2 (professionals only)	This theme was also only present on the concept maps of professionals and relates to the pedagogical technique of using questions as a strategy for communication

a large Brazilian city. It is important to note that the work conducted in the science center context, did not examine touch-tanks or live animals in exhibits. Instead, the "Oceans" exhibition contained signage, touch screen interactives, and realistic dioramas distributed sequentially so visitors could move through increasing ocean

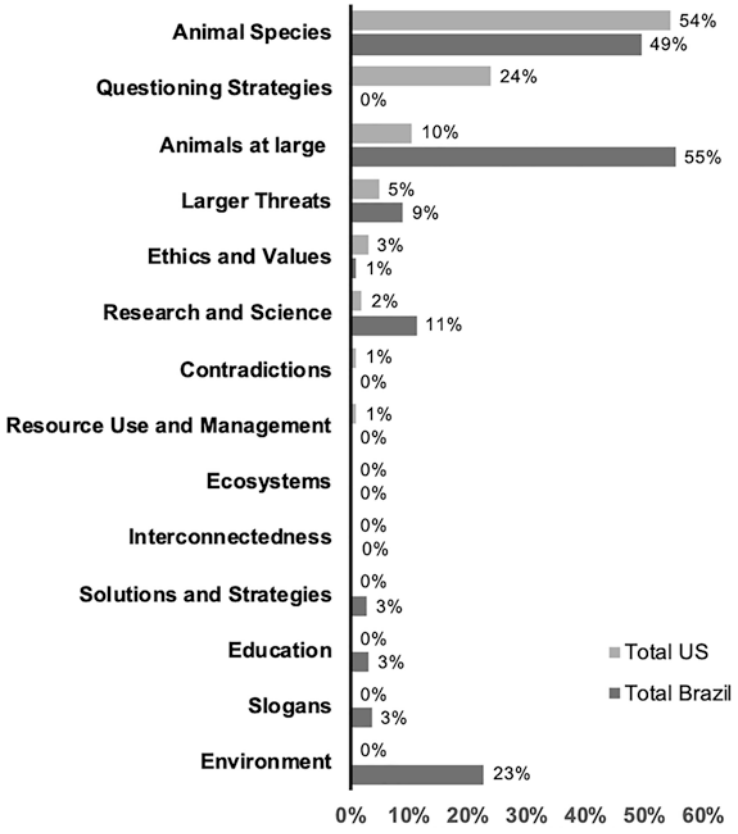

Fig. 10.1 Percentage of conservation talk by categories of conservation talk among visiting families in Brazil (no live animals) and the United States (touch tanks)

depths. Dioramas simulated aquariums, including interactive screens displaying information about marine nektonic fauna, their location, diet, and size at different depths. One interactive table included topics such as marine relief, water temperature, ocean currents, salinity, chlorophyll concentrations, amount of biomass, ocean currents, or migration of humpback whales and different species of turtles. An immersive installation designed for visitors to walk through with a significant level of difficulty was aimed at raising awareness of the impact of marine pollution on marine animals.

Visitors completed pre-questionnaires containing sociodemographic information and questions related to their cultural and leisure habits, especially those related to similar places and activities (visits to zoos, museums, interactive science centers, and libraries). The visit to the exhibition and the resulting interactions were video recorded with a GoPro® camera arranged in a special support on the head of one of the children in the family groups. This "subjective camera" approach records

visitors' experiences from their points of view and is described in detail in Massarani, Chagas, et al. (2019a); Massarani, Mucci Poenaru, et al. (2019b). Visits lasted an average of 15.3 min, generating 243 one-minute segments.

Conservation related talk in both contexts represented approximately 18% of all one-minute segments of activity. Figure 10.1 shows the relative frequency of fourteen different categories of conservation talk as a percentage of total segments of conservation talk in the US and Brazilian settings. Visitors to the oceans exhibit in Brazil and the touch tanks in the US context spent about the same percentage of their conservation related talk discussing specific animal species that they were observing or reading about. In the Brazilian exhibit, the dioramas were accompanied by explanatory texts and interactive digital materials which (as is often the case) were absent in the touch tank exhibit. This accounts for the greater percentage of talk about animals at large and the environment in general than is seen in the US examples.

Additionally, the touch tank experience almost always involved a staff person either interacting directly with families or observing touch behavior which accounts for the larger percentage of questions asked in the U.S. data. In fact, about 85% of instances of family conservation talk occurred when staff were present. This is largely explained by the fact that just over 78% of all the conservation talk was either about individual animals (much of which was related to larger conversations with staff about names, species, or characteristics) or in the form of questions often directed at staff. That said, just over 12% of instances of family conservation talk draw on animal species. Discourse overlapped with questions related to conservation, and only a portion of those were questions directed to staff (for a more detailed discussion, see Rowe, 2018).

Enhancing Conservation Outcomes at Touch Tanks

The studies discussed above add to the strong body of research discussed above demonstrating that animal-based exhibits can and do promote interaction and talk that can lead to a variety of learning outcomes, and that direct guidance can increase meaning-making talk and interaction among families. With active staff intervention, visitors engaged in a great deal more of the kinds of talk and activity that make a difference in learning. Our studies in Brazil and the US suggest that exhibits containing live animals promote about the same amount of conservation-focused talk as exhibits that do not contain live animals. Given ongoing concerns within the ZA community regarding animal welfare, this has further implications in the field as researchers seek to document the value of live animal displays and explore the kinds of learning, changes to behavior, and changes to identity provided by live animal exhibits. It is important to better understand just what kinds of learning outcomes might be expected from these live animal-touch experiences and encounters. However, the fact that certain outcomes could be linked to higher frequencies of

activities provides practitioners with some direction with respect to how best to support learning and conservation discussion in these settings.

While 18% of family talk in the interactions studied here did relate to conservation themes, the families in these studies as a whole did not directly engage conservation ideas in their interactions. We believe this is because the experiences were designed on traditional, more linear, environmental education approaches to building experiences in ZAs that focus largely on building knowledge and empathy. While these are important elements of learning and do correlate with pro-environmental behavior (Clayton et al., 2011; Grajal et al., 2016), they fall short when it comes to the conservation mission as they do not necessarily support visitors' own conservation talk, including the worldviews and environmental values they bring to the surface when talking about conservation. As demonstrated in Rowe (2018), as educators, we underestimate visitors' readiness to engage in more than basic biological talk, and we are frustrated when their talk does not rise above basic biology or ecology concepts. However, when families are asked to think and talk about conservation more specifically, they are ready to engage in action driven dialogue and talk about solutions and strategies to address perceived environmental problems. This is echoed in the fact that visitors recognize and appreciate the conservation mission of ZAs as institutions (Falk, et al., 2007; Nickels, 2008), but do not necessarily recognize how this mission is reflected in individual exhibit experiences themselves (Rowe, 2018). The research reported here with touch tanks thus echoes the findings of research on live animal exhibits (Clayton et al., 2011) and animal-focused natural history dioramas (Tunnicliffe & Scheersoi, 2015). Like those, touch experiences have an immense potential to contribute to visitors' constructions of conservation as they talk about their held values and belief systems, but this is not likely as an outcome unless explicitly guided through staff and interactive scaffolding that asks visitors to put their own perceptions of conservation into dialogue with those of ZAs.

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Chapter 11
The AZA Social Science Research Agenda 2020: How the Social Sciences Can Help People and Wildlife Thrive Together

Joy Kubarek, Jackie Ogden, Amy Rutherford, Shelly Grow, and Vicki M. Searles

Introduction

Social science research continues to gain recognition as an essential component of understanding the complexities of conservation issues (Bennett et al., 2017; Saunders, 2003). Within the Association of Zoos and Aquariums (AZA), the past 20 years have demonstrated substantial growth in the presence of social sciences in zoo and aquarium efforts. Social science research helps zoos and aquariums (Z/As) fully realize their missions of helping people and animals thrive together by focusing on the human elements of conservation, both in terms of individuals and communities. It equips Z/As to understand their audiences; apply effective strategies to educate, engage, and enable these audiences to be part of achieving their

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conservation mission; and mitigate future issues through the cultivation of the next generation of conservation advocates. In the context of this work, conservation is defined in a broad sense as reflected in the AZA (2020a) accreditation standards, meaning one or more of the following: in situ/field conservation efforts (direct impact on animals/habitats in the wild), sustainability/green practices, connecting animal collections with the wild (e.g., reintroduction programs, applied research), and conservation education and advocacy (AZA, 2020a).

Social science research in Z/As is important not only for this community but also for the larger fields of conservation and informal learning. Z/As represent a large sector for both informal learning and conservation organizations; as of 2020, there were over 230 AZA accredited Z/As engaging over 200 million visitors and contributing over $200 million to conservation annually. They are leaders in the cultural sector in advancing a social mission via their commitment to conservation (Saunders, 2003). Given their cross-disciplinary efforts in education, conservation, research, and public engagement, Z/As also intersect with a number of other organizations such as NGOs, non-profit conservation organizations, schools, universities, and government agencies. Lessons learned from the work of Z/As have far-reaching implications for the work of these other organizations as well.

Early Efforts

While social science research first gained traction in Z/As in the early 2000s, it became more established in 2010 when AZA produced the first Framework for Zoo and Aquarium Social Science Research (Fraser et al., 2010). The framework was intended to be a guiding document to direct social science research within Z/As. It was developed by a panel of zoo and aquarium practitioners and academics with expertise or a vested interest in social science research. The effort was primarily facilitated by the AZA Conservation Education Committee and the framework itself was heavily rooted in education.

The 2010 framework identified seven core research areas to help advance knowledge about how Z/As could fulfill their conservation mission: (1) role in lifelong learning experiences, (2) comparison to other informal learning institutions, (3) shaping social action and activism, (4) role in social services, (5) unique characteristics of learning, (6) education profession, and (7) applying and disseminating existing knowledge. Within each of these core research areas, the authors further segmented the topic to provide more specific recommendations for sub-questions appropriate to evaluation or research. The framework document itself provides a more substantial narrative of what each topic entails and its relevance and importance.

In addition to the framework, in 2012, the Research and Technology Committee of AZA drafted a white paper on research priorities (AZA, 2012). The paper served two primary purposes: to provide an overview of the scope of research being conducted in Z/As at that time and to identify significant gaps in the scope of research

that needed more attention. More specifically, the white paper reviewed and discussed research efforts related to sustainable animal collections, animal care and welfare, species and habitat conservation, and conservation education and public engagement.

Both the framework and the white paper clearly articulated social science research priorities for Z/As at the time. Coupled with the development of these foundational documents was the emergence of more support for Z/As to carry out these research activities. More Z/As have since allocated resources to social science research and evaluation, including establishing evaluation and research departments, working with external consultants, and collaborating with other institutions. A select few organizations have even established their own Institutional Review Boards to oversee these activities within the organization. Further, around this same time, the Conservation Education Committee of AZA started a "Research and Evaluation" initiative to support the capacity of AZA member organizations to carry out these activities, including a mentoring program to match experts with practitioners. Most recently, in 2019, AZA approved the formation of the Social Science Research and Evaluation Scientific Advisory Group (SSRE SAG) to further address the burgeoning need for coalescing people around social science research and evaluation efforts.

Impetus for Change

During the time between the establishment of the 2010 Framework and the new 2020 Agenda, the expectations and role of Z/As continued to evolve in social discourse. While education continues to be a mainstay of Z/As, the conversation has broadened to include questions about the role Z/As do and could play in larger social issues. For example, the current "Why Zoos and Aquariums Matter" study (Fraser et al., 2020) addresses in part how the public situates the voice of Z/As in society. As part of efforts to drive the integration of conservation into AZA-accredited zoo and aquarium organizational culture, members of AZA's 2018 Executive Leadership Development Program conducted preliminary research about organizational conservation culture and developed a framework to guide AZA's long-term efforts. Subsequently, in 2019, AZA established a one-year task force to build on this work and better understand how the conservation culture of Z/As may influence the organization's ability to meet their missions – specifically to work toward a world in which people and wildlife thrive together and for Z/As to be synonymous with conservation (AZA, 2020b). A convening in 2019, at the Houston Zoo, including representatives from universities, social science research nonprofits, and AZA-accredited Z/As, further fueled the conversation around the role of Z/As in influencing social change. Concurrent with all of this were increased efforts to address issues of diversity, equity, access, and inclusion (DEAI) within Z/As. Lastly, an NSF-supported literature review of zoo- and aquarium-focused social science research published since the 2010 framework revealed that significant gaps

remained, including the role of Z/As in shaping social action and activism as well as the role of Z/As in supporting social services (Johnson et al., 2020; UN 2030 Agenda for Sustainable Development, 2015).

All of this pointed toward the field's need for a new social science research agenda, one that was responsive to the changing social climate within which Z/As operate.

Development Process

In Spring 2020, AZA convened an interdisciplinary group of academics, practitioners, and researchers to lay the foundation for the next zoo and aquarium social science research agenda. This group included 19 individuals, representing three social science research nonprofits, two universities, Z/As (five in person and four virtually), and AZA staff. The participating individuals were selected based on their past, present, and future involvement with social science research within the zoo and aquarium community. Two professional facilitators planned and led the meeting with support from AZA and the "Why Zoos and Aquariums Matter" project team.

During this two-day meeting, the group reflected on past accomplishments in zoo and aquarium social science research, current trends and pressing issues, and forecasted what the zoo and aquarium community will need to address in the future. The group also engaged in an iterative identification and prioritization process to articulate gaps in what had been gained from social science research in the past 10 years. This culminated with the generation of potential key research questions for the next research agenda. The group further examined three of these potential research questions to affirm the viability of these questions as an area of research. This examination included identifying potential resources, researchers, and outcomes related to a body of work supporting that particular question. This exercise proved beneficial in vetting the prospective questions and informing the next steps.

Following the in-person meeting, the potential research questions were refined to five key research questions with accompanying sub-questions. The facilitators created a summary document for disseminating this work and to inform a critical review process. The critical review process consisted of two primary groups of reviewers: the original attendees of the two-day research agenda meeting and an additional group of key stakeholders. These stakeholders included a purposeful sample of additional academics, practitioners, and researchers. These reviewers were provided with the summary document and a brief questionnaire distributed via SurveyMonkey to gather feedback systematically. The facilitators and AZA staff reviewed the responses and identified recurring themes or potentially potent outliers among the comments for consideration in revisions. Lastly, three additional stakeholder groups – the AZA Wildlife Conservation Committee, the Green Scientific Advisory Group, and the Social Science Research and Evaluation Scientific Advisory Group – provided verbal feedback after reviewing the proposed agenda.

The initial in-person meeting occurred precisely as the COVID-19 pandemic began to ramp up within the United States and domestic travel restrictions, social distancing measures, and public closures were put into place. Due to the novelty of the pandemic, it was not considered in the development of the original document. Reference to it has been subsequently incorporated, but the authors recommend a review of this aspect as the immediate and downstream effects of the pandemic become more clear.

A New Agenda

The following describes the five key research questions that comprise AZA's second Zoo and Aquarium Social Science Research Agenda. Within each key research question is a brief description including references to literature supporting the relevance and criticality of this research. Each key research question in the agenda also has a series of sub-questions. These sub-questions provide context and help bring focus to areas of inquiry that support the broader key research question. For the sake of this book chapter, only a sample of the sub-questions for each key research question are shared. All sub-questions may be found in the final published agenda.

Key Research Question #1: How Can Zoos and Aquariums Help Build a More Equitable Society Through Critical Reflection on Their Internal Operations, Culture, and Communications? How Can Zoo and Aquarium DEAI Efforts Support This?

Since the 2010 Framework for Social Science Research in Zoos and Aquariums, social issues have evolved with great speed, accelerated in part due to the prevalence of social media. Questions regarding long-standing issues of equity and justice have come to the forefront, including within the conservation community, with widespread anti-racism protests and increasing recognition among white people of the systemic nature of racism in the United States and many European countries. Within the conservation community, discussions of systemic racism have generally focused on the imposition of norms and values from typically "western" or "northern" countries – those that historically have a history of colonizing other countries and/or of disrupting indigenous populations (Balcos, 2019; Mullenbach et al., 2019; Tuck & Yang, 2012).

The social sciences, of course, have not been immune to such influences on equity and social/environmental justice, with many noting that social science traditions have been rooted in structural inequalities (e.g., Kirkhart, 2005). The zoological world has also not been immune. The zoological world is beginning to acknowledge this legacy – from a historical foundation as menageries of royalty and

the very wealthy, to collecting animals from colonized or exploited countries, to participation in what were referred to as "ethnological expositions." Such expositions, now often referred to as "human zoos," were generally the provenance of the world's fairs in the nineteenth and twentieth centuries, and focused on the public exhibitions of peoples who were considered more "primitive" (Blanchard et al., 2011). Even prominent, well-regarded zoos participated in such activities and exhibitions during this time. Carl Hagenbeck, the founder of Tierpark Hagenbeck, is widely viewed as a father of modern traditional zoo design, creating a zoo without bars, and instead featuring moated exhibits. Hagenbeck was also a merchant in wild animals and was known to collect and exhibit not only animals but also members of the communities where the animals were found – including members of Samoan, Sami, and Nubian communities. In the United States, the Bronx Zoo displayed Ota Benga, a Mbuti man brought from the Ituri forest, as part of an ethnological display (Newkirk, 2015), following Benga's exhibition at the 1904 World's Fair. Z/As have evolved since this time, yet this is a reminder of how colonialism and racism have shaped how they operate. While such exhibitions would never be tolerated today by responsible, accredited Z/As, nonetheless, it is important for all Z/As to consider their own history and how they influence current practices and community relationships.

Indigenous communities, social science scholars, and conservationists are increasingly identifying the continuing impact of colonial norms and values on conservation efforts, often manifesting as the imposition of conservation actions without either involving or benefiting the local communities (e.g., protection of lands without regard to the needs of local peoples, establishment of ecotourism without working with local communities, imposition of "bans"'while disregarding or without understanding local impacts (Lahiri, 2018; Reinl, 2013; Rodriques, 2019)). The awareness of the impact of colonial heritage was once limited to pockets of our society but is growing. With the mass adoption and usage of social media, the general public now has more direct access to personal narratives of the inequities that exist in society, a fact that has been made more visible during the pandemic, the current Black Lives Matter movement, and other social justice movements (e.g., Dakota Access Pipeline protests/#NoDAPL, #AllofUs combatting anti-immigrant/nativist rhetoric during the COVID-19 pandemic). This, plus the changing demographics in the United States and elsewhere, is challenging businesses and organizations to address issues of diversity, equity, and inclusion in the workplace and with those they serve (Tuck et al., 2014). This is the premise for the second key research question as well, moving from an internal look at organizational practices toward an external perspective of working with and within the community.

This key research question of the agenda acknowledges the need for Z/As to take an inward look at the profession and how they are situated in this larger national and international conversation. This question is intended to prompt Z/As to take a critical look at how and to what extent their operations and culture may be perpetuating inequitable societal norms and privileges and how to move toward more equitable and just practices. The sub-questions for this area encompass questions about zoo

and aquarium business operations, relationships and collaborations with others, and understanding their role in the historical and political landscape.

This key research question also provides an invitation for Z/As to engage staff and volunteers in participatory action research to raise awareness of the challenges that exist and to involve them in being part of the solution (Hall & Tandon, 2017; Madden et al., 2013; Reason & Bradbury, 2013). Through cycles of research, action, and reflection, staff and volunteers can not only help generate change within their organizations but also deepen the understanding of their organizational cultures (Lonetree, 2012). This may prove to be a fruitful approach for some aspects of this key research question.

Examples of sub-questions for this key research question include the following:

- How do Z/As design their businesses differently to maximize equity and avoid perpetuating the privilege that emanates from our colonial histories?
- How can conservation culture (i.e., bringing the conservation aspects of the organization's mission to life by integrating it into the operation) help drive this?
- How does cultural and political discourse impact zoo and aquarium policies, practices, and behaviors (including employee engagement/promotion/recognition/retention)?

Key Research Question #2: What Is the Role of Zoos and Aquariums in Communities, Including in the Context of Striving for Environmental and Social Justice?

Whereas the first key research question reflects an inward look at the zoo and aquarium profession, this key research question looks externally at the positioning of Z/As in a community and societal context. The sub-questions capture the many facets of this context, including what and how Z/As contribute to their local communities, how Z/As engage with communities, what communities expect from them, and what communities can contribute to Z/As. Indeed, in recent years, Z/As have started to shift from asking what they can do *for* a community to what they can do *with* a community. Some Z/As have started to adopt the North American Association for Environmental Education (NAAEE)'s Community Engagement: Guidelines for Excellence (2017) detailing effective practices for community engagement in the context of the environment. NAAEE's extensive set of guidelines could serve as another lens for pursuing this key research question. It should also be acknowledged that the term community means different things in different contexts. Defining community should be foundational to the pursuit of such questions as having been outlined in this new agenda.

This key research question also provides the potential to co-design studies with communities. By "co-design," we refer to "a process where people come together to conceptually develop and create things that respond to certain matters of concern and create a future state. In co-design processes, people come together despite, or

because of, their different agendas, needs, knowledge, and skills" (Zamenopoulos & Alexiou, 2018). As Sanders and Stappers (2014) say, "(i)n a co-design process, the roles change: the person who will eventually be served through the design process is given the position of 'experts of their experience,' and plays a large role in knowledge development, idea generation, and concept development" (p. 12).

The findings of this key research question would be a particularly unique contribution to the literature base of zoo and aquarium social science research. Some Z/As are already experimenting with the co-design of programs – and evaluations – with their communities; the co-design of research studies could be a natural progression.

This focus on work with communities has further elevated questions of environmental and social justice, particularly the roles that Z/As do and could play in confronting the reality that some communities and groups are disproportionately subjected to higher levels of environmental risk and degradation than others. Environmental justice can be defined as "the equal treatment and involvement of all people in environmental decision-making" (EPA, 2018). Examples include having fair and equitable access to adequate water, soil, and air quality (Skelton & Miller, 2016), but it has broadened to include issues of access to natural and/or green spaces, engagement with nature, food deserts, public health, and more (e.g., Wolch et al., 2014). Environmental and social justice are, not surprisingly, quite intertwined. Social justice is rarely well-defined in the literature, but – simply – can be defined as the view that everyone deserves equal economic, political, and social rights and opportunities (Novak & Adams, 2015). Again, these social, environmental, and public health inequities have been made even more visible during the current pandemic. There is a potential role for Z/As in promoting community interface and environmental education efforts that support both environmental and social justice (Haluza-Delay, 2013). However, for Z/As, this is still a relatively new way of thinking about their conservation missions and is oftentimes overlooked.

Examples of sub-questions for this key research question include the following:

- How can Z/As positively support communities to take action and develop resilience?
- What are effective strategies for zoos, aquariums, and communities to bring transparency and two-way dialogue?
- In what ways do Z/As contribute to the culture of the communities they are situated within? How do communities contribute to the culture of Z/As?
- In what ways can Z/As catalyze conservation ethics and/or amplify existing conservation ethics in the community? How can working with and learning from partners assist in this endeavor?

Key Research #3: What Is the Role of Zoos and Aquariums in Contributing to Social Change Toward Conservation?

These questions of societal norms and privilege, working with communities, and advancing environmental justice all contribute to the bigger goal of social change. This next key research question addresses the potential for Z/As to influence social values and culture toward measurable conservation impact and, specifically, two outcomes: (1) people and wildlife thrive together, and (2) Z/As become synonymous with conservation. Z/As have largely demonstrated they can positively affect people's conservation knowledge and attitudes (Clayton et al., 2017; Macdonald, 2015; Spooner et al., 2019; Yalowitz, 2004). In recent years, there has been more headway in understanding whether and to what extent Z/As contribute to an individual's behavior change, with some examples of successful behavior change, or at least conservation action (Pearson et al., 2014; Skibins et al. 2019). That said, findings from research in this area are oftentimes muddled with loose distinctions between interest and intent versus behavior change and often accept evidence of short-term, one-time conservation action as a proxy for sustained behavior change. There are fewer studies looking at the mechanisms and subsequent impact of community-wide change as a result of zoo and aquarium efforts. Key examples of studies of broader changes are Monterey Bay Aquarium's Seafood Watch Program (Kemmerly and Macfarlane, 2009) and Zoos Victoria's Kicking Goals for Wildlife program in Kenya (Squires et al., 2016). These broader, community-wide changes are key to understanding the potential role for Z/As in contributing to sustainable, larger social change. The current pandemic will be an important consideration moving forward, both in terms of how it affects the public's ability and interest to engage in conservation action efforts, and how the etiology of this pandemic – the wildlife trade – impacts people's attitudes toward wildlife in general.

This key research question also challenges Z/As to examine their own organizational cultures and how well the conservation aspects of their missions are integrated, that is, whether all employees feel that conservation is *their* mission. Internal evaluations thus far have supported the notion that organizations with a strong conservation culture are more effective in accomplishing conservation goals and improving employee engagement and perhaps even donor engagement (Searles, personal communication, 2019; Bumpus, personal communication, 2019). However, this is a relatively emergent area of focus for Z/As and warrants further empirical research. AZA's 2019 Conservation Culture Task Force synthesized a literature review about organizational culture that could inform this work moving forward (AZA, 2020b).

Examples of sub-questions for this key research question include the following:

- How can Z/As better embrace and model conservation behavior and social changes within our own institutions?
- How do Z/As define and measure conservation impacts at both human and wildlife levels? And how does one impact the other?

- How can Z/As shift focus and monitoring from simple actions to broader social change (i.e., empowerment/agency/norms)?
- How do Z/As identify existing partners/social change efforts to join, rather than work in isolation?

Key Research Question #4: What Is the Role of Zoos and Aquariums in Contributing to the Development of a Person's Intellectual, Social, Emotional, and Physical Well-being?

This key research question builds upon much of the work of the 2010 AZA Framework for Social Science Research and its deep roots in education. While this new agenda broadens the research lens, learning, engagement, and human development are still within its purview. This question is about the positioning of Z/As within an individual's life experiences, including but not exclusive to that of education and learning.

As the seminal publication on informal learning from the National Academies highlighted, learning in settings such as Z/As extends "lifelong, life-wide, and life-deep" (National Research Council, 2009, p. 28). While most are familiar with the concept of lifelong learning, life-wide (learning across social activities and settings) and life-deep (the influence of values and culture) learning are less common in public understanding. All three of these facets of human development and learning in the context of Z/As merit a closer look. The "Why Zoos and Aquariums Matter" (Falk et al., 2007; Fraser & Sickler, 2008; Fraser et al., 2020) studies have laid a considerable foundation in this regard.

One of the socio-emotional factors in this key research question area is addressing learning in social situations. It has been well established that zoo and aquarium guests often visit as a social unit (Falk et al. 2008); while we have gained some traction on family learning, broader questions about engaging different social units remain. Additionally, it will be of interest to examine the impact of the current pandemic and various aspects of our society (e.g., online learning, the digital divide, disconnection from nature) on learning overall.

Examples of sub-questions for this key research question include the following:

- What are the role and opportunities of Z/As in the broader learning ecosystem (e.g., within the community)?
- What barriers keep individuals from staying involved with Z/As as they shift life stages? How can Z/As think differently to mitigate those barriers?
- How can Z/As effectively co-design programs and experiences for different social units?
- What role do Z/As play in "social services"?

Key Research Question #5: How Can Zoos/Aquariums Maximize Their Systemic Impact on Conservation[1]?

Conservation efforts developed and managed by Z/As have grown significantly over the past decade. Financial support for field conservation alone has grown from $130 million in 2010 to over $230 million in 2019, and indicators suggest similar increases for specific tactics, including conservation education/advocacy, business operations and sustainability programs, and applied research (AZA, 2020a, c). Specifically, conservationists have become more strategic in their approach – putting clear goals and targets in place for sustainability (The Walt Disney Company, 2020; Cincinnati Zoo, 2020) and advocacy programs (e.g., 96 Elephants, Wildlife Conservation Society). Over this period, many field conservationists have begun taking a threat-based approach to conservation – first identifying threats to a given species or habitat, then strategically identifying actions to reduce or eliminate those threats. This has resulted in a much more systemic approach to conservation impact, with more conservation programs positioned to clearly articulate and measure real conservation impact (AZA, 2020c; Conservation Measures Partnership, 2020).

During this time, the multi-faceted nature of conservation has become clear; including the recognition that conservation fieldwork must address the human dimensions of conservation, rather than a limited focus on the biological dimension (Bennett, 2017). Similarly, increasing focus on sustainability/green practices requires a clear understanding of organizational culture and how to integrate sustainability into operational behaviors. However, the need for this multidisciplinary approach is not always considered when planning for, measuring the impact of, and communicating about conservation fieldwork. This key research question brings focus to the role social science research can play in advancing conservation goals.

As Maynard et al. (2020) found in their review of zoo and aquarium conservation efforts, very few initiatives articulate behavior change strategies as methods for reducing threats (although there are exceptions: see Kuhar et al., 2010, Lukas et al. 2019). Yet, people's behaviors are crucial to making a difference in conservation and often are the only way to address particular threats – whether that is through policy changes, individual behavior changes, or changes to social norms. Maynard and her colleagues (2020) propose a framework for integrating both the biological and social elements into conservation strategic planning and implementation; this is a critical area for maximizing the role of Z/As in conservation and one that is made even more critical given the considerable impacts of the COVID-19 pandemic on the conservation crisis facing our planet.

Examples of sub-questions for this key research question include the following:

[1] For this agenda, conservation is defined as: in situ/field conservation efforts (direct impact on animals/habitats in the wild); sustainability/green practices; connecting animal collection with the wild (e.g., reintroduction programs, applied research); and conservation education and advocacy (AZA, 2020).

- How can Z/As more effectively use social science research and tools to more effectively achieve their missions?
- How can Z/As better align and work in concert with the research, tools, and effective practices used by other biological and conservation disciplines?
- How can Z/As scale up from individual species to habitat level restoration/conservation/challenges?
- In what ways does conservation culture influence conservation impact? What are effective practices for doing this?
- What are effective strategies for Z/As to bring a lens of equity and social justice to their field conservation programs?

Discussion and Implications

Social science research has a crucial role to play in the future of Z/As; it should be the touchstone for conservation work, guiding zoo and aquarium efforts from education to community engagement to fieldwork. Social science research provides empirical data and evidence to support and inform the myriad roles Z/As do (or can) play in society. This next social science research agenda gives a nod toward the significant social science-based progress that has been made in the zoo and aquarium community while recognizing that society has evolved and so have the expectations and value of these institutions. The works highlighted in this book further support the key questions that have emerged in this new agenda.

Making It Happen

The longevity and success of this agenda are dependent on the support of many rather than a few. Practitioners, academics, professionals, students, and the AZA all have a role in helping make this work happen. The 2010 Framework was widely accessible but lacked a coordinated strategy for ensuring it was at the forefront of research and evaluation efforts. The new agenda will have a clearly articulated strategy not only to disseminate the framework among key audiences but also to assure that the agenda is reviewed regularly and assessed as to whether these critical questions are being addressed. The strategy will also include tactics to help bridge the findings of the research to practice within Z/As. It is imperative that this research be applied and adopted by those working in the zoo and aquarium community. The following elaborates on how this agenda and subsequent strategies could be disseminated and implemented by specific stakeholders working with and within the zoo and aquarium community.

AZA

The AZA has elevated the importance of social science research in the fabric of the zoo and aquarium community by supporting a research and evaluation initiative within its Conservation Education Committee and, more recently, through the creation and approval of a Social Science Research and Evaluation (SSRE) Scientific Advisory Group. These AZA groups, as well as key AZA staff, will serve as champions of this new agenda, working to connect institutions and individuals to potential research projects. These AZA groups will revisit the agenda on a regular basis and monitor progress toward bringing this vision of research to reality.

AZA Members

Individual AZA member organizations have an important role to play in advancing this new agenda. Many Z/As now have established positions or departments for carrying out evaluation and/or research efforts. These staff should maintain familiarity with the agenda and, when possible, seek opportunities to contribute to the key research questions. This may come in the form of internal studies, alignment of existing or future studies with the agenda, or engaging in multi-institutional studies. Regardless of the type of involvement, it is imperative that organizations have awareness of the agenda and understand the importance of this work for the future of Z/As.

Researchers

Academics, graduate students, and professionals conducting research and evaluation will largely be the ones on the ground carrying out the work that directly responds to the key research questions. This includes in-house evaluation personnel within Z/As who are uniquely positioned to contribute to both individual organization and field-wide understanding of these questions. This group of stakeholders must have encouragement and support to pursue these studies and to maintain working relationships with Z/As.

Broadening Perspectives

We recognize that many of the key research questions in this agenda may require interdisciplinary collaboration. Some of the key research questions are already well understood in different but complementary fields of work. For example, the field of environmental education and the North American Association for Environmental Education (NAAEE) have pursued questions of environmental justice for quite some time now. Key research questions that prompt a closer look at business

operations and work culture may benefit from research done on organizational development. The current pandemic will force us to think about epidemics, the potential of morphing attitudes towards animals, and the resulting impact on society globally. While Z/As have traditionally anchored social science research efforts in the work of conservation psychology or education research, this agenda calls for a broader lens, one that integrates perspectives and expertise from different disciplines.

Conclusions

The AZA Social Science Research Agenda 2020 is intended as a compass to guide the next decade of research around Z/As. It reflects the priorities, trends, and emerging issues that social scientists and practitioners in the zoo and aquarium community have identified as the most relevant to address in coming years. However, this is not to say that research which is positioned outside of these key research areas is not important; there is still much that can be studied to strengthen our knowledge base about the role of Z/As in society, conservation, and social change. In addition, it is imperative to continue to conduct an outcome-based evaluation of programs and experiences to maximize effectiveness and to demonstrate impact. Likewise, maintaining audience research studies is important to monitor visitation trends and to include the visitor's voice in decision-making. This agenda is not a directive for the exclusion of any of these other efforts.

We recognize that there may already be research efforts underway that address the key research questions. It will be important to raise awareness of these efforts and find alignment with the agenda. However, we anticipate that much of this work has yet to come to fruition. Starting new research, fostering interdisciplinary relationships, and cultivating collaborations will all take time. This is why it is even more important for champions of the agenda to keep it alive in conversations and planning and to make connections when possible.

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