Rongting Fan, Michael Lück

Conservation education at zoos and aquaria: Avoiding long distance travel to experience wildlife

https://doi.org/10.37307/b.978-3-503-24396-9.13

Abstract: *Raising awareness of biodiversity loss is an important goal of conservation science. Tourism observing wildlife in the natural habitat has long been believed to be the best way to convey conservation messages to the public. However, the often-required long-distance journeys to wildlife tourism destinations are unsustainable. In contrast, zoos and aquaria provide an alternative to observe and interact with wildlife in a local context. Many zoos and aquaria see themselves as avenues for conservation education. Research demonstrated that the provided conservation education often does not appear to be effective. To understand the potential and gaps of conservational education, qualitative research was conducted. Results show that interpretation may contribute to conservation education and the content can influence visitors' post-visit opinions. The main gaps include different understandings of definitions of conservation; and conservation issues were not the dominant category of the interpretation. This research proposes a model for better conservation education design.*

Keywords: *Conservation Education, Interpretation, Zoo, Aquarium, Interpretation Model*

1 Introduction

Towards the third decade of the 21st century, environmental problems and loss of biodiversity have become increasingly obvious and urgent around the world (Balakrishnan, 2018). Human induced habitat loss and wildlife extinction also negatively affect the subsistence of human beings. For example, deforestation caused by the expansion of cities and farms not only leads to the loss of wildlife habitats, but also to climate change and more extreme weather (Wu et al., 2021). The unprecedented pandemic of the coronavirus disease 2019 (COVID-19) resulted in more people thinking about the relationship between humans and wildlife. Most scientists believed that this new virus was transmitted from wild animals to humans (Shereen et al., 2020), and humans' invasion into wild habitats may cause more cross-species infections (Walsh et al., 1993). Therefore, conservation is not only related to the existence of wildlife, but also related to every human being (Mace, 2014). Conservationists also argue that the conservation goals of maintaining wild habitats and biodiversity cannot be achieved without the participation of the public (Ardoin & Heimlich, 2013). Thus, conservation education (CE) has become a significant domain, transferring concepts from conservation researchers to the general public, increases public awareness of biodiversity issues, and may change humans' behaviour towards a more biodiversity-friendly lifestyle (Spring, 2017).

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According to the Cambridge Conservation Forum (CCF), conservation entails the enhancement of ecosystems, habitats, species, and populations in the wild, without harmful effects on human well-being (Kapos et al., 2008). As the wild is an accepted definition in conservation science, it emphasises that the success of conservation should happen in the wild. It also indicates that the goal of successful conservation is not only related to the populations of individual species, but also the wider health of habitats and ecosystems, which are the foundation of wild populations. Referring to the goals of modern conservation science, Kareiva and Marvier (2012) argued that conservation science has the major goal of improving human well-being through environmental management, and the distinction between conservation science and environmental science lies in strategies to jointly extend subsidies to humans and biodiversity. A major underpinning of this concept is that humans depend on a healthy ecosystem to live, as much as wildlife does. Consequently, if all wildlife were extinct, humans would not be able to exist on Earth. Protecting the ecosystems for wildlife is equivalent to safeguarding a healthy environment for humans. Therefore, in the narrative of conservation, human beings are not only the saviour of wild species but are making efforts more for their own future.

With the permanent goals of promoting conservation beliefs and behaviours, CE addresses broad issues and contains a variety of activities. It can be supplied by conservation institutions and organisations, tourism attractions (nature reserves or parks), schools, and cooperatives. Whether CE can achieve its goal largely depends on the design and plan of the programmes. As Jacobson et al. (2015) argued, successful CE requires the providers to understand the demands, interests, and behaviours of their target population. Wildlife tourism plays an important role in informal CE, since visitors can receive conservational knowledge by reading or listening to interpretations during their visits. However, in many cases observing wildlife in their natural habitat requires (often long-haul) travel to remote locations. In contrast, the recently rising airfares due to increasing fuel costs (Pal & Mitra, 2022), personnel and aircraft shortages and other factors, may not be affordable for large parts of the general public any longer. This means that access to conservation education is limited for a large proportion of the population. Thus, the output of CE may be limited (Morris et al., 2007; Stern et al., 2008). Furthermore, travelling long distance by air also causes significant CO_2 emissions, and exacerbates the climate changing (Ritchie, 2020).

In contrast, zoos and aquaria provide an alternative where the public can observe and interact with wildlife in local settings: first, the main exhibitions in zoos and aquaria are wildlife, which are also the major target of protection in conservation; second, according to the World Association of Zoos and Aquariums (WAZA), zoos and aquaria engage a large number of visitors worldwide (more than 700 million per year); and third, most zoos and aquaria state that conservation is their primary mission (WAZA, 2021). Some studies have been conducted to determine whether zoos and aquaria have undertaken conservation work as well as they are claiming. Most of these studies involve education

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output as an important indicator for evaluating the conservation achievements of zoos and aquaria (Buckley et al., 2020). Some authors argue that zoos and aquaria are very successful in CE and have irreplaceable roles in conservation (Packer & Ballantyne, 2010; Pearson et al., 2014), whilst others argue that CE in zoos and aquaria is not sufficiently successful, and requires significant improvement (Kelly & Skibins, 2020).

Interpretation plays an important role in addressing environmental and conservational issues to the public, Orams (1997) proposed a model for improving environmental education through wildlife tourism. This model aims to promote behaviour change of tourists at ecotourism attractions. There are five main techniques in the model: 1) appropriate questions can inspire curiosity towards wildlife; 2) using stories can affect visitors' emotions of sympathy; 3) information concerning environmental problems and simple solutions can motivate visitors to act; 4) it is important to provide opportunities for the visitors to act, such as enrolling in conservational organisations and using environmentally friendly products; and 5) effectiveness assessment and feedback on the programmes is important for improving interpretations.

Why are opinions about CE in zoos and aquaria so controversial? To understand the potential and the gaps of conservational education to the public by zoos and aquaria, qualitative research regarding the contents of interpretive panels, organisational websites, and visitor reviews was conducted. This study also aimed to understand the role of the content of CE interpretations at zoos and aquaria. It also proposes a specific model regarding the content of interpretation for improving CE in zoos and aquaria.

This research selected Auckland Zoo (AZ) and SEA LIFE Kelly Tarlton's Aquarium (KT) as the two study sites. Their organisational functions met the requirements for the target sites of the research and data required for this research were available from these two institutions. AZ is the largest zoo in New Zealand, and located in the Western Springs area of Auckland, and home to more than 120 species in an area of 17 hectares. As one of Auckland's most famous attractions, it has welcomed more than 28 million visitors since its opening in 1922 (Auckland Zoo, 2021). AZ is operated by Auckland Unlimited (AU), an Auckland Council controlled organisation aiming to maximise cultural, social, and economic benefits for residents and visitors to Auckland (Auckland Unlimited, 2021). It is a not-for-profit wildlife conservation science organisation and has been involved in multiple conservation works. The staff of AZ established the Auckland Zoo Conservation Fund in 2000, which has received NZD four million for conservation projects in and out of New Zealand. The zoo is also successful in breeding and releasing native endangered insects and birds, which contributes to in situ conservation. SEA LIFE Kelly Tarlton's Aquarium, located close to Auckland's city centre on the waterfront of the Hauraki Gulf, is a well-known attraction featuring ocean creatures and Antarctic themes. It has the largest penguin colonies in captivity in the southern hemisphere, the only turtle hospital in New Zealand (SEA LIFE Kelly Tarlton's Aquarium, 2021), and welcomes

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citizens and tourists to discover the undersea world. Working with the SEA LIFE Trust, KT also participates in conservation work. Besides rescuing and releasing sea turtles, the aquarium organises beach clean-up activities.

2 Methods

Data collection for this research was conducted in three parallel phases from March to June 2021 (Table 1). First, the first author visited AZ and KT multiple times, photographing interpretive materials available to the public, to analyse the written content of the interpretation available. Second, pages of the official websites of the two institutions were investigated in order to identify the mission of the organisations. Third, reviews on TripAdvisor were captured and imported into Excel files, to study the views of the visitors. The study included reviews written between 1st January 2018 and 1st June 2021. The data collection yielded 584 visitor reviews on AZ and 644 visitor reviews on KT.

To analyse the interpretation material from the AZ and KT, this research adopted a manifest qualitative content analysis method. As Bengtsson (2016) argued, manifest analysis aims to describe what was stated with no interpretation of possible implicit meanings. This part employed a four-step procedure: 1) *Decontextualisation* (open coding), which suggests the segmentation of materials into small meaningful units containing useful information for answering the research questions; 2) *Recontextualisation* means to make sure all aspects of the necessary information have been coded; 3) *Categorisation*, which are groups of broader contents according to the research topic. The results of this step can be named as categories. 4) *Compilation*, serves as a bridge between the data analysis and the presentation of findings. It also reflects the researchers' role in the analysis process and their adaptation to the results (Bengtsson, 2016).

This research applied a reflexive thematic analysis method (Braun et al., 2019) to study data from the official websites and information panels of AZ and KT. This phase includes six steps: 1) *Familiarisation with data*; 2) *Generating initial codes*. Codes reflect a characteristic of the data relating to the analysis of questions and are basic elements of the raw materials. 3) *Searching for themes.* A theme captures something important about the data in relation to the research question, and is on a broader level than codes. 4) *Reviewing themes.* Suitable themes, their inter-relationships, and the relationships between themes and the whole data set should be clear and coherent. 5) *Defining and naming themes.* 6) *Producing the report.* Choosing the most vivid examples to demonstrate the themes (Braun et al, 2019).

This research adopted the netnographic method to analyse visitor reviews on TripAdvisor, after their visits to AZ and KT. According to Kozinets (2020), netnography is a type of qualitative research devoted to comprehending the cultural practices reflected in the threads and structures of social media. This research phase employed five steps: 1) *Collating* prepares data for coding. 2) *Coding* in netnography refers to breaking data into small meaningful segments and label-

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ling them. 3) *Combining* organises related codes into higher level elements, naming each as a pattern code. 4) *Counting*, as a quantitative tool, can also contribute to qualitative research, which accepts that the researcher makes comparisons between the identified or pattern codes. 5) *Charting* can help explain the findings of a netnographic study more clearly (Koznet, 2020).

Table 1: Data collection and analysis of the three research phases

Phase	Data Source(s)	Type of Data	Analysis
Phase 1: Content of Interpretation Panels	Interpretation panels throughout A and KT	Text data of information panels, photographed for analysis	Manifest content analysis
Phase 2: Content of websites	Websites of AZ (https://www.aucklandzoo.co.nz/) and KT (https://www.visitsealife.com/auckland/)	Text data on websites, specifically mission statements	Manifest content analysis
Phase 3: Visitor reviews of AZ and KT	TripAdvisor	Text data	Netnography

Source: First author

3 Findings

3.1 Contents of interpretive information

Interpretive materials are important media that convey information from attractions to their visitors. The content is crucial to the learning experience and has to be engaging but also factually correct.

3.1.1 Main contents in the interpretive information at Auckland Zoo

At AZ, an abundance of interpretations is delivered to visitors, an example is shown in Figure 1. Although the types, styles, and emphases of the interpretation panels vary between different exhibition zones, they can be categorised according to the content of the textual information. In general, six categories of contents were identified: biological knowledge, knowledge about animal habitats and ecosystems, Māori culture, conservation information, information about the zoo and its work, and visitor information. The proportions of the content in the six categories were uneven. Biological knowledge was the most dominant category of AZ's interpretations, including names, distributions, classifications, physical features, habitats and adaptation, behaviours, and values. Codes in this category occupied nearly half of the interpretation content. "Conservation information" was the second category in the content of interpretation materials at AZ, although the number of codes was only about half that of the first category. There are four sub-categories of this category: species' endangered facts and reasons, conservation advocacy, conservation history and achievements, and conservation programmes and methods. The first two sub-categories were the dominant contents in this category. There were also interpretations

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introducing the zoo and its work. The three sub-categories in this category are work of the zoo, organisational information, and zoo animals. Visitor information was considered a vital part, providing promotions, locations, and timetable information to visitors. Knowledge about ecology and Māori culture, as supplementary knowledge, enriched the interpretation content of AZ.

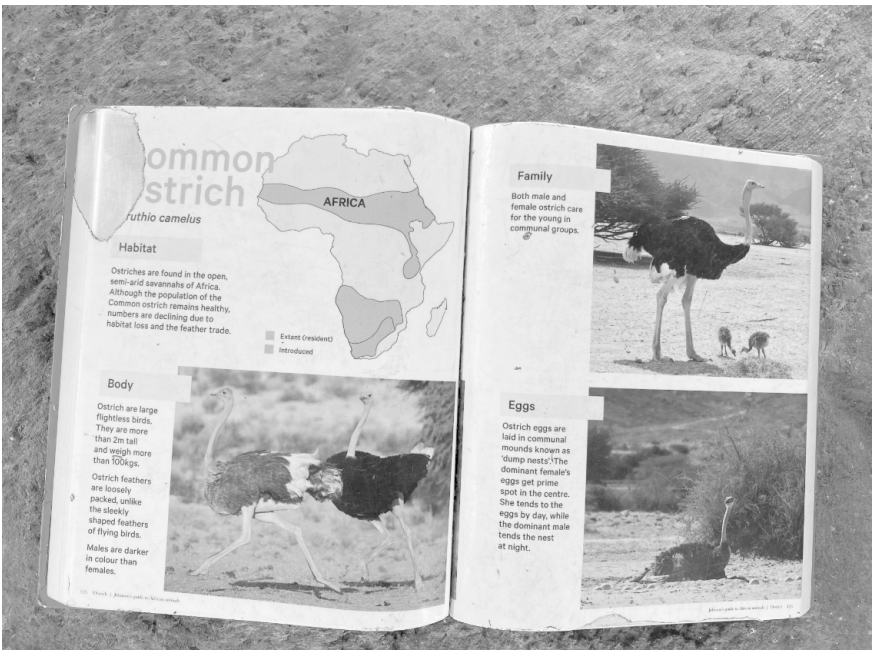


Figure 1: Interpretive Panel in the Africa Track, with Information about the Common Ostrich

Source: First Author

3.1.2 Main contents in the interpretive information at SEA LIFE Kelly Tarlton's Aquarium

KT provided rich textual interpretations for visitors in an indoor environment, see the example in Figure 2. The major categories of the interpretive materials were biological knowledge, conservation and environmental information, information about the aquarium and its work, visitor information, knowledge about Antarctica, ecology knowledge, Māori culture, and brain teasers. Biological knowledge was the dominant content at the aquarium, followed by conservation and environmental information, and information about the aquarium and its work. Visitor information was also a vital part of the aquarium. The aquarium also provided knowledge about Antarctica, ecology, Māori culture, and some brain teasers to enrich the interpretations.

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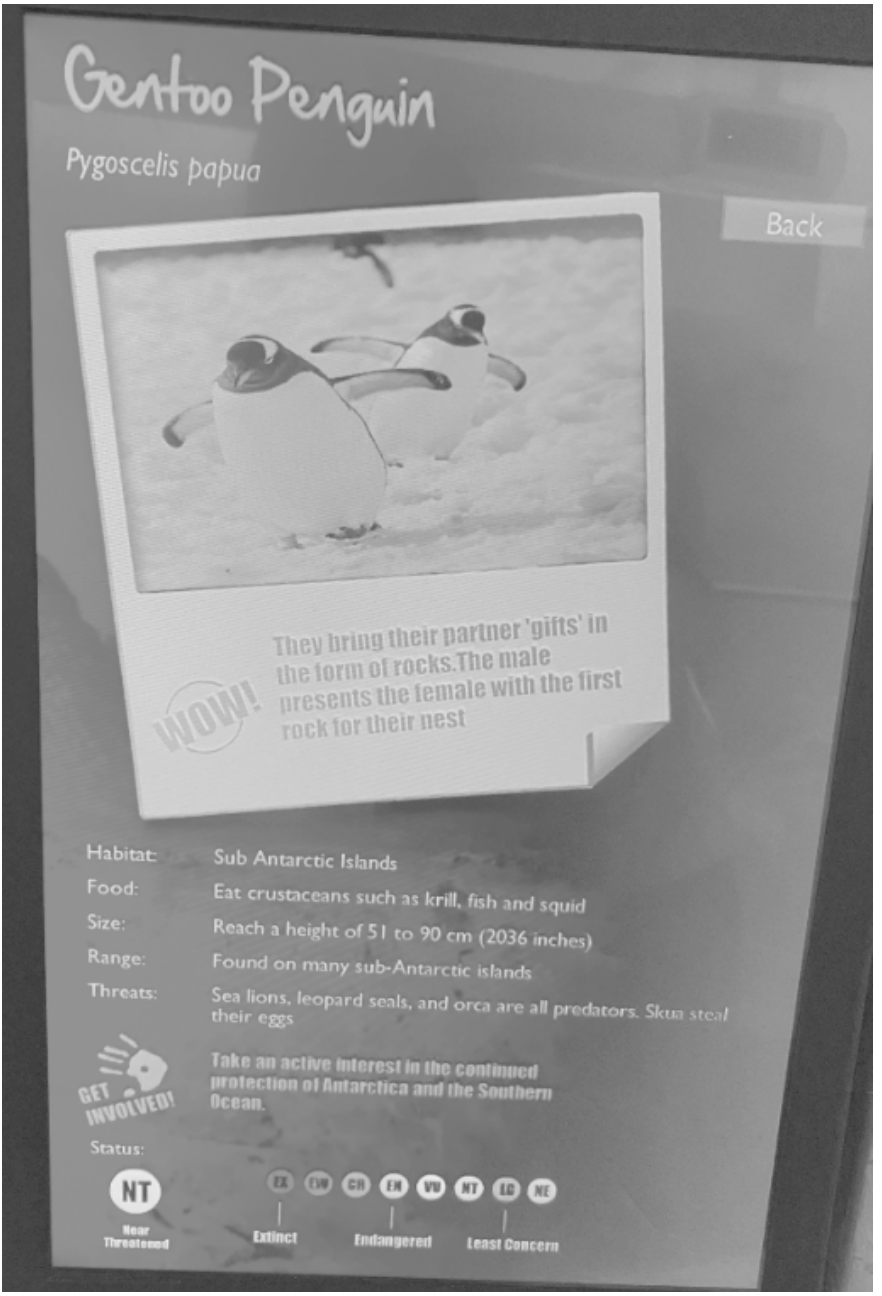


Figure 2: An Example of Electronic Panel in SEA LIFE Kelly Tarlton's Aquarium
Source: First author

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3.2 Organisational mission and conservational work

An organisational mission is crucial for most organisations, and the foundation for the strategies and actions of the organisations. Mission statements of zoos and aquaria commonly include conservation and education elements (Maynard et al., 2020) and guide the contents of interpretation materials. Conservation work conducted by zoos and aquaria provided materials for the CE interpretations at the attractions. The official websites of both AZ and KT provided specific information about their organisational missions and conservational work.

3.2.1 Organisational mission and conservational work of Auckland Zoo

AZ mentioned its mission several times on its website. Although the descriptions were slightly different, the main ideas were similar and presented as Theme Z1: *The mission of AZ is to bring people together to build a future for wildlife*. Two elements demonstrated the organisational mission of AZ, Sub-theme Z1-1: *to build a future for wildlife*, and Sub-theme Z1-2: *to bring people together*.

"To build a future for wildlife" was the ultimate goal of the mission statement. There was some information on the official website explaining the kind of future for wildlife that the zoo aimed at: "A future where people value wildlife, and species are safe from extinction." It was evident that "a future" referred to all species being safe from extinction. It was also observed that the zoo used an absolute expression, "all," and emphasised a future when no species would become extinct. Furthermore, the mission statement did not indicate whether it referred to the future for wildlife in the wild or in captivity. The zoo also stressed that the future for wildlife is not naturally formed but "being built" by the zoo and other people. The second sub-theme indicated that AZ sought to unite and lead the public to achieve its ultimate goal. As a popular attraction with a group of experts, the zoo did have the potential to impact and lead the public to make efforts to meet its goal. In terms of targeting people, the website explained that the zoo had welcomed over 28 million visitors since its opening. In terms of professionalism, AZ was clearly proud of the advanced work of zookeepers and staff of the vet hospitals.

As the website also explained, "in practice, this [mission] is wildlife conservation science at work or what we here at the Zoo call Wild Work." The statement stressed that "Conservation is at the heart of Auckland Zoo." Theme Z2: *Everything we do at Auckland Zoo directly contributes to our conservation efforts*. In practice, their conservation work includes five sub-themes. Z2-1: *Care for zoo animals with humanisation*. As AZ considers caring for zoo animals as its most important conservation work. Z2-2: *Wild work*. The wild work of the zoo comprised a range of work, such as fieldwork in and outside New Zealand, breeding and releasing programmes for endangered species, and rescues of injured or sick wild animals. Fieldwork referred to the work zoo staff conducted in the wild, such as pest control, health checks for endangered species in the New Zealand wild, and conservational work overseas. Z2-3: *Conservation fund*. The zoo's conservation fund provided economic support for various conservation efforts, and

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visitors could donate to the zoo feeding through the fund. The fund also supported zoo staff's fieldwork and the conservation work of overseas NGOs. Z2-4: *Sustainable management of the zoo*. AZ information stated that minimising the environmental impact was another important part of assisting conservation work. Z2-5: *Connect people with wildlife conservation science*. The zoo staff tried "to connect people with wildlife conservation science" through education, sponsorship, and its conservation fund. Education from the zoo consisted of both education programmes for school students and free choice learning to the public through interpretations at the attraction.

3.2.2 Organisational mission and conservational work of SEA LIFE Kelly Tarlton's Aquarium

KT did not address its organisational mission with conservational issues. Instead, it stated its vision about the conservation of ocean creatures and their environment. Theme A1: *Our vision is of a world where our oceans are healthy, properly protected and full of diverse life*. The aquarium first emphasised the health of the oceans and that the ocean should be properly protected. This statement implied that without active protection, our oceans would not be able to maintain their health. It also suggested that the result of healthy oceans is that they could be full of diverse sea life.

Conservation is one of the most important tasks of SEA LIFE Kelly Tarlton's Aquarium. Theme A2: *The aquarium cares for and creates love for the oceans and lovely ocean creatures*. The aquarium did not provide an obvious theme of the aims of conservation work but expressed love for animals and the sea. Their conservation work includes four parts. A2-1: *Wildlife rescuing and releasing*. Marine wildlife rescuing and releasing was the main conservation practice of the aquarium. Tanks for exhibition in the aquarium provided a refuge for sick turtles, where they could recover and prepare for being released. A2-2: *Conservation trust*. According to the website, a non-profit organisation, the Kelly Tarlton's Marine Wildlife Trust, was created mainly for raising funds to cover the cost of the rescue and rehabilitation of sea life and scientific research. A2-3: *Sustainable management of the aquarium*. The aquarium's website emphasised efforts to reduce the use of plastic by removing plastic bags and encouraged visitors to use their own cups for a discount on their café purchase. A2-4: *Community involvement*. The aquarium provided some tips for the public to ensure responsible activities for wildlife and the environment. Staff organised conservational events to engage communities in their conservation work. They also advocated for donations from the public to their conservation trust and SEA LIFE Trust.

3.3 Visitors' reflections on conservation issues

Visitors' opinions on the conservation content provided by an organisation – in this case AZ and KT – may provide valuable insights into the success of such efforts. It is acknowledged that these are highly subjective, and different visitors experience zoos and aquaria differently; however, it is claimed that many orga-

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nisations design their educational content based on factors other than visitor preferences and thus miss the mark with their success.

Publicly available visitor statistics about AZ and KT are limited but Auckland Tourism, Events and Economic Development (ATEED) states that 28 % and 20 % of domestic tourists visit AZ and KT, respectively (ATEED, 2020). Furthermore, Toitū Envirocare (2024) noted that AZ is visited by 50,000 school students each year.

3.3.1 Visitor reviews of Auckland Zoo and their reflections on conservation issues

As reviews online about any attractions, visitor reviews of AZ reflected the authentic feelings of the visitors after their visits. It was found that the main concerning aspects of the reviews included feelings around seeing animals, concern for animals' welfare in captivity, complaints about unpleasant confrontations, and understandings of the functions of the zoo. There was also some information about visitors' profiles. It shows that one of the most important aims for visitors to visit the zoo is to see animals. Pattern codes were generated for understanding visitors' views regarding conservational issues in the zoo.

Pattern code Z1: Concerning animal welfare. Reviews also showed that visitors not only cared about seeing animals, but also about the welfare of animals in captivity. A main theme of the review data showed that visitors expressed concern for zoo animal welfares, such as the enclosure conditions and care provided at the zoo. As part of this, visitors expressed concern about the animal enclosures.

Pattern code Z2: *Conservation work is a main focus of the zoo*. Ten reviewers believed that the zoo stressed conservational work a great deal. For example: "Conservation is obviously a priority for Auckland Zoo. Kudos!" (AZ 1).

Pattern code Z3: *Visitors' understanding of conservation work of the zoo*. Reviewers expressed their feelings about specific conservation work by the zoo, such as animal welfare, rescue and captive breeding programme, sustainable management of the zoo, conservation funds, and inspiring conservation understanding. A few reviews discussed the breeding programme for native endangered animals.

Pattern code Z4: Interpretations. Less than ten percent of the reviews discussed interpretations and information provided at the zoo. Most of these were positive about the information and some learned animal information from the signs, especially from information about native animals. Visitors also found that information on panels not only provided concise biological information but also specific facts about the animals. About one third of the reviews referring interpretations argued that the signs did not provide enough information and needed improvement.

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3.3.2 Visitor reviews of SEA LIFE Kelly Tarlton's Aquarium and their reflections on conservation issues

Similar to reviews of AZ, reviews of KT were related to visitors' feelings about exhibitions, their complaints, their understanding of the function of the aquarium, and animal welfare. Seeing exhibits in the aquarium was the most frequent topic in the reviews.

Pattern code A1: *Concerning animal welfare*. An interest in animal welfare was not very dominant in the reviews. Overall, only a small number of reviewers believed the animals were well cared for and in good condition. However, there was more concern at KT than at AZ, where reviewers thought that the aquarium did not provide appropriate enclosures for animals in captivity, especially observing that the penguins' enclosure was too small for so many penguins.

Pattern code A2: *The aquarium makes some effort to preserve animals and the environment*. About ten visitors mentioned the conservation work of the aquarium, mainly in two aspects: protecting wildlife, and the marine environment. Another ten reviews were related to the turtle rescue and rehabilitation programme, which was the most noticeable conservation work of the aquarium and is discussed in the next pattern code. Two reviewers had positive attitudes towards the conservation education effect of visiting the aquarium. However, a few reviewers assessed the conservation of the aquarium critically. Some argued that some aquarium business practices were inconsistent with their conservational concepts, such as "selling plastic gifts." (KT 1) Another visitor thought that in a conservational organisation, penguins in captivity should be rescued and released, but not living in captivity lifelong.

Pattern code A3: *Turtle rescue and rehabilitation*. Some visitors were impressed by the rescue and rehabilitation of sea creatures, especially the work for rescuing sea turtles. For example, "Good experience very informative along with the information that they are a rescue centre who assist sea life back into the environment they came from." (KT 2). However, a few visitors were conflicted about the rehabilitation programme, since they wanted to see more turtles in the aquarium.

Pattern code A4: *Interpretations*. Over ten percent of the reviews were related to information provided by the aquarium. Over 30 reviewers thought the aquarium was very informative: "Very interesting and informative with an awesome range of sea life." (KT 3) Some visitors noticed the interpretations of Scott Base and the Antarctic, and information about the founder of the aquarium, Kelly Tarlton. A few reviews mentioned the turtle rescue programme.

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4 The potential and the gaps of conservational education to the public by zoos and aquaria

4.1 The potential

Modern zoos and aquaria have been recognised as educational and conservational attractions and have the potential to transmit conservation education to the public. Interpretive materials at the attractions can play important roles in transferring conservational concepts to visitors. The findings of this research supported these arguments in two aspects: the target population, and visitors' attention to interpretations. Zoos and aquaria host a large number of visitors, and these visitors are the targets of CE. As the World Association of Zoos and Aquariums (WAZA) claimed, zoos and aquaria around the world attract an immense number of visitors each year (WAZA, 2021). However, the target population of CE is the general public, who are not experts in conservation issues (Thomas et al., 2018). The profiles of visitors of AZ and KT suggested that most of the visitors were general New Zealand residents without much conservational background. Results from the reviews of the zoo and aquarium showed that most of the visitors were families. Therefore, zoos and aquaria such as AZ and KT, have the privilege of imparting CE to the public.

4.1.1 Interpretation may contribute to conservation education

Comparing findings between the contents of interpretive information with their conservational work, it was found that the interpretation reflects the conservation work conducted by the zoo and the aquarium. It helps to transmit this work to the public. Firstly, interpretations at the zoo represented how the zoo cared for animals. Secondly, interpretations at the zoo also presented the "wild work" of the zoo. As identified in Sub-theme Z3-2, the wild work of AZ included fieldwork, breeding and releasing programmes, and rescues of injured or sick wild animals. These efforts of the zoo were also presented in interpretations. Thirdly, regarding the zoo's conservation fund, some panels at the zoo encouraged visitors to donate to the fund. Fourthly, interpretations at the zoo connected visitors with wildlife conservation science in two ways: on one hand, interpretations conveyed conservational knowledge and information to the public. Many interpretations at the zoo were related to this, such as endangered species facts and reasons, conservation history and achievements, conservation programmes and methods, and most of the information regarding work of the zoo. On the other hand, interpretations told visitors how to contribute to conservation work in practice, which was evident in conservation advocacy.

Interpretations at the aquarium reflected some of the conservation work of the aquarium as well. Theme A2 showed that KT conducted conservation work as an expression of love for the ocean and sea creatures. There were four subthemes under this theme: wildlife rescue and release, conservation trust, sustainable management of the aquarium, and community involvement. Firstly, there were interpretations about the aquarium's wildlife rescue and releasing

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work, especially the sea turtle rescue and rehabilitation work. Secondly, interpretations were found regarding the SEA LIFE Trust. Thirdly, information on a rubbish bin stated that the aquarium was selling compostable coffee cups, which was related to the sustainable management commitment of the aquarium. Fourthly, regarding community involvement, the interpretation provided conservation tips for visitors and some conservational slogans and advocated for donations. There was also a banner at the entrance area of the aquariums, illustrating beach cleaning activities organised by the aquarium. Overall, interpretations at the aquarium partially reflected its conservation work, although information was not provided in detail.

4.1.2 The content of interpretation can influence visitors' opinions after their visit.

Comparing findings from visitor reviews on TripAdvisor and those from interpretive materials at the two attractions, it was evident that some visitors noticed interpretive materials and agreed with the main contents of the interpretations. First, both visitors to the zoo and the aquarium mentioned information about interpretations, which showed that visitors do pay attention to interpretations at attractions. Second, visitors showed their general feelings about the attractions in reviews, which may have been influenced by interpretations, as reviews about the educational and conservational functions of the attractions may have resulted from the visitors' reading of the interpretations at the attractions. For example, visitors believed that they could learn animal names and facts when visiting the zoo and aquarium. Coincidentally, Category Z1 and Category A1 showed that most interpretations of the zoo and aquarium were about basic biological knowledge. Third, the main contents of visitor reviews agreed with the main categories of the interpretations at the two attractions. Visitors to both attractions cared about seeing animals during their visits, and they noticed animals' morphological characteristics and behaviours. While biological information was the most dominant category of the interpretations.

Visitor reviews regarding conservation issues numbered around 30 for each attraction, showing that not many visitors were commenting about conservational issues. One reason for this might be because conservation interpretations were not the major themes at the attractions. Another reason might be that visitors are not particularly concerned about this issue when visiting a zoo or aquarium and thus do not share such thoughts in their reviews. However, the pattern codes regarding conservational issues reflected the interpretations at the attractions. First, visitors' understanding of the importance of the conservation work of the two attractions agreed with the interpretations, which reflected the organisational missions and visions of the zoo and the aquarium. As Pattern code Z2 and Pattern code A2 showed, visitors could see that conservation work was emphasised by the zoo, and that the aquarium made efforts to preserve animals and the environment. Additionally, information about specific conservational knowledge and work can also contribute to visitors' understanding of how the zoo stresses its conservation work. Visitors stated that the aquarium

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made some effort to preserve animals and the environment, which agreed with interpretations at the aquarium. Second, visitors' understandings of the main conservational work of the zoo and the aquarium agreed with that shown in interpretations. As Pattern code Z3 showed, visitors could see multiple kinds of conservational work conducted by the zoo. Some reviews linked animal welfare with conservation work, as the zoo emphasised in its interpretations. Visitors also mentioned rescue and captive breeding programmes, sustainable management of the zoo, and how their tickets contributed to conservation funds. The most likely information resource for these reviews was the interpretations at the zoo. Visitors to the aquarium considered that the most important conservation work of the aquarium was the sea turtle rescue and rehabilitation programme, as Pattern code A3 showed. This also agreed with the findings of Sub-category A3-1, which showed that the most important work of the aquarium was the turtle rescue and releasing programme. Therefore, visitors' reflections on conservation issues after their visits to the two attractions agreed with conservational interpretations at the attractions.

4.2 The gaps

4.2.1 Different understandings of definitions of conservation

The definition of conservation is the most important issue in understanding CE, the content of CE, and the relationships between interpretations and CE. During the analysis of data, it was found that AZ and KT have different understandings of conservation than conservation experts. Therefore, before discussing how the content of interpretation may contribute to CE, it is important to discuss the definition of conservation from different viewpoints and identify any inconsistencies.

In contrast, AZ, as a member of the World Association of Zoos and Aquariums (WAZA), has a different understanding of conservation. As presented before, AZ claimed that conservation was at the heart of its work. As a conservational organisation, the zoo stated its organisational mission to be *"to build a future for wildlife, where people value wildlife, and species are safe from extinction."* This mission statement showed that the zoo emphasised more the species level, and successful conservation to the zoo meant no extinction of any species. The zoo did not indicate the future of wildlife being either in the wild or at the zoo and did not provide much information on why they should conduct conservation work. Additionally, the zoo promoted the idea that caring for animals in captivity is the most important conservation work. AZ's understanding of conservation could also include the understandings of WAZA, since WAZA also values caring for zoo animals in its conservation strategy (WAZA, 2005). Additionally, KT considered healthy oceans as the foundation for the maintenance of the sea. The aquarium suggested that doing conservation is an expression of love for the oceans and wildlife living in the oceans.

From this information, it is evident that conservation scientists and AZ and KT hold different understandings of the definition of conservation in three aspects.

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First, most conservation scientists believe that conservation means the maintenance of both species and their ecosystems in the wild. KT held a similar understanding to those of conservation scientists on this point. However, AZ focused only on the non-extinction of species, and did not emphasise that the objectives of conservation work should be animals in the wild. As existing research shows that a large proportion of animals in captivity cannot live independently in the wild, conserving animals in their wild ecosystem and protecting animals in captivity are quite different (Kapos et al., 2008). Second, conservation scientists argue that the ultimate goal for conservation is to protect the ecosystem where humans live, whereas AZ and KT did not emphasise this goal. In their statements, the foundation for conservation work is more related to emotional and ethical reasons.

Third, in the context of conservation science, caring for animals in captivity is not an important issue, but at AZ, caring for zoo animals was the most significant of its conservation work. Caring for zoo animals is related to animal welfare and the relationship between animal welfare and wildlife conservation has been debated for some years (e.g., Hutchins & Wemmer, 1987). It is believed that these two topics belong to two different domains and are sometimes contradictory in specific circumstances, since conservation science is primarily concerned with species and ecosystems, while animal welfare primarily refers to individuals. The origin of animal welfare is related to farm animals and pets that are under the control of humans (Paquet & Darimont, 2010). Thus, animal welfare is mainly a topic related to the treatment of captive animals. The welfare of zoo animals is an extension of this topic, as zoo animals are also in captivity. Animal welfare may contribute to wild animals' conservation (Paquet & Darimont, 2010), because according to animal welfare logic, humans should not hunt wild animals. However, sometimes animal welfare may be inconsistent with wildlife conservation. For example, when pet cats and dogs are allowed to wander in wild areas, they can have devastating effects on birds and other animals. Additionally, the welfare of zoo animals may help them live a high-quality life but may not contribute to their wild population recovery. Therefore, animal welfare and wildlife conservation are two different topics. According to this analysis, the zoo and the aquarium used the concepts of conservation and animal welfare interchangeably.

4.2.2 *Conservation categories at Auckland Zoo and SEA LIFE Kelly Tarlton's Aquarium*

In order to explore the content of CE provided through interpretations at AZ and KT, this research categorised textual interpretations at the two attractions. Interpretations of the zoo were grouped into six categories: biological knowledge, knowledge about animal habitat and ecosystem, Māori culture, conservation information, information about the zoo and its work, and visitor information. The major categories of the interpretive materials of the aquarium were biological knowledge, conservation and environmental information, information about the aquarium and its work, visitor information, knowledge about Antarc-

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tica, ecology knowledge, Māori culture, and brain teasers. It was found that both organisations provided plenty of knowledge in their interpretations, and basic biological knowledge was the dominant category, although conservation information was also provided in the interpretations. Conservational interpretations at the zoo were more specific than were those at the aquarium. The aquarium also addressed ocean environmental issues in its interpretations. These findings show that conservational issues were important content in interpretations of the two attractions, but not the most stressed part.

4.2.3 Other issues regarding the content of interpretations towards conservation education

Generally, AZ and KT both achieved some success in CE, since both attractions addressed conservation issues in their interpretations. Additionally, visitor reviews showed that the zoo seemed more successful than the aquarium in CE, as more visitors believed that the zoo was a conservational organisation and gave positive reviews about CE at the zoo. The reasons for this can be considered from three perspectives: firstly, the zoo presented its conservation mission in the interpretations, which was therefore very obvious for visitors. Secondly, the zoo provided scientific facts and statistics about biodiversity issues, which were objective and scientific. Thirdly, the zoo provided specific information regarding the reasons for population decline and procedures for the conservation of some species. This information may have helped visitors understand more about conservation.

Not many visitors expressed their post-trip behaviour changes in the reviews at neither of the two studied attractions. Despite the reasons discussed before, this paragraph discusses some other reasons associated with the weak commitment to conservation issues. First, the conservational theme in the interpretations of both attractions was not clear, and mixed with information about animal welfare, adorable characteristics, and stories of individual animals. This directed visitors' attention to topics other than that of conservation, such as caring for captive animals and being willing to contact animals up close. Second, interpretations of the two attractions did not provide clear information about why humans should protect biodiversity. Thus, visitors could not see the relationships between conservation and their lives, so did not experience much motivation to change to conservational behaviours. Third, some interpretations were not rigorous. For example, the aquarium stated the threat of sea turtles as humans and sharks that feed on adult turtles. There were two problems in this interpretation; firstly, sharks are natural predators of sea turtles, so should not be seen as a threat for a species, according to conservation science (Washington, 2019). Secondly, this interpretation did not explain the relationship between boat collisions, pollution, and hunting for turtle eggs, which are the main human-induced threats to sea turtles (Alae Eddine et al., 2020; Mejias-Balsalobre et al., 2021; Sala et al., 2021). The zoo also demonstrated similar shortcomings in the interpretations of their mission, as information argued that the zoo was willing to build a future for wildlife where there would be no extinction

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anymore. However, species extinction happens in nature, so conservation science focuses only on human-induced extinctions (Washington, 2019). Due to this kind of interpretation, visitors may become confused about the main problems of conservation, which may lead to less behaviour change. Fourth, some interpretations in the zoo were not objective, as they over-emphasised their contribution to conservation work and persuaded visitors to contribute just by visiting the zoo or donating to their conservation fund. This information may have misled visitors to believe that conservation is the zoo's work but not that of individuals. Most conservation experts agree that conservation does not depend on conservationists, and without the participation of the public, conservation goals will never be achieved (Mace, 2014). Indeed, visitors could contribute more to conservation through their everyday behaviour than by visiting the zoo.

5 Making conservational education in zoos and aquaria more effective

5.1 Adjusting organisational understanding of conservation to conservation science

This research identified organisational understanding of conservation as an important factor in the CE of zoos and aquaria. It is also determined that although AZ particularly emphasised conservation, its understanding of conservation was different from that of conservation science. AZ considered caring for captive animals as the most important conservational work, but most conservation scientists do not emphasise this aspect. This unexpected inconsistency could profoundly influence the effectiveness of CE in zoos and aquaria, because an over-emphasis on caring for captive animals may not lead to conservational behaviour. Therefore, to achieve a better conservational effect through CE, more adjustment of the approach of zoos and aquaria to that of conservation science is required.

Both zoos and aquaria, and conservational organisations can make efforts to improve CE in such attractions. Firstly, most zoos and aquaria claim that they prioritise conservation work, but they need to be clear about their conservation and CE goals. Certain conservation goals as presented by the Cambridge Conservation Forum, can contribute to the public's better understanding of conservation issues (Kapos et al., 2008). Secondly, more cooperation between zoos/aquaria and conservation organisations without captive animals is required. Through this cooperation, interpretations at zoos and aquaria may be closer to the perspectives of conservation science, so visitors can receive more comprehensive information about conservation issues.

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5.2 Improving conservation education effectiveness through appropriate interpretation design

5.2.1 The role of content of interpretations and interpretation design in conservation education

As discussed, the content of interpretations at zoos and aquaria may influence visitors' conservational learning, and various factors can affect the content of interpretations. This section discusses the role of content of interpretations in CE and the relationships of relevant factors, by proposing a relationship map, as presented in Figure 3.

Visitors' CE learning is the goal of CE interpretations at zoos and aquaria. Two important factors have been discussed as affecting visitors' CE learning; one is the content of interpretation, and the other is visitors' understanding of animal and conservational issues. This research argues that visitors' understanding of animal and conservational issues is affected by the content of interpretations in zoos and aquaria, as findings from this research showed that visitors do notice and learn from interpretations during their visits.

This research identified factors of CE in zoos and aquaria. Organisational missions, functions, and the understanding of conservation, are significant factors influencing the content of interpretations in zoos and aquaria. Visitors' profiles and their understandings of animal and conservational issues may also affect the content of interpretation, which should be considered by interpretation designers. Therefore, interpretation design may be an important procedure that serves as a bridge linking the influencing factors with the content of interpretation.

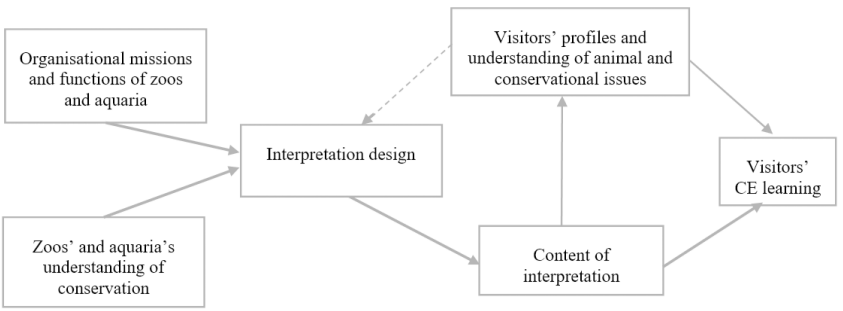


Figure 3: The Role of Interpretation Content in Conservation Education
Source: Author's work

5.2.2 A model for effective conservation education interpretation design at zoos and aquaria

The content of interpretation is an important factor influencing visitors' CE learning, as it not only affects visitors' CE learning directly, but also indirectly,

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by influencing their understanding of animal and conservational issues. This research argues that interpretation design commonly dictates the content of interpretation. Thus, this section proposes a model for effective CE interpretation design at zoos and aquaria, which is a content-centric model based on Orams' (1997) model.

This content-centric model includes four phases, as shown in Figure 4. The first phase is that of conditions and considerations, which are crucial for the interpretation design. Before designing interpretations for zoos and aquaria, it is imperative to consider information from both organisational and visitors' perspectives. Organisational missions and functions are guidelines for interpretation design, so it is important to adjust organisations' understandings of conservation to those of conservation science. An appropriate interpretation design also needs to consider visitors' profiles and their conservation foci, which determine their tolerance and capacity for CE interpretations. After clarifying the conditions and considerations of interpretation design, the second phase is that of pre-interpretation design. This step sets a structure for the interpretation design at zoos and aquaria. In this phase, clear CE goals and the proportion of CE in interpretations needs to be determined. The CE goals should agree with conservation science and can be composed of a strategic goal and some sub-CE goals. The sub-CE goals may be associated with some conservational programmes.

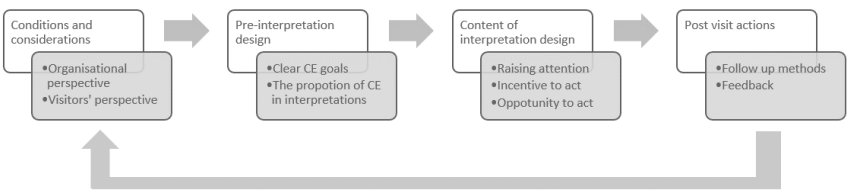


Figure 4: A Model for Effective Conservation Education Interpretation Design at Zoos and Aquaria

Source: Authors

The third phase of the content of interpretation design is the core phase of this model. The content of CE interpretation is divided into three parts derived from Orams' (1997) model. As Figure 4 shows, the content of CE interpretation includes raising attention, incentive to act, and opportunity to act. Specific information is suggested for each part, as shown in Figure 5. There are some differences between the raising attention aspect of this model and Orams' (1997) model. In Orams' model, interpretations can use the affective domain and curiosity to increase public attention to conservation issues, but as discussed in this chapter, visitors' thinking about animals and conservational issues have changed, and too much emotional connection may lead to undesirable outcomes for conservation. Therefore, a more scientific basis to encourage public

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attention is emphasised in this model. This could address topics in relation to why everyone needs to participate in conservation work, the facts of endangered animals, human induced reasons, and the effects of species extinction. This research argues that conservation is not only the work of conservationists, but of every human, because if all animals disappeared, the environment would no longer be suitable for humans. This point should be emphasised in the interpretations at zoos and aquaria.

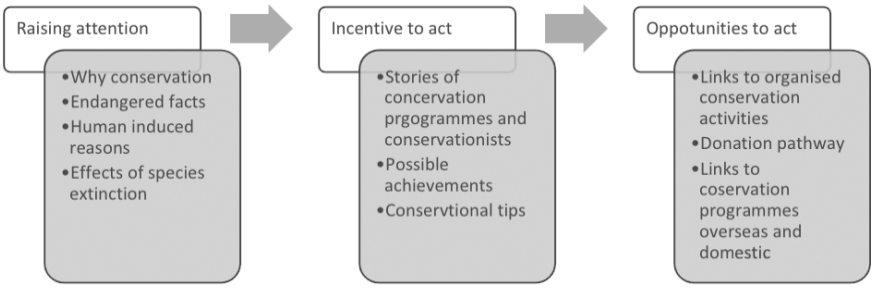


Figure 5: The Specific Content of Interpretation Design
Source: Authors

Content encouraging visitors to participate in conservational behaviour could include stories of conservation programmes and conservationists, possible achievements for the public, and conservational tips to practise in their daily lives. This research also argues that zoos and aquaria could provide more opportunities for visitors to participate in conservational activities. Besides donation boxes, they could provide QR (quick response) codes for visitors who want to donate through an online payment system, and application forms for local organised conservation activities and links to conservational programmes, both overseas and domestic.

The last phase of this model is that of the post-visit actions, which could extend the effects of interpretations. Zoos and aquaria could conduct multiple follow-up methods to make a long-term connection with visitors and provide more in-depth CE information. Social media and social media groups could contribute to this method. Additionally, understanding visitors' feedback about conservation issues is also important. Zoos and aquaria could collect feedback from visitors on numerous tourism websites and social media. Such feedback could contribute to the first phase of this model, so organisations could change their interpretations according to the profiles and understandings of their visitors; interpretations at zoos and aquaria are not fixed but require change.

6 Conclusion

In the context of the changing climate and global wildlife diversity crisis, conducting conservation education in zoos and aquaria can be an effective way to transmit conservation information to the public. Although most zoos and

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aquaria claim that conservation is one of their most important works, the effectiveness of informal conservation education to the public is often not satisfactory. Qualitative research was conducted to explore the underlying content of conservation education provided to the public by zoos and aquariums. The study focused on analysing interpretive panels, organisational websites, and visitor reviews from AZ and KT in New Zealand. The findings indicate that current interpretation efforts may indeed contribute to conservation education and that the content of interpretation can significantly impact visitors' perceptions post-visit. However, discrepancies exist in the understanding of conservation definitions, and conservation issues are not consistently prioritised in interpretive materials. To enhance conservation education in zoos and aquariums, it is recommended that these institutions align their understanding of conservation with scientific principles. Additionally, the research proposes a model for designing more effective conservation education programmes within the context of zoo and aquarium tourism, with a focus on improving the quality of interpretive content.

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