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Pros and Cons of Marine Zoological Parks According to Marine Conservationists

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Capstone of
Kayla L. Patama

Submitted in Partial Fulfillment of the Requirements for the Degree of

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M.S. Marine Biology

Nova Southeastern University
Halmos College of Natural Sciences and Oceanography

December 2017

Approved:
Capstone Committee

Major Professor: Nick Funicelli

Committee Member: Patrick Hardigan

HALMOS COLLEGE OF NATURAL SCIENCES AND OCEANOGRAPHY

PROS AND CONS OF MARINE ZOOLOGICAL PARKS ACCORDING
TO MARINE CONSERVATIONISTS

By

Kayla Patama

Submitted to the Faculty of
Halmos College of Natural Sciences and Oceanography
in partial fulfillment of the requirements for
the degree of Master of Science with a specialty in:

Marine Biology

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ABSTRACT

Throughout history zoos and aquariums have satisfied a number of different, albeit to some, conflicting roles (Ballantyne, Packer, Hughes, & Dierking, 2007). In recent years, zoos and aquariums have shifted their focus on taking a proactive role in wildlife conservation and promoting conservation learning among their visitors. The present capstone addresses the justifications that marine conservationists see in marine zoological parks and how they believe parks can become more relevant and valuable in the future. A 65 question survey (Appendix I) was distributed to marine science professionals online through personal contact between June and September 2017 questioning participant's personal opinions about justifications for having animal-based attractions, specifics about parks and demographics. Participants were also invite to submit any comments about the marine zoological parks at the conclusion of the survey. Participants contacted online were either students (UF undergraduate class, PSU scientific divers and PSU marine science society members), marine zoological park professionals, or conservation professionals. A total of 102 completed surveys were considered for the study. Descriptive statistics were run as well as chi square test to see significant differences between gender and education across survey questions. Results show that marine conservationists want parks to focus less on entertainment and theatrics and more on relevant education concepts such as conservation (95%) and biology, natural history and laws (96%). Updated delivery methods of educational concepts can make a more meaningful impression to a larger audience.

Keywords

Marine, zoological park, conservationist, aquarium, education, conservation, research, rescue, rehabilitation, entertainment

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1. INTRODUCTION

1.1 HISTORY OF ZOOS AND AQUARIUMS

1.1.1 Ancient Collections

The earliest animal collections are believed to have been kept by Egyptians, Chinese, and Romans (Carr & Cohen, 2011). Saqqara, Egypt was home to the first documented zoological collection with several thousand wild animals (Lyles & Wharton, 2013). The first botanical garden is thought to be the Shen Ming Garden in China around the same time (Hoage & Deiss, 1996). These ancient collections were typically not kept for public viewing, and or were maintained for purposes other than recreation or education (Kisling, 2000). Ancient Egyptians kept several species of wild animals for religious ceremonies and perhaps with the hopes of domestication (Lyles & Wharton, 2013). As far back as 1150 B.C. Chinese emperors had walled “parks of knowledge”, which were simply walled animal collections. Romans filled amphitheaters with water to battle hippos as a combat spectacle (Croke, 2014). Holding areas for these animals, called *viveria*, made public viewing possible in the arenas (Lyles & Wharton, 2013).

After the fall of Rome, animal collections were not common in Europe until the Middle Ages when imperial menageries again became significant as diplomatic gestures and ceremonial gifts. This first major segment in zoological parks history ranges from these earliest collections until the fourteenth century (Kisling Jr, 2012). Henry III created the first zoo of sorts for this historical segment in 1252 when he transferred his menageries to the Tower of London where the public could view some of the animals, such as a polar bear and an elephant (Lyles & Wharton, 2013). Urban menageries followed in Frankfurt in the late 1300s and to The Hague and Augsburg in the 1500s.

1.1.2 Menageries

With expanding populations, world exploration, and societal growth also came the beginning of modern science (Kisling Jr, 2012). The second major historical segment of zoological parks evolution includes menageries from the fifteenth century through the eighteenth century. Public spectatorship arose out of hobby to display living trophies as the product of spoils from imperialism (Marino, Bradshaw, & Malamud, 2009). Most

animals displayed were from areas known to the collectors (Kisling Jr, 2012), but more exploration to Africa, Asia, and America meant different species to display. Menageries displayed as many species as possible in taxonomically arranged exhibits made of barred cages (Kisling, 2000). The European Renaissance brought more animals into Europe, which also ushered in the rising profile of zoos (Lyles & Wharton, 2013). In 1665 Louis XIV established the first zoological garden that displayed both plants and animals in Versailles, which became a division of Paris' natural history museum in 1794. Traveling menageries, the precursors to modern circuses, first appeared in Europe at the turn of the 18th century (Marino et al., 2009). The first "modern" zoo that survives today is the Schönbrunn Zoo in Vienna, which was originally a private collection in the 1770s that allowed public viewing intermittently (Lyles & Wharton, 2013). As the nineteenth century approached more people became concerned with the humane treatment of animals and more concern for the loss of animals in the wild.

1.1.3 Cultural Institutions

Zoos and aquariums were generally accepted forms of entertainment, with little thought given to their roles in society or ethical trade-offs associated with capture and confinement on animals (Marino, Lilienfeld, Malamud, Nobis, & Broglio, 2010). Modern zoos evolved from places of human curiosity to the centers of biological conservation and education (Patrick & Tunnicliffe, 2013). Regents Park by the Zoological Society of London in 1828 is arguably the advent of modern zoos and a significant event in the evolution of zoo development (Kisling Jr, 2012). This collection was intended to surpass all others in existence with an emphasis on education and science. London Zoo, owned and operated by Zoological Society of London, served as both an entity for scientific research in behavior and reproduction of captive animals and as an entertainment center (Galbraith & Rapley, 2005). America's first zoos were established in Philadelphia and Cincinnati in the 1870s (Jamieson, 1986).

In the 1850s Robert Warington and Philip H Gosse developed the first self-sufficient and self-contained aquariums in Great Britain (Kisling Jr, 2012). Gosse worked with the Zoological Society of London to establish its aquarium, the first public aquarium in 1853 (M Lück, 2007). In the 1860s the first cetaceans were held in captivity and since then

around 35 different species have been on display with varying levels of success (Mayer, 1998). The Surrey Zoological Gardens opened shortly following the opening of London Zoos. In 1861 an aquarium in Paris opened with fourteen 200 gallon tanks, followed by the Crystal Palace in 1871 (Doar, 2007). Aquariums continued to increase in number and improved their programs in animal husbandry research, education and conservation until World War I (Kisling Jr, 2012).

1.1.4 Conservation Centers

This fourth historical segment started in the twentieth century when zoological parks evolved into conservation centers and increasingly focused on saving endangered species and on environmental issues (Kisling Jr, 2012). After recovering from the social and economic impacts of World War I and World War II there was a surge in new zoos and aquariums. By the early 1990s there were more than 10,000 zoos worldwide (Ballantyne et al., 2007) and 39 aquariums in the United States (Doar, 2007). A dolphinarium along the Black Sea Coast opened in the 1970s in Constanta which displayed three species of dolphins (Dima & Gache, 2004). The first marine park in the U.S., Marine Studios, opened in 1938 in St. Augustine, Florida as a dolphinarium (Marino et al., 2009) with bottlenose dolphins that they had captured (Jiang et al., 2007). In 1961 the first captive killer whale was put on display in California, only survived a few days.

In recent years, zoos and aquariums have shifted their focus on taking a proactive role in wildlife conservation and promoting conservation learning among their visitors. The proportion of potentially threatened species on Earth is rapidly increasing, leaving only a few species safe from the threat of extinction (Frynta, Šimková, Lišková, & Landová, 2013). A profound link between zoos and conservation began with the development of the European endangered species programs (EEPs) in the 1970s and the Species Survival Plans (SSP) programs in the 1980s in the United States (Braverman, 2014). In-situ and ex-situ conservational efforts cannot be missed if there is any potential chance for animal conservation. The world's zoos, aquaria, botanical gardens, and gene banks are some examples that provide insurance for species and genetic diversity survival.

According to (George B. Rabb, 2004) zoos, as conservation centers, strive to help create a more sustainable and harmonious relationship with nature by doing four things:

- 1) Ensuring that their operations are as environmentally friendly as possible (model citizen)
- 2) Contributing to the careful management of the Earth's biological resources, which include captive and wild animal populations and viable ecosystems (wildlife conservationist)
- 3) Inspiring others to celebrate and conserve nature, and to adopt earth friendly lifestyles (agent for conservation)
- 4) Building human capacity by mentoring and training others (mentor and trainer)

Balancing captive value and use continues to be a challenge that zoological parks attempt to keep positive and as an effective contributor to this new conservation ethic (Kisling Jr, 2012).

1.2 CONSERVATION

A well-known argument for keeping marine mammals in captivity is that marine parks significantly contribute to education and ultimately conservation of the species they display. Captive viewing tourism reaches a large number of visitors a year without negatively impacting the wildlife or wildlife habitats of the species they display (Packer & Ballantyne, 2012). As the world population continues to rise, causing global biodiversity to decline due to loss of habitat, animal conservation is crucial, including the gene banks that zoos and aquariums provide as an insurance for species and genetic diversity (Frynta et al., 2013). While *in situ* populations and *ex situ* population have distinctly different pressures, both groups require monitoring and intervention to some degree to ensure that they are healthy and sustainable (O'Brien & Robeck, 2010). Aquaria can serve as 'safe havens' for endangered species (M Lück, 2007). The contemporary zoological facility hence can be seen in as redemptive; the new Noah, savior of species, havens of wildlife protection, and vessels of rescue for nonhuman animals under attack from industrial civilization (Acampora, 2005).

Population management of captive species has substantially reduced or eliminated the need to take animals from the wild (G. B. Rabb & Saunders, 2005). Captive animals receive ample food and water, veterinary care, and protection from predation and

conflict, leading to healthier, longer lives that breed more successfully than conspecifics in their natural environment (Mason, 2010). However, zoos and aquariums will not be able to accommodate many more taxa in existing facilities. As natural habitats and populations are being irretrievably destroyed, it makes no sense for zoos and aquariums to preserve hundreds or thousands of species for reintroduction; instead they should focus on supporting field conservation efforts (Hutchins, 2003). Zoos and aquariums are valuable resources prior to introductions and afterwards to maintain viable populations, reintroductions should originate from breeding centers in native countries rather than zoological institutions (Frynta et al., 2013). When captive-breeding and reintroduction is deemed appropriate, it should be combined with habitat conservation, education and community-based economic incentives. Individually and collectively our institutions must engage in field-conservation programs, including *in situ* captive breeding programs (G. B. Rabb & Saunders, 2005).

Some species have become flagships of conservation; Bison *Bison bison*, Bald Eagle *Haliaeetus leucocephalus*, and Alligator *Alligator mississippiensis*, represent successful rescue from extinction (G. B. Rabb & Saunders, 2005). Zoos and aquariums should inspire and rally people to the notion that all threatened species deserve this type of response and outcome. This has been observed by Whitehead (Michael Lück & Jiang, 2007) who stated that ‘many people are thrilled, excited and fascinated to see captive whales performing. Knowledge is a key to action. If we are to preserve the whales and their environment, people, and perhaps most importantly children must be able to experience them.’

Unlike other types of public institutions, zoos and aquariums are threatened literally with extinction, like the animals they display. Critics argue that this would be a good thing because they present nature unnaturally and reflect an unworthy dominating attitude towards the creatures of the natural world (G. B. Rabb & Saunders, 2005). A common argument against zoological parks is that some species do not fare well in these false conditions. Humboldt penguins (*Spheniscus humboldti*) in UK zoos have half the chick output of their free-living counterparts, and also show a higher incidence of aspergillosis,

a stress-related opportunistic fungal infection, in captive versus wild population of penguin species (Mason, 2010). Others argue that, even theoretically, if zoos tried to keep and breed endangered species at populations large enough to sustain a long-term captive breeding program, the space would be too limited to hold only a fraction of the needful species while avoiding inbreeding depression (Frynta et al., 2013).

Understanding the reproductive physiology of captive cetacean populations has led to the development of assisted reproductive technology (ART) which can establish permanent repositories of valuable genetic material which could captive species' genetic diversity (O'Brien & Robeck, 2010). ART has significantly enhanced genetic reductive and social management of ex situ cetaceans through gamete preservation for genome resource banking, artificial insemination and sperm sexing. Bottlenose dolphin *Tursiops truncatus*, the most common cetacean in captivity, has reproductive success that parallels or exceeds wild population success, despite the large captive populations being dispersed between genetically isolated facilities (T. Robeck et al., 2005). Artificial insemination using cryopreserved semen in combination with genome resource banking is improving genetic management of these large populations without the need for animal transportation. Genome resource banking and assisted reproductive technology, such as AI, are important tools in maintain maximal genetic diversity of captive populations, such as killer whales *Orcinus orca* (T. R. Robeck et al., 2004). ART combined with in situ conservation efforts, may prevent future extinction of cetacean species (O'Brien & Robeck, 2010).

Ex situ (off-site) conservation efforts of animal-based attractions have been relatively successful and unanimously accepted as they buy time for animals whose natural habitats are threatened, and are reducing the scale of the global extinction crisis (Shani & Pizam, 2010). Conservation initiatives don't need to end in the parks. National Marine Aquarium at Plymouth, UK has a collaborative conservation project between the Blue Bay Marine Park in Mauritius and a local hotel (Gross, 2015). The program education and incentives members of the hotel staff to look after surrounding conservation needs, make business decisions that are more sustainable and reduce its environmental impacts, and guide

visitors to not disrupt the habitat needs of the animals. Animal based-attractions are allocating more resources and becoming more involved with *in situ* (on-site) conservation efforts (Shani & Pizam, 2010). More than \$160 million each year is spent on *in situ* conservation efforts around the world by the more than 200 accredited members of the (US) Association of Zoos and Aquariums (<http://www.aza.org/conservation-funding/>). *In situ* conservation efforts can have a larger influence and be more meaningful, while also making zoos and aquariums more like proactive conservation organizations and less like museums with live exhibits (Shani & Pizam, 2010).

Target 1 of the Aichi Biodiversity Targets within the United Nations Strategic Plan for Biodiversity 2011-2020 (<http://www.cbd.int/sp/targets>) calls for action ‘by 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.’ With the more than 700 million annual visits to zoos and aquariums annually, they have been shown to be making a contribution to achieving Aichi Biodiversity Target 1 (Jensen, Moss, & Gusset, 2017). According to one study (Graham, 2015), zoological institutions are places where people are being influenced in a positive manner and are effectively learning from housing animals in captivity, especially visitors of younger demographics. A study conducted by The Association of Zoos and Aquariums (AZA) found that visits to accredited zoos and aquariums prompted 54% of surveyed individuals to reconsider their role in environmental problems, conservation action, and to see themselves as part of the solution (Falk et al., 2007). Thus, increasing marine stewardship substantially.

1.3 EDUCATION

Crowds visiting zoological institutions are often inclined to be interested in animals and nature, allowing opportunities for key reinforcement of educational messaging and strengthen the bond between humans and animals (Ogle, 2016). In 1968 the Zoological parks Board of New South Wales established Australasia’s first dedicated education facility and world class veterinary center at a zoological institution(Kelly, 1997). In the debate about the educational value of aquaria and marine parks, there is strong opposition

to those facilities holding dolphins or whales claiming that there is minimal educational value in seeing these species in captivity (M Lück, 2007). Some argue that whale and dolphin watching tours are more educational (Michael Lück & Jiang, 2007), as these tours have a relatively captive audience, while marine parks have a non-captive audience where entertainment is the prevalent motivation. A 2012 study (Packer & Ballantyne, 2012) found that non-captive wildlife viewers value the importance of learning during their visit, while captive site viewers valued the social aspects more. Education and conservation are secondary to families while planning their weekend outing of exotic animals doing interesting things (Hyson, 2004). Critics of marine parks believe that little is taught about natural behaviors, ecology, demographics or population distribution in marine parks and oceanaria. Studies have shown that visitors do not take advantage of exhibit signs or that overall experience does not result in any discernable knowledge or attitude following a visit (Clayton, Fraser, & Saunders, 2009). It is difficult to undertake an independent study of visitors to parks because worried about negative publicity, organizations don't generally let researchers investigate their customers on their premises (Michael Lück & Jiang, 2007).

Alternatively, The Alliance of Marine Mammal Parks and Aquariums (1999), quote a Roper Poll in 1995, where 92% of respondents agreed that 'these facilities are essential in teaching the public about marine mammals they might not otherwise get the opportunity to learn about', noting that marine wildlife parks and aquaria play an important role in conservation education (Michael Lück & Jiang, 2007). An awareness study (Jiang, 2004) found respondents visited parks 'to learn about the natural history of the marine wildlife on display', 'educational opportunities', and information of conserving the natural environment' and those reasons were more important than 'petting dolphins or whales', 'feeding dolphins or whales', or 'facilities of the aquarium or marine park.' Thus showing that visitors to marine parks and aquaria value the educational value to their visit. Reporting that an experience is educational does not mean that knowledge is retained or gained from the experience (Miller et al., 2013).

A number of marine parks offer educational programs for various target groups including; children, families and teachers. Educational programs range from day camps, overnight and scout camps, lectures and/or seminars, and webpages. Informal learning sites operated by zoos and aquariums display simulated marine environments that allow students to observe phenomena and processes that are inaccessible in a classroom setting (Ballantyne, 2004). Jensen (2014) published the first large-scale impact study of biodiversity and conservation issues both before and after 2,839 school children visited the London Zoo. He observed 41% positive change in the visits supported by the zoo's education officers and 34% positive change in the visits guided by teachers. This one third positive change in understanding biodiversity and conservation has a potential significant impact given that there are over 700 million visits to accredited wildlife attraction annually. Aquaria help both school students and public understand marine science, biology, and why they should safeguard marine ecosystem and species (Ballantyne, 2004).

Luck & Jiang (2007) found that when comparing marine parks by location, western parks have a clearer focus on education with a more practical approach to education through camps and special programs. Japanese parks focus more on education through lectures and seminars. Five out of the eight western parks provided information on conservation, while only one of their Japanese counterparts did the same. Captive wildlife tourism need to capitalize on allowing visitors to see animals up close and encourage visitors to discuss and share their ideas with companions (Packer & Ballantyne, 2012). Visitors seeing rehabilitation in practice is an important instrument in providing the general public information about the species (Osinga, 2010).

1.4 RESCUE AND REHABILITATION

Periodically, wild animals suffer injuries or find themselves in difficult situations that require human intervention. Marine parks have been involved with the rescue and rehabilitation of odontocetes, marine birds, sea turtles, and other marine life for decades and is often a main argument used in support of zoological facilities. In the 1970s, release

and rehabilitation of marine mammals was not considered a serious issue, but as knowledge of marine mammal medicine and care improved, stranded animals increasingly replaced captured animals for public display facilities concern arose (Moore et al., 2007). Rehabilitation can also provide support for a population under pressure, attesting that rehabilitation can be approached from an origin in animal welfare or population biology (Osinga, 2010). Participating facilities have to meet the Minimum Standards set forth by the National Marine Fisheries Services (NMFS) Stranding Agreements (Gage, 2006). Rehabilitation should always be conducted in a professional way, following strict protocols, and include scientific research and education for the benefit of the individual, as well as conservation for the species (Osinga, 2010).

Limited data suggests that rehabilitation of stranded odontocetes receiving dedicated veterinary medical care and husbandry do not survive long after release (Zagzebski, Gulland, Haulena, & Lander, 2006). Although survival rates appear to be disheartening for some species considerable financial and personnel resources continue to be used. Busch Entertainment Corporation, a former parent company of SeaWorld parks, spent nearly one million dollars annually on direct costs to support wildlife rescue and rehabilitation across the three SeaWorld facilities (Andrews, Davis, & Parham, 2001). The rescue and rehabilitation of JJ, an infant gray whale *Eschrichtiues robustus* in 1997, allowed researchers the opportunity for the first time ever to study this species in detail for several months on the whale's hearing abilities, husbandry and veterinary medicine, growth and behavior (Andrews et al., 2001). During rehabilitation, SeaWorld aimed to provide adequate nutrition for deposition of sufficient fat to sustain a several week long migration to northern feeding grounds as well as encourage and develop nominal foraging behaviors for after release (Bruehler, DiRocco, Ryan, & Robinson, 2001). The main goal of SeaWorld's animal rescue and rehabilitation program is to return rehabilitated sick and injured animals back to the wild, but also values the information gathered from these rescues as additional information helping to conserve free-ranging populations and guiding future wildlife management (Andrews et al., 2001). JJ's 14 month rehabilitation exceeded \$350,000 and the seven and a half month rehabilitation and release of one Risso's dolphin *Grampus griseus* reached approximately \$400,000 (Zagzebski et al., 2006).

Twenty five years (1997-2002) of live-stranded odontocete data from northern California was evaluated and results show that of the 70 rescued for rehabilitation only five were released back into the wild (5%), three were placed into captivity because they were deemed non-releasable (4%) and the other sixty two animals died within hours to months of being rescued (Zagzebski et al., 2006). Twenty four years (1986-2010) of data from 69 cases were evaluated (Wells, Fauquier, Gulland, Townsend, & DiGiovanni, 2013) involving ten species of odontocete cetaceans with release data. In the early years, successful cetacean rescue, rehabilitation, and release was infrequent, but success rates have improved markedly in recent years (Wells et al., 2013). In 1993, a female sperm whale was taken to the National Aquarium in Baltimore after ('Inky') stranded alive on the New Jersey coast due to ingesting several large pieces of plastic (Campbell, 2001). Live stranded pygmy sperm whales have not survived well previously in captivity, so it was decided that releasing 'Inky' in the wild would be the best option for survival.

During the 1970s rehabilitation of harbor seals *Phoca vitulina* proved to be an important factor in stopping the decline of common seals in the Dutch Wadden Sea, and their population recovery in the 1980s following an outbreak of phocine distemper virus (PDV) (Osinga, 2010). As an indicator species for the Wadden Sea, common seal rehabilitation is an important way to gather information on the health of this species and its ecosystem. The United States has a long standing rescue, rehabilitation, and release program, along with supplemental captive care when needed, for injured or distressed manatees (Adimey et al., 2012). The U.S. Fish and Wildlife Services (USFWS) is ultimately responsible for animals under the authority of the U.S. Endangered Species Act and Marine Mammal Protection Act providing management oversight. There are eleven core manatee rehabilitation programs, five of these are authorized for critical care, and four of those five are captive animal facilities. Captive –born orphans and animals with over fifteen years in captivity are the most challenging to release, but through monitoring of these animals via radio transmitters, managers and biologists have been able to gain a better understanding of habitat use, distribution patterns, behavior, health, and the capacity for adaptation to the wild.

Morgan, a female killer whale, rescued from Dutch waters was rescued and rehabilitated to full health, but instead of the Dutch authorities granting her release back to the wild, they transferred her to a zoological facility in Spain (Trouwborst, Caddell, & Couzens, 2013). This decision was based on a specialist's advice that her survival would be greatly diminished since they could not identify her pod and allow her to rejoin. In the United States, NMFS has developed guidance and criteria for release based on minimizing the risk to wild populations and optimizing the chances of survival (Gage, 2006). Morgan's saga illustrates the tensions between animal welfare groups and nature conservation that is still alive today involving zoological facilities and governing bodies.

1.5 SCIENTIFIC RESEARCH

The first zoological park established in the late eighteenth century, the Jardin des Plantes in Paris, stressed that its purpose was scientific research rather than public entertainment, and many scientists took advantage of the opportunities this zoo provided (Kleiman, Thompson, & Baer, 2010). By the 19th century, the London Zoo, was serving the community as both an entertainment entity and as a platform for serious scientific research into the behavior and reproduction of captive animals (Galbraith & Rapley, 2005). In 1998, Tab and Presley, two typical show dolphins at Brooklyn's New York Aquarium participated in groundbreaking research that showed dolphins could recognize their own reflections, a test of self-awareness that only chimpanzees and humans were known to possess at that time (Grimm, 2011). The finding was a milestone in animal cognition and a breakthrough for dolphin research. Sadly, both dolphins from the study died at the early age of around 20 years, half a dolphin's normal life span in the wild, after being transferred to another facility. A common complaint among those who do not support zoos (Jamieson, 1985). Lori Marino, the biopsychologist associated with this research left the field of captive research after learning of the dolphin deaths. Although some scientists are concerned with the welfare of dolphins in captivity, most have concluded that captive research is the best way to learn about the intelligence of this species and the best way to protect them in the wild (Grimm, 2011).

In the 1960s, the U.S. Navy invested heavily in research involving dolphin physiology and echolocation in order to recover practice rockets and mines from the sea floor (Grimm, 2011). In 1970, Lou Herman, founded a research-only dolphin facility in Honolulu, Hawaii. His research showed that dolphins could understand artificial languages based on electronic sounds and trainer's hand gestures. Research conducted by captive studies have helped scientists understand dolphin's sensitivity to noise, pollution, and other dangers; all of which have led to the Navy writing better conservation guidelines. Experiments elsewhere have looked at different thickness of netting that porpoises can detect and if they can be deterred using sound or reflectors in attempt to reduce that problem of fishing gear entanglement (Mayer, 1998).

Only a small fraction of desirable marine ornamental fishes have been captive bred (Cassiano et al., 2015); 80 coral reef fish species of the approximately 1,200 species in the international ornamental fish industry. The unsustainable collection of smaller fish is another concern for critics (M Lück, 2007). New research at public aquariums has been focused on evaluating the rearing potential of marine fish eggs and larvae collected from their displays. SeaWorld Parks and Entertainment initiated the Rising Tide Conservation (RTC) in 2009 to develop economically viable aquaculture strategies for marine ornamental fish species among a collection of research facilities, industry partners, and Association of Zoos and Aquariums institutions (<http://risingtideconservation.org/>). Three species examined; *Heniochus sp.* (bannerfish), *Paracanthurus hepatus* (Blue Tang), and *Pomacanthus semicirculatus* (Half-circled Angelfish) show potential for commercial aquaculture and alleviating live capture from reef communities. RTC research has also resulted in the creation of an egg and larval identification catalog which can be used in future cross-disciplinary ecological studies (Cassiano et al., 2015).

In January 2006, a young bottlenose dolphin jumped from this tank at the Minnesota Zoo and smacked his head on the surround concrete, later dying from the fractured skull he had sustained from the jump (Grimm, 2011). Incidents such as these illustrate the ills of captivity (Grimm, 2011). Captive cetaceans can also suffer from health problems such as stress, aggression, and diseases which could result in injuries or death (Jiang et al., 2007).

Stress is believed to be a factor in up to 50% of captive cetacean deaths. Marino says, “We need to move the science to a place that doesn’t compromise our ethics” (Grimm, 2011). Arguably, some research suggests that research involving captive cetaceans has been minimal, made little progress, and produced few significant contributions towards our understanding of marine mammals (Hill & Lackups, 2010). Opponents to research with captive animals argue that marine parks puts animals under stress creating behaviors very different very different in the wild, and (M Lück, 2007) quotes the late Jacques Cousteau, saying:

No aquarium, no tank or marineland, however spacious it may be, can begin to duplicate the conditions of sea. And no dolphin who inhabits one of those aquariums... can be described as a ‘normal’ dolphin.

Studies on free-living animals continue to increase in sophistication and the greater relevance of data collected from such studies casts a larger shadow of doubt on the justification of research on captive cetaceans (Mayer, 1998).

Zoos and aquariums over the last 30 years have increased their scientific validity, but have not yet reached their full potential (Maple & Perdue, 2013). Research in facilities can engage not only conservation-minded biologists on wildlife issues, but also psychologists, social scientists, marketers and others involved in research, which can be applied everywhere to the benefit of conservation (G. B. Rabb & Saunders, 2005). Research undertaken by institutions can cover a broad spectrum of projects both *in situ* and *ex situ*, veterinary science, husbandry, animal (and visitor) behavior, ecology, habitat rehabilitations, taxonomy, systematics, physiology, phenology, DNA analysis for comparative genetic purposes or reference, forensic evolution, pathological reference, parasitology, comparative anatomy or physiology and genome banking (Galbraith & Rapley, 2005). Although zoos and aquariums can take pride in their scientific studies, our institutions needs to publish studies and disseminate news to spread information and understanding, and stimulate critical review and engagement by professionals of various disciplines (G. B. Rabb & Saunders, 2005). Hubbs SeaWorld Research Institute

researchers published twenty papers in 2015 (hswri.org/publications/) and is currently working with 20 graduate students (hswri.org/graduate-students/). Additional research outputs that can be utilized by aquaria include external publications and member newsletters, developing curricula and promoting advocacy (M Lück, 2007).

1.6 ENTERTAINMENT

When zoos were converted to public menageries, they became centers of entertainment, using projecting an almost man-the-magician imagery (Acampora, 2005). Animal shows and “petting zoos” were incorporated into zoos as a way to attract visitors and increase revenue (Kleiman et al., 2010). P.T. Barnum opened ‘the first public aquaria in America’ in the mid-1850s in the American Museum in New York (M Lück, 2007). The big show at his park was advertised as ‘The Whale Harnessed and Driven Around the Great Tank by a Young Lady’. The first two beluga whales *Delphinapterus leucas* capture for display perished within days because they were kept in freshwater, the next pair survived somewhat longer being housed in salt water. In 1913, The New York Museum captured and display five bottlenose dolphins *Tursiops truncatus*, the last one perishing after 21 months in captivity. Barnum then acquired the rights to pump seawater directly from the sea, improving marine exhibitions, and enabling the display of living sharks, porpoises, sea horses and other fish.

A main argument against zoos and aquariums is the perceived abuse of power that humans have over their animal ‘prisoners’. Should sentient beings be held in captivity for the amusement of others? These arguments are particularly resonant for cetaceans that are trained to perform (Gross, 2015). Today, approximately 26 billion animals, spanning over 10,000 species, are kept in captivity (Mason, 2010). Visiting zoos and aquariums is a popular family-oriented leisure activity that brings in more than 143 million visitors per year in the United States (Falk et al., 2007) and 600 million annually throughout the world (Catibog-Sinha, 2008; Lyles & Wharton, 2013). It has been shown that visitors priorities for visitors to zoos is for entertainment rather than spending the day learning (Ogle, 2016) and highly choreographed shows with marine mammals are the center of visitors’ attention (Michael Lück & Jiang, 2007). Those against zoos and aquariums

argue that commercial tourism facilities, including zoological parks, cater to the visitors' entertainment with the "added extra" of education (Packer & Ballantyne, 2002). Educational segments of orca shows highlight notions of respect for the animals' intelligence and can focus on their natural habitat characteristics, some training "tips", and stresses the importance of the relationship between the trainer and whale (Jiang et al., 2007). If marine parks really had conservation of animals in mind, there should be no need for ambitious training programs and elaborate, entertainment shows (M Lück, 2007). In the 1990s concerns about captive animal welfare and the environment made voyeuristic entertainment a less acceptable justification for captivity (Mayer, 1998). Can zoological institutions effectively adapt to the new role focused on conservation and education rather than just entertainment?

Zoos, aquariums, and other captive-setting sites are associated with entertainment, amusement, and recreation, but there are elements of these facilities that allow observing and interacting with wildlife (Shani & Pizam, 2010). Many facilities include exhibits that include guest interactions with a variety of marine life, including invertebrates, fish, sharks, or stingrays as a vehicle for knowledge transfer (Ogle, 2016). These types of interactions consistently ranks in the top of the highest ranked experience at a zoo by visitors. It has been argued that these exhibits are focused on entertainment with no education purpose. However, visitors reported a greater impact on their knowledge and appreciation of the animals after they had the chance to interact with marine mammals (Miller et al., 2013). An important distinction between theme parks and animal-based attractions is that the latter presents the challenges of environmental and ecological sustainability while incorporating live animals, while the former tends to focus on fictional content (Shani & Pizam, 2010). Participants of entertaining dolphin shows showed a significant increase in conservation-related knowledge, attitude, and intended behavior three months following the programs. These shows and programs can also be an important part of conservation education and not just entertainment. Some argue that interactive programs are simply a way for the facility to take advantage of the public by profiting through the sales of feeder fish at petting pools and offering inappropriate, pricey personal encounters (Jiang et al., 2007).

Some parks, especially western based animal parks, have developed unique programs that are both entertaining and educational. One of these sources of entertainment/education at SeaWorld San Diego and Orlando are the 'trainer for the day' experience which takes participants on a behind the scenes look at the park. Many animal-based attractions have integrated storytelling, simulations, and interactive activities raising the entertainment value, which can enhance the effectiveness of the site's educational messages (Shani & Pizam, 2010).

2. PURPOSE AND OBJECTIVES

This capstone presents the results of a 65 question survey that was distributed online to marine conservationists. The capstone addresses the justifications that marine conservationists see in marine zoological parks and how they believe parks can become more relevant and valuable in the future. This was achieved by analyzing the yes/no survey questions and the percentages of each answer. Where appropriate chi-square goodness of fit tests was used to see where data varied significantly from theoretical data based on demographic parameters.

This capstone determines these three main points:

1. Modern zoological parks promote marine stewardship
2. Marine conservationists want parks to focus less on entertainment and theatrics and more on relevant education concepts
3. Marine zoological parks should update their delivery methods of education to make a more meaningful impact on a larger audience

3. METHODS

To better understand the foundational pros and cons of modern zoological marine parks, an extensive literature search through academic databases provided by Nova Southeastern University was conducted. Literature focused on the history of zoos and aquariums, conservation practices, education standards, parks as alternatives to research and their use of scientific research, park entertainment, and regulations to wildlife. Collected literature was stored in EndNote. This EndNote library was accessible on both my personal computer and online. Based on the literature collected, a survey was created using REDCap and Microsoft Word (Appendix I), following current IRB protocols (<http://www.nova.edu/irb/irbmanager/index.html>). The survey questioned participant's personal opinions about justifications for having animal-based attractions, specifics about parks and demographics. To streamline answers, question responses were limited to "yes" or "no". Participants were also invited to submit any comments about marine zoological parks at the conclusion of the survey.

Surveys were distributed to marine science professionals online through personal contact between June and September 2017. Participants contacted online were either students at University of Florida and Penn State University Park, marine zoological park professionals, or conservation professionals that I knew from previous work within the zoological and marine conservation community and university. This was not random sampling, but rather convenience sampling that allowed for a more targeted audience. Participants were encouraged to share the survey with marine conservationists that they knew. Paper versions of the survey were distributed to marine science classes through personal contact with professors at University of Florida. The paper surveys were distributed to ensure that students participated in the study and make our results more robust. Distribution of the survey among different universities allowed for us to capture participants across a broad spectrum of education (i.e. bachelor's degree, master's degree and Ph. D.).

Questions in the survey are based on the line of questioning used for a quantitative investigation (Shani, 2012) on tourists' attitudes toward animal-based attractions. Survey data can be accessed online through REDCap. Demographic information was collected in

the first section of the survey. The second part of the survey focused on the justifications of animals based questions. The third section focused on the specific personal opinions on animal based attractions. Descriptive statistics was used to calculate all study variables including the mean and standard deviation for the survey constructs (e.g., Conservation), counts and percentages for categorical variables. Where appropriate chi-square goodness of fit tests was used to see if the data set is consistent with our hypothesized distribution. Chi-square tests are ideal for this data set because our data is categorical and we will be employing a convenience sampling method. Statistical significance is found at $p < 0.05$.

4. RESULTS

A total of 110 respondents participated in the survey (Appendix I). Five participants did not identify as conservationists and three surveys were incomplete. Those eight surveys were eliminated from this study, leaving a total of 102 surveys for consideration.

Demographic information was collected (Table 1).

Table 1: Five demographic questions asked in the study survey along with the corresponding respondent percentages.

Variable	Count (Percent)
Gender	
Male	26 (25%)
Female	76 (75%)
Ethnicity	
African American	1 (1%)
Asian	2 (2%)
Caucasian	83 (81%)
Hispanic	12 (12%)
Other	2 (2%)
<i>Prefer Not to Answer</i>	2 (2%)
Age	
<20 Years	2 (2%)
20-27 Years	59 (58%)
28-35 Years	21 (21%)
36-43 Years	4 (4%)
44-51 Years	4 (4%)
52-59 Years	1 (1%)
60+ Years	11 (11%)
<i>Prefer Not to Answer</i>	0 (0%)

How many times a year (on average) do you visit marine parks?

<i>I rarely or never visit marine parks</i>	20 (19%)
<i>1 visit</i>	40 (39%)
<i>2-4 visits</i>	22 (22%)
<i>5-10 visits</i>	10 (10%)
<i>11+ visits</i>	10 (10%)
<i>Prefer Not to Answer</i>	0 (0%)

What is the highest level of education you have completed?

<i>High school</i>	9 (9%)
<i>Vocational school</i>	3 (3%)
<i>Bachelor's degree</i>	55 (54%)
<i>Master's degree</i>	30 (29%)
<i>Doctoral degree</i>	5 (5%)
<i>Prefer Not to Answer</i>	0 (0%)

as well as yes / no answers for the fifty-nine non-demographical survey questions (Table 2).

Table 2: List of the fifty nine non-demographical questions regarding marine zoological parks covered in the study survey along with the corresponding percentage of yes/ no respondents.

Number	Marine Zoological Park Survey Study Questions	YES %	NO %
1	Marine parks play an important role in preserving endangered species	88	12
2	Marine parks allow people to see wildlife without destroying their natural habitat	89	11
3	Marine parks are important place for wildlife conservation	83	17
4	We must support marine parks so they can develop breeding programs for at risk animals	83	17

5	Marine parks are important places for adults to share something with children	93	7
6	Marine parks play an important recreational role for families	87	13
7	Marine parks are important education sites for children	95	5
8	Marine parks are important sites for everyone to learn about animals	93	7
9	Marine parks help promote environmental awareness	89	11
10	Marine parks are important places where scientific education can be shared with the public	93	7
11	Using animals in tourist attractions is beneficial for educational purposes	72	28
12	marine parks demonstrate how to treat animals responsibly	63	37
13	Without marine parks many people would not have the opportunity to see wildlife	89	11
14	Marine parks are a safe and secure alternative to seeing wildlife in their natural habitat	81	19
15	Marine parks are an affordable alternative to seeing wildlife in their natural habitat	75	25
16	Research conducted at marine parks is vital in order to save species from becoming extinct	77	23
17	Marine parks play an important role in scientific research	83	17
18	Conducting research in marine parks is sometimes the only way scientists can learn about wildlife	78	22
19	Marine parks play an important role in entertaining visitors	75	25
20	Entertainment is an important factor in capturing visitors' attention	73	27
21	Entertainment shows encourage visitors to care more about the species of animals used in the shows	54	46

	Entertainment is an important tool in engaging the		
22	audience to the marine park's mission	66	34
	Marine parks provide a safe and secure environment for		
23	wildlife	72	28
	Animals in marine parks are better off than animals in the		
24	wild, since they are free from predators	23	77
	Animals in marine parks are better off than animals in the		
25	wild, since they have no food concerns	30	70
	Animals in marine parks are better off than animals in the		
26	wild, since they have no habitat pollution	39	61
	Keeping animals in attractions is a key factor in		
	discovering ways to regulate and supervise the natural		
27	environment and wild populations	43	57
	Should marine parks have to be involved with local		
28	conservation efforts?	98	2
	Should marine parks have to be involved with ex situ		
29	conservation efforts?	87	13
	Should marine parks develop breeding programs for all		
30	animals in their care?	37	63
	Should marine parks develop breeding programs for		
31	threatened/endangered animals in their care?	97	3
	Should marine parks develop breeding programs in order		
	to have interactive exhibits? (i.e., touch tanks and feeding		
32	encounters)	41	59
	Should marine parks develop breeding programs for		
	marine mammals? (i.e., sea lions, walruses, seals,		
33	manatees, and polar bears)	73	27
	Should marine parks develop breeding programs for		
34	cetaceans? (i.e., whales and dolphins)	62	38
	Should marine parks be involved with rescue and		
35	rehabilitation of sea birds?	98	2

36	Should marine parks be involved with rescue and rehabilitation of sea turtles?	99	1
37	Should marine parks be involved with rescue and rehabilitation of marine mammals? (i.e., sea lions, walruses, seals, manatees, and polar bears)	97	3
38	Should marine parks be involved with rescue and rehabilitation of cetaceans? (i.e., whales and dolphins)	97	3
39	Should marine parks be allowed to display non-releasable animals to the public?	89	11
40	Should marine parks be able to use those non-releasable animals in their animal shows?	53	47
41	Should marine parks use marine mammals in their animal shows?	62	38
42	Should marine parks use cetaceans in animal shows?	57	43
43	Should animal shows at marine parks be focused on entertainment? (i.e., music, theatrics, choreographed behaviors)	16	84
45	Should animal shows at marine parks be focused on education? (i.e., biology, natural history, laws, etc.)	96	4
46	Are fish okay to keep on display for educational purposes?	93	7
47	Are sharks okay to keep on display for educational purposes?	85	15
48	Are invertebrates okay to keep on display for educational purposes?	94	6
49	Are marine mammals okay to keep on display for educational purposes? (i.e., sea lions, walruses, seals, manatees, and polar bears)	76	24
50	Are cetaceans okay to keep on display for educational purposes? (i.e., whales and dolphins)	72	28

51	Should marine parks have educational signage on display throughout the park?	99	1
52	Should marine parks have educators positioned at all animal displays throughout the park?	94	6
53	Should education at marine parks focus on biology and natural history of the animals on display?	98	2
54	Should education at marine parks focus on threats to their natural environment, education, and protective laws?	99	1
55	Should education at marine parks focus on how to interact with wild animals?	78	22
56	Should marine parks be required to be actively involved with scientific research?	91	9
57	Should marine parks have other types of entertainment for guests besides the animals on display? (i.e., roller coasters, rides, attractions)	56	44
58	Should marine parks have fish/invertebrate touch tanks?	58	42
59	Should marine parks have exhibits where guests can feed animals?	49	51

Survey respondents were 75% females and 25% males (Figure 1).

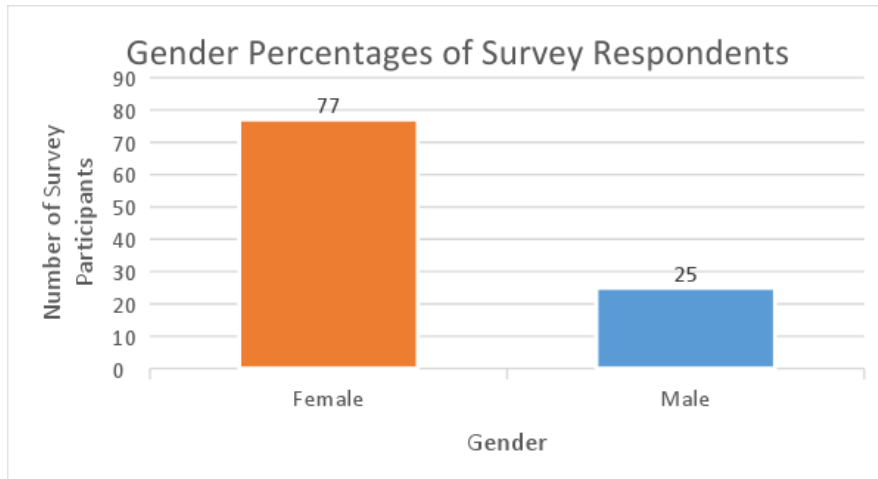


Figure 1: Percentage of survey respondents that are female and male.

Survey participants encompassed five different ethnicities ranging in age from less than 20 years of age to over 60 years of age (Figure 2). Significant differences were found between gender and ethnicity ($p < .001$)

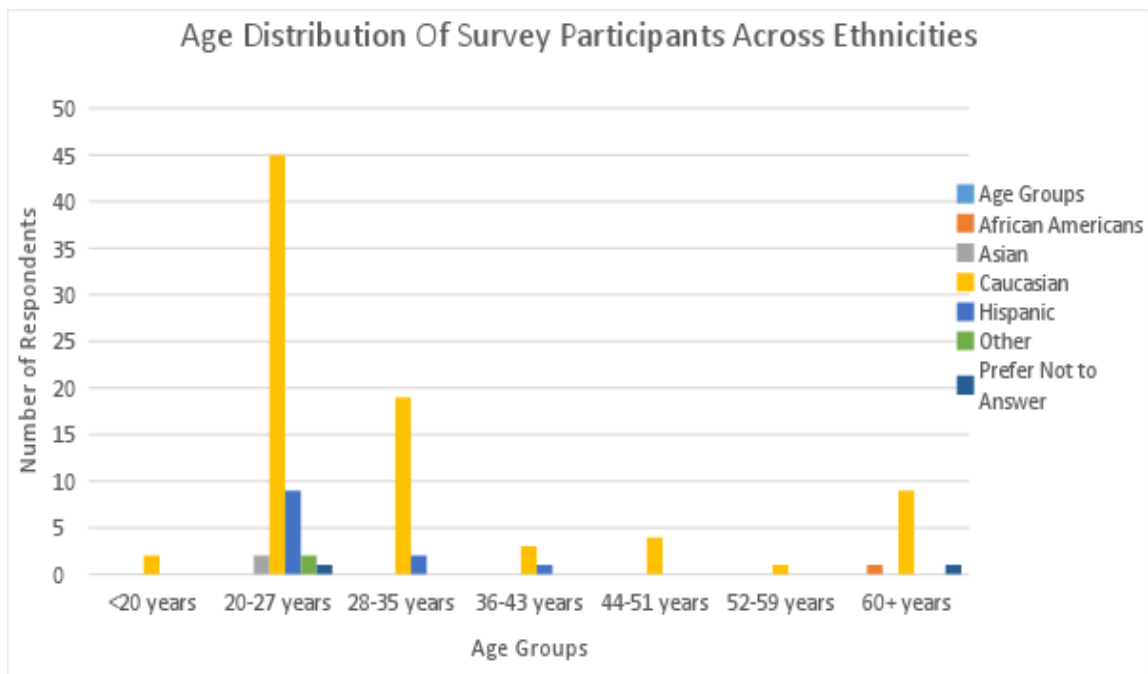


Figure 2: Age distribution of survey participants across five ethnicities with a p value of $p < .001$

Demographic data was also collected on the highest level of education completed and the average number of times a year each participant visited a marine zoological park (Figure

3). There was a significant difference between education level and the amount of annual visits to marine zoological parks ($p=0.003$).

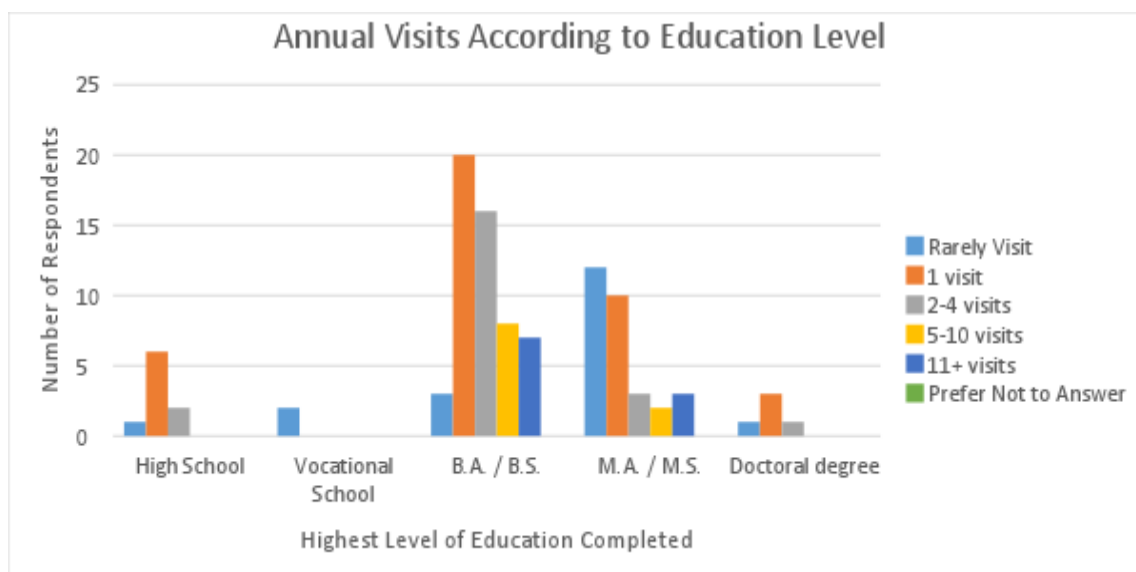


Figure 3: Annual number of visits survey respondents take each year to marine zoological parks according to the highest level of education they have completed with a p value of $p=0.003$

88% of participating marine conservationists believe that marine zoological parks play an important role in preserving endangered species. Parks are important sites for everyone to learn about animals (93%) and 89% of those surveyed believe that parks help promote environmental awareness.

78% of respondents think that education at marine parks should focus on how to interact with wild animals and results varied significantly by gender ($p<.001$). An overwhelming amount of respondents believe that marine zoological parks should be involved with the rescue and rehabilitation of sea birds (98%), sea turtles (99%), marine mammals (97%) and cetaceans (97%).

Marine conservationists surveyed believe that marine zoological parks are important places where scientific education can be shared with the public (93%). Respondents showed a significant difference by education ($p=0.008$) about the important role in scientific research. Marine zoological parks play an important role in scientific research (83%) as it is sometimes the only way scientists can learn about wildlife (78%). There are significant differences by gender ($p=0.016$) and education ($p=0.010$) as to the research

conducted at marine parks is vital to save species from becoming extinct. Although, marine conservationists believe that research at parks is important, respondents showed a lack of support that research in attractions is a key factor in discovering ways to regulate and supervise the natural environment and wild populations (43%). Approximately 31% of respondents believe that animals in marine zoological parks are better off than animals in the wild due to lack of predators, abundance of food, and free of pollution. There was a significant difference between education and the idea that animals in marine parks are better off than animals in the wild, since they have no food concerns ($p=0.051$).

Respondents want to see marine zoological parks that rely less on entertainment and have more shows that focus on conservation (95%) and biology, natural history, laws, etc. (96%). Over 95% of conservationists surveyed believe that educational signage and educators should be at each animal exhibit, focusing on the animal's biology, natural history and threats they face in their natural environment. Significant differences were seen between education level and the idea that marine parks play an important role in entertaining visitors ($p=0.008$).

Marine conservationists surveyed believe that marine zoological parks play an important role in preserving endangered species (88%), and that supporting parks is important in order to develop breeding programs for at risk animals (83%), but should not develop breeding programs in order to have interactive exhibits (41%). Respondents showed significant differences by gender ($p=0.032$) and education ($p=0.047$) about marine parks developing breeding programs for marine mammals. A significant difference ($p=0.038$) was seen between education and developing breeding programs for cetaceans.

Respondents believe that marine zoological parks are important educational site for children (95%). Surveys indicate that entertainment is a tool in capturing visitors attention (73%), but don't believe that entertainment shows encourage visitors to care more about the species of animals used in the shows (54%), or that it is an important tool in engaging the audience to the marine park's mission (66%).

5. DISCUSSION

Survey results reveal that marine conservationists believe that marine zoological parks play an important role in marine education for today's society. 93% of survey participants believe that marine zoological parks are important sites for everyone to learn about animals and that parks are important places where scientific information can be shared with the public. Marine parks still need to acquaint people with the sheer diversity of life in the ocean and the relationships of marine plants and animals, but they also must communicate more effectively the role that man plays in ecosystems globally (George B Rabb, 1994). This was shown by the percentage of participants that believe that education at marine zoological parks should focus on threats to their natural environment (99%) and the biology and natural history of the animals on display (98%). 95% of marine conservationists survey believed that these themes of conservation and also biology, natural history and laws (96%) should translate into the live animal shows. This belief is in strong juxtaposition to those who believe that entertainment should be a main factor in live animals shows (16%). Only 54% of survey participants believe that entertainment shows encourage visitors to care more about the species of animals used in the shows. Again, showing strongly that marine conservationists don't agree that entertainment is an important tool in engaging the audiences to the marine park's mission (66%).

Marine zoological parks should be agents of change and examples of how to treat animals responsibly. 78% of participants surveyed believed that marine zoological parks should teach how to interact with wild animals. Marine zoological parks should incorporate the Marine Mammal Protection Act of 1972 (MMPA). The two goals of the MMPA is to maintain U.S. marine mammals stocks at their optimal sustainable conditions and to uphold their ecological role in the ocean (Roman et al., 2013). Teaching visitors about the MMPA not only teaches them what animals are considered marine mammals, but also that it is illegal to interact with these animals in the wild. This will encourage visitors to not interact with animals in the wild making them less dependent on humans for food and attention. There are a number of published accounts of human interactions with sociable dolphins that can alter normal behaviors, modifying foraging strategies and social relationships (Cunningham-Smith, Colbert, Wells, & Speakman, 2006). Education about

the MMPA could then transition into teaching visitors how their everyday actions can help protect wild animals. For example; reduce your use of plastic bags, recycle, leave a beach cleaner than how you found it, throw out old fishing gear, don't use straws, reduce water usage, etc. Another helpful tool that marine zoological parks could use is teaching their visitors about the proper numbers to call when they see an animal in distress.

Approximately 30% of participants surveyed believed that animals held in marine zoological parks are better off than their wild counterparts. This leads to the belief that marine conservationists would rather see these species in the wild thriving, but are sensitive to the fact that marine zoological parks do play an important role in rehabilitation and education. This point is further driven home by the fact that only 37% of those surveyed believed that marine zoological parks should develop breeding programs for all animals in their care. Animal welfare concerns often clash with ethical standards to conserve a population or ecosystem through research and management intervention (Minteer & Collins, 2013). Yes, these animals in captivity have plenty of food, clean water, and are safe from predators, but those are just the bare minimums required for a good life. At the same time, some animals in marine zoological parks, those that have been rehabilitated but deemed non-releasable, are better off in parks because they are able to live longer lives with some disabilities versus being released to the ocean for certain death. Marine zoological parks should model themselves more as sanctuaries that do not seek out animals from the wild or breed captive held individuals, but instead provide refuge and care for individuals (Marino et al., 2009). By aligning themselves more in the standards of sanctuaries, marine parks could better demonstrate to the public how to treat animals responsibly. Only 63% of those surveyed believe that marine parks do this already. These animals can serve as ambassadors to their species and be used to teach visitors about their biology, natural history, dangers they face, etc. 89% of participants surveyed believe that marine zoological parks should be allowed to display non-releasable animals to the public, but only 53% believe that they should be allowed to be used in shows. This is one area in which marine parks could change their shows to be more educational and less entertaining. By making such changes, using non-releasable animals in their shows would allow a greater amount of knowledge to be shared with guests about the perils they face in the open ocean and how they ended up in the parks

care. They can use these animals as a way to teach about rehabilitation and the laws that govern what animals can be released and why (Gage, 2006).

Reducing interactive programs in parks is another initiative that marine zoological parks can start increase their conservation value. Only 49% of participants surveyed believed that marine zoological parks should have exhibits where guests can feed animals. The proliferation of interactive and feeding programs with captive dolphins may lead to more public interest in engaging in these activities with wild populations, putting both species at risk (Cunningham-Smith et al., 2006). Animals housed at marine zoological parks should be there for a purpose besides entertainment. They should be there because they can't be released, are part of a breeding program for at risk species, or are undergoing rehabilitation. Marine parks and zoos have traditionally played an important role in captive breeding programs that are essential to many conservation programs for endangered and threatened species (Galbraith & Rapley, 2005). Breeding programs at parks was a point of contention among those surveyed. 83% of participants believed that marine zoological parks should develop breeding programs for at risk species, but only 41% believed that breeding programs should exist in order to have interactive exhibits. Marine conservationist see the need for breeding if it is beneficial for the species and not just for the parks bottom dollar and attractions. Significant differences were seen between gender ($p=0.032$) and education ($p=0.047$) for parks developing breeding programs for marine mammals. Male participants were split approximately 50/50, while females were more in favor of breeding programs (78%).

Similar significant differences by education were seen regarding breeding programs for both marine mammals ($p=0.047$) and cetaceans ($p=0.038$) (Figure 4).

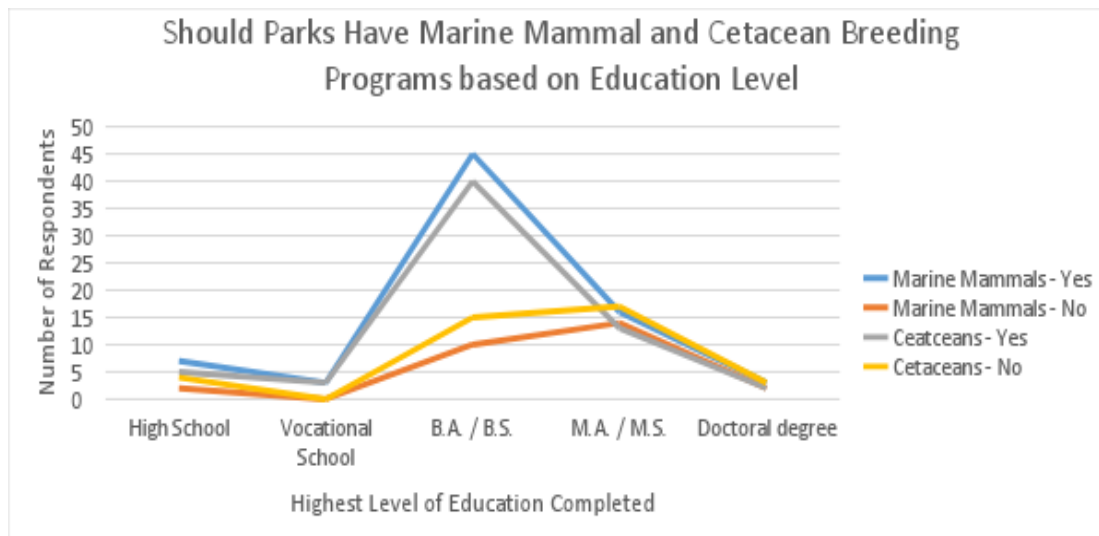


Figure 4: Respondents based on education level that agree or disagree that marine parks should have breeding programs for marine mammals and cetaceans in their care.

Bachelor's level education and below tend to show a trend towards encouraging breeding programs for cetaceans and marine mammals at marine zoological parks. Master's level education and above tend to lean towards not wanting breeding programs for marine mammals and cetaceans unless those species are at risk and are part of a breeding program aimed at increasing species numbers.

One of the greatest ways marine zoological parks can increase their value to the public sector is to increase their research initiatives. The AZA reports that members participate in over 700 cooperative conservation and management programs including, 106 species survival plans, 282 population management plans, over 400 studbooks, 46 taxon advisory groups, nine conservation action partnerships and 13 scientific advisory groups (Galbraith & Rapley, 2005). 91% of those surveyed want to see marine zoological parks required to be active in scientific research. Marine zoological parks should partner with local universities to allow students to have hands on experiences both teaching and learning about the species in their care. Marine zoological parks can also partner with other conservation groups around the world to send ambassadors to help with conservation and education initiatives. Research should be conducted in the parks in order to help scientists better understand these species. This research should then be published and shared with the general public. This is especially important today when the

sciences seem to be under threat to be cut and 'disproved' by government agencies. A great opportunity for marine zoological parks to capture is to travel to schools to teach the younger generation about marine life and conservation efforts and why these animals and this ecosystem are important to save. Sea World does a good job at reaching out to community schools for educational programs (<https://seaworld.org/en/Education-Programs>) and also has the HUBBS SeaWorld Research Institute (<http://hswri.org/>). Improvement can be made by have more scientific lectures like those seen in eastern marine zoological parks (Michael Lück & Jiang, 2007).

An innovated way marine zoological parks could make their research more practical is to do research like that involved with the Rising Tide Conservation (Cassiano et al., 2015). This is a novel idea that can help stop the decline of ornamental fishes due to the aquarium trade. The Vancouver aquarium no longer keeps killer whales in their facilities, but still house belugas in order for researchers to conduct basic research on food consumption, growth rates, reproductive cycles and behaviors (Galbraith & Rapley, 2005). They also were able to provide DNA as a healthy gene bank to compare DNA of captive St. Lawrence belugas that were exposed to high levels of environmental contaminants. This type of research provides direct conservation action in the field.

The other major change marine zoological can make to be more in line with modern day marine conservationists is to rely less on entertainment throughout the parks. While entertainment is an important factor in attracting the crowds, modern day visitors want to see more education. Education should be the focus in the shows and other attractions throughout the park. Shows instead of being choreographed to music and elaborate light shows should be more intimate. Show the connection that trainers have with the animals and show natural behaviors in context to why they would use these behaviors in the wild. A splash or two close to the barrier wouldn't hurt though as long as it was displayed and presented in an educational manner. Another suggestion is to have more trainers throughout the park exhibits throughout the day. Have the trainers do small sessions throughout the entire day instead of one big attraction to draw a large crowd profits. This way more people could see the behaviors, feeding, exercise, etc. that goes on throughout the day and enable them to talk to the trainers more one on one. Trainers can point out the

enrichment and physical benefits of these training sessions. This affords everyone the opportunity to gain more valuable knowledge that is often reserved for those that can pay a hefty fee to see these things on tours or behind the scenes.

Marine zoological parks should also be internally consistent with their conservation values. Not just with the values they teach, but with their actions by applying common sense practices to conserving natural resources and energy whenever possible (George B. Rabb, 2004). Facilities could compost, recycle, rain collection barrels and planning or retrofitting facilities to save or produce energy to increase their conservation values. These conservation practices could then be taught in the park and told how to use these practices in their everyday lives.

Only 56% of marine conservationists surveyed believed that marine zoological parks should have other forms of entertainment available to guests besides animal attractions such as roller coasters and other rides (Table 2). I believe that one way to make other attractions to guests that are educational is for parks to look into virtual reality / live feed type of entertainment. These applications provide a great platform to incorporate education into the attraction, but doing it in a way that guests would be interested. 3D rides that take you on a journey through the Arctic so guests can see the types of challenges species face in their natural habitat, a roller coaster ride that takes you through the different zones of the ocean so you can learn about the adaption species have for living a certain depths. A live camera feed to places around the world where populations of sharks are known to travel, or a live feed of the resident killer whale population in the Pacific Ocean. Video or live feed of conservation efforts that the park and their employees are a part of so the guests can see ways the park is involved with *ex situ* conservation efforts. These new and innovative efforts would decrease the value placed on live interactive exhibits and increase the value of education in the park.

Marine zoological parks need to continue to grow in pace with the ecosystems currents needs. Increased *in situ* and *ex situ* programs across parks and organizations is encouraged, as well as increased relevant research. This research needs to be shared online, in lectures, and molded into the conservation and education teachings within the park. Advancements in communication technologies should not be ignored, but

embraced. Parks employing virtual learning via online face to face lectures and live feeds of wild populations are some ways parks can embrace the future. Marine zoological parks should model themselves more after sanctuaries rather than living museums. The animals in their care should be there for a purpose; rehabilitation or having a good quality of life if they are deemed non-releasable.

6. CONCLUSIONS

Survey results indicate that marine conservationists believe that marine zoological parks play an important role in marine education for today's society. They fill the role of 'agents of change' and need to continue to grow along with present and future conservation needs. This can be achieved by increasing both their *in situ* and *ex situ* conservation programs, and increasing collaborative efforts with schools and universities. Increasing their collaborative efforts can foster more relevant research programs. Sharing their research with the public will only increase their research value and increase the general public's knowledge of the perils facing marine environments. Embracing advancement in communication technologies will help them reach a wider audience. These advancements should be embraced in the parks to fully immerse their guests in the marine environment and also use these technologies on a global scale. Embracing these advancements will allow marine zoological parks to reach an audience outside their borders. The most important change marine zoological parks need to model themselves more as sanctuaries and not entertainment venues. Acting as safe havens for animals and teaching their guests about their rescue and rehabilitation efforts will fortify their value in today's conservation efforts.

APPENDIX I**Participation Letter**

Title of Study: Pros and Cons of Marine Zoological Parks According to Marine Conservationists

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Description of Study: Kayla Patama is a master's student at Nova Southeastern University, Halmos College of Natural Sciences and Oceanography engaged in research for the purpose of satisfying a requirement for a Master of Science degree. The purpose of this study is to enhance our understanding of the motivations and justifications that marine conservationists believe in supporting modern marine parks.

If you agree to participate, you will be asked to complete the attached questionnaire. This questionnaire will help the writer identify the justifications and opinions of marine conservationists on modern day marine parks. The data from this questionnaire will be used to identify key justifications for marine parks and suggested recommendations to enhance marine parks to be more beneficial to both the patrons and captive animals. This data will also be used to satisfy a requirement for a Master of Science degree. The questionnaire will take approximately fifteen minutes to complete.

Risks/Benefits to the Participant: There may be minimal risk involved in participating in this study. There are no direct benefits to for agreeing to be in this study. Please understand that although you may not benefit directly from participation in this study, you have the opportunity to enhance our understanding of how marine conservationists view marine parks. If you have any concerns about the risks/benefits of participating in this study, you can contact the investigators and/or the university's human research oversight board (the Institutional Review Board or IRB) at the numbers listed above.

Cost and Payments to the Participant: There is no cost for participation in this study. Participation is completely voluntary and no payment will be provided.

Confidentiality: Information obtained in this study is strictly confidential unless disclosure is required by law. All data will be stored in a locked file cabinet and in an Excel file only accessible to principal and co-investigators. Your name will not be used in the reporting of information in publications or conference presentations.

Participant's Right to Withdraw from the Study: You have the right to refuse to participate in this study and the right to withdraw from the study at any time without

penalty.

I have read this letter and I fully understand the contents of this document and voluntarily consent to participate. All of my questions concerning this research have been answered. If I have any questions in the future about this study they will be answered by the investigator listed above or his/her staff.

I understand that the completion of this questionnaire implies my consent to participate in this study.

Number	Questions
1	Gender <i>Male / Female</i>
2	Ethnicity <i>African American / Asian/ Caucasian / Hispanic / Other / Prefer Not to Answer</i>
3	Age <i><20 years / 20-27 years / 28-35 years / 36-43 years / 44-51 years / 52-59 years / 60+ years / Prefer Not to Answer</i>
4	Do you consider yourself a conservationist? Conservationist here is defined as: a person who advocates or acts for the protection and preservation of the environment and wildlife. <i>Yes / No</i>
5	How many times a year (on average) do you visit marine parks? <i>I rarely or never visit marine parks / 1 visit / 2-4 visits / 5-10 visits / 11+ visits / Prefer Not to Answer</i>
6	What is the highest level of education you have completed? <i>High School / Vocational School / Bachelor's degree / Master's degree / Doctoral degree</i>
7	Marine parks play an important role in preserving endangered species
8	Marine parks allow people to see wildlife without destroying their natural habitat
9	Marine parks are important place for wildlife conservation We must support marine parks so they can develop breeding programs
10	for at risk animals Marine parks are important places for adults to share something with
11	children
12	Marine parks play an important recreational role for families
13	Marine parks are important education sites for children
14	Marine parks are important sites for everyone to learn about animals
15	Marine parks help promote environmental awareness

- 16 Marine parks are important places where scientific education can be shared with the public
- 17 Using animals in tourist attractions is beneficial for educational purposes
- 18 marine parks demonstrate how to treat animals responsibly
- 19 Without marine parks many people would not have the opportunity to see wildlife
- 20 Marine parks are a safe and secure alternative to seeing wildlife in their natural habitat
- 21 Marine parks are an affordable alternative to seeing wildlife in their natural habitat
- 22 Research conducted at marine parks is vital in order to save species from becoming extinct
- 23 Marine parks play an important role in scientific research
- 24 Conducting research in marine parks is sometimes the only way scientists can learn about wildlife
- 25 Marine parks play an important role in entertaining visitors
- 26 Entertainment is an important factor in capturing visitors' attention
- 27 Entertainment shows encourage visitors to care more about the species of animals used in the shows
- 28 Entertainment is an important tool in engaging the audience to the marine park's mission
- 29 Marine parks provide a safe and secure environment for wildlife
- 30 Animals in marine parks are better off than animals in the wild, since they are free from predators
- 31 Animals in marine parks are better off than animals in the wild, since they have no food concerns
- 32 Animals in marine parks are better off than animals in the wild, since they have no habitat pollution

- Keeping animals in attractions is a key factor in discovering ways to regulate and supervise the natural environment and wild populations
- 33** Should marine parks have to be involved with local conservation efforts?
- 34** Should marine parks have to be involved with ex situ conservation efforts?
- 35** Should marine parks develop breeding programs for all animals in their care?
- 36** Should marine parks develop breeding programs for threatened/endangered animals in their care?
- 37** Should marine parks develop breeding programs in order to have interactive exhibits? (i.e., touch tans and feeding encounters)
- 38** Should marine parks develop breeding programs for marine mammals? (i.e., sea lions, walruses, seals, manatees, and polar bears)
- 39** Should marine parks develop breeding programs for cetaceans? (i.e., whales and dolphins)
- 40** Should marine parks be involved with rescue and rehabilitation of sea birds?
- 41** Should marine parks be involved with rescue and rehabilitation of sea turtles?
- 42** Should marine parks be involved with rescue and rehabilitation of marine mammals? (i.e., sea lions, walruses, seals, manatees, and polar bears)
- 43** Should marine parks be involved with rescue and rehabilitation of cetaceans? (i.e., whales and dolphins)
- 44** Should marine parks be allowed to display non-releasable animals to the public?
- 45** Should marine parks be able to use those non-releasable animals in their animal shows?
- 46** Should marine parks use marine mammals in their animal shows?
- 47**

- 48** Should marine parks use cetaceans in animal shows?
Should animal shows at marine parks be focused on entertainment?
- 49** (i.e., music, theatrics, choreographed behaviors)
- 50** Should animal shows at marine parks be focused on conservation?
Should animal shows at marine parks be focused on education? (i.e.,
- 51** biology, natural history, laws, etc.)
- 52** Are fish okay to keep on display for educational purposes?
- 53** Are sharks okay to keep on display for educational purposes?
- 54** Are invertebrates okay to keep on display for educational purposes?
Are marine mammals okay to keep on display for educational
- 55** purposes? (i.e., sea lions, walruses, seals, manatees, and polar bears)
Are cetaceans okay to keep on display for educational purposes? (i.e.,
- 56** whales and dolphins)
Should marine parks have educational signage on display throughout
- 57** the park?
Should marine parks have educators positioned at all animal displays
- 58** throughout the park?
Should education at marine parks focus on biology and natural history
- 59** of the animals on display?
Should education at marine parks focus on threats to their natural
- 60** environment, education, and protective laws?
Should education at marine parks focus on how to interact with wild
- 61** animals?
Should marine parks be required to be actively involved with scientific
- 62** research?
Should marine parks have other types of entertainment for guests
- 63** besides the animals on display? (i.e., roller coasters, rides, attractions)
- 64** Should marine parks have fish/invertebrate touch tanks?
- 65** Should marine parks have exhibits where guests can feed animals?

REFERENCES

- Acampora, R. (2005). Zoos and eyes: Contesting captivity and seeking successor practices. *Society & Animals*, 13(1), 69-88.
- Adimey, N., Mignucci-Giannoni, A., Auil Gomez, N., Da Silva, V. M., Alvite, C., Morales-Vela, B., & Rosas, F. (2012). Manatee rescue, rehabilitation, and release efforts as a tool for species conservation. *Sirenian conservation: Issues and strategies in developing countries. Florida: University Press of Florida*, 205-217.
- Andrews, B., Davis, W., & Parham, D. (2001). Corporate response and facilitation of the rehabilitation of a California gray whale calf. *Aquatic Mammals*, 27(3), 209-211.
- Ballantyne, R. (2004). Young students' conceptions of the marine environment and their role in the development of aquaria exhibits. *GeoJournal*, 60(2), 159-163.
- Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, 13(3), 367-383.
- Braverman, I. (2014). Conservation without nature: the trouble with in situ versus ex situ conservation. *Geoforum*, 51, 47-57. doi: <https://doi.org/10.1016/j.geoforum.2013.09.018>
- Bruehler, G., DiRocco, S., Ryan, T., & Robinson, K. (2001). Husbandry and hand-rearing of a rehabilitating California gray whale calf. *Aquatic Mammals*, 27(3), 222-227.
- Campbell, W. B. (2001). A note on the release and tracking of a rehabilitated pygmy sperm whale (*Kogia breviceps*). *J. Cetacean Res. Manage*, 3(1), 87-94.
- Carr, N., & Cohen, S. (2011). The public face of zoos: images of entertainment, education and conservation. *Anthrozoös*, 24(2), 175-189.
- Cassiano, E. J., Wittenrich, M. L., Waltzek, T. B., Steckler, N. K., Barden, K. P., & Watson, C. A. (2015). Utilizing public aquariums and molecular identification techniques to address the larviculture potential of Pacific blue tangs (*Paracanthurus hepatus*), semicircle angelfish (*Pomacanthus semicirculatus*), and bannerfish (*Heniochus* sp.). *Aquaculture international*, 23(1), 253-265.
- Catibog-Sinha, C. (2008). Zoo tourism: Biodiversity conservation through tourism. *Journal of Ecotourism*, 7(2-3), 160-178.

- Clayton, S., Fraser, J., & Saunders, C. D. (2009). Zoo experiences: Conversations, connections, and concern for animals. *Zoo biology*, 28(5), 377-397.
- Croke, V. (2014). *The modern ark: the story of zoos: past, present, and future*: Simon and Schuster.
- Cunningham-Smith, P., Colbert, D. E., Wells, R. S., & Speakman, T. (2006). Evaluation of human interactions with a provisioned wild bottlenose dolphin (*Tursiops truncatus*) near Sarasota Bay, Florida, and efforts to curtail the interactions. *Aquatic Mammals*, 32(3), 346.
- Dima, L. D., & Gache, C. (2004). Dolphins in captivity: realities and perspectives. *Analele Științifice ale Universității, Al I Cuza, Iași, Biologie animal ă*, 100, 413-418.
- Doar, K. H. (2007). *Case Studies in Aquarium History*.
- Falk, J. H., Reinhard, E. M., Vernon, C., Bronnenkant, K., Heimlich, J. E., & Deans, N. L. (2007). *Why zoos & aquariums matter: Assessing the impact of a visit to a zoo or aquarium*: Association of Zoos & Aquariums Silver Spring, MD.
- Frynta, D., Šimková, O., Lišková, S., & Landová, E. (2013). Mammalian collection on Noah's Ark: the effects of beauty, brain and body size. *PloS one*, 8(5), e63110.
- Gage, L. (2006). Policies and Best Practices Marine Mammal Stranding Response, Rehabilitation, and Release. *Standards for rehabilitation facilities. JE Whaley. Silver Spring, NOAA National Marine Fisheries Service, 49*.
- Galbraith, D. A., & Rapley, W. A. (2005). Research at Canadian zoos and botanical gardens. *Museum Management and Curatorship*, 20(4), 313-331. doi: <https://doi.org/10.1016/j.musmancur.2005.09.003>
- Graham, N. L. M. (2015). Conservation Education in Zoos and Aquaria: The Benefits of These Institutions and Their Impact on Conservation Action According to Staff.
- Grimm, D. (2011). Are Dolphins Too Smart for Captivity? *Science*, 332(6029), 526-529.
- Gross, M. (2015). Can zoos offer more than entertainment? *Current Biology*, 25(10), R391-R394. doi: <https://doi.org/10.1016/j.cub.2015.04.056>
- Hill, H., & Lackups, M. (2010). Journal Publication Trends Regarding Cetaceans Found in Both Wild and Captive Environments: What do we Study and Where do we Publish? *International Journal of Comparative Psychology*, 23(3).

- Hoage, R. J., & Deiss, W. A. (1996). *New worlds, new animals: from menagerie to zoological park in the nineteenth century*: JHU Press.
- Hutchins, M. (2003). Zoo and aquarium animal management and conservation: current trends and future challenges. *International Zoo Yearbook*, 38(1), 14-28. doi: 10.1111/j.1748-1090.2003.tb02060.x
- Hyson, J. (2004). Education, entertainment, and institutional identity at the zoo. *Curator: The Museum Journal*, 47(3), 247-251.
- Jamieson, D. (1985). Against zoos. *Environmental Ethics: Readings in Theory and Application*, 5, 97-103.
- Jamieson, D. (1986). Against zoos. *Environmental Ethics: Readings in Theory and Application*, 5, 97-103.
- Jensen, E. A., Moss, A., & Gusset, M. (2017). Quantifying long-term impact of zoo and aquarium visits on biodiversity-related learning outcomes. *Zoo biology*, 36(4), 294-297. doi: 10.1002/zoo.21372
- Jiang, Y., Lück, M., & Parsons, E. (2007). Public awareness, education, and marine mammals in captivity. *Tourism Review International*, 11(3), 237-249.
- Kelly, J. D. (1997). Effective conservation in the twenty-first century: the need to be more than a zoo. One organization's approach. *International Zoo Yearbook*, 35(1), 1-14. doi: 10.1111/j.1748-1090.1997.tb01184.x
- Kisling Jr, V. N. (2012). Zoological Parks A2 - Chadwick, Ruth *Encyclopedia of Applied Ethics (Second Edition)* (pp. 575-583). San Diego: Academic Press.
- Kisling, V. N. (2000). *Zoo and aquarium history: Ancient animal collections to zoological gardens*: CRC press.
- Kleiman, D. G., Thompson, K. V., & Baer, C. K. (2010). *Wild mammals in captivity: principles and techniques for zoo management*: University of Chicago Press.
- Lück, M. (2007). Managing marine wildlife experiences: The role of visitor interpretation programmes. *Marine wildlife and tourism management: Insights from the natural and social sciences*, 334-346.
- Lück, M., & Jiang, Y. (2007). Keiko, Shamu, and friends: Educating Visitors to Marine Parks and Aquaria? *Journal of Ecotourism*, 6(2), 127-138.

- Lyles, A. M., & Wharton, D. (2013). Zoos and Zoological Parks A2 - Levin, Simon A *Encyclopedia of Biodiversity (Second Edition)* (pp. 470-479). Waltham: Academic Press.
- Maple, T. L., & Perdue, B. M. (2013). Building Ethical Arks *Zoo Animal Welfare* (pp. 1-20): Springer.
- Marino, L., Bradshaw, G., & Malamud, R. (2009). The Captivity Industry. *BEST FRIENDS*, 25.
- Marino, L., Lilienfeld, S. O., Malamud, R., Nobis, N., & Broglio, R. (2010). Do zoos and aquariums promote attitude change in visitors? A critical evaluation of the American zoo and aquarium study. *Society & Animals*, 18(2), 126-138.
- Mason, G. J. (2010). Species differences in responses to captivity: stress, welfare and the comparative method. *Trends in Ecology & Evolution*, 25(12), 713-721.
- Mayer, S. (1998). A review of the scientific justifications for maintaining cetaceans in captivity: Whale and Dolphin Conservation Society.
- Miller, L., Zeigler-Hill, V., Mellen, J., Koepfel, J., Greer, T., & Kuczaj, S. (2013). Dolphin shows and interaction programs: benefits for conservation education? *Zoo biology*, 32(1), 45-53.
- Minteer, B. A., & Collins, J. P. (2013). Ecological ethics in captivity: Balancing values and responsibilities in zoo and aquarium research under rapid global change. *Ilar Journal*, 54(1), 41-51.
- Moore, M., Early, G., Touhey, K., Barco, S., Gulland, F., & Wells, R. (2007). Rehabilitation and release of marine mammals in the United States: risks and benefits. *Marine Mammal Science*, 23(4), 731-750.
- O'Brien, J. K., & Robeck, T. R. (2010). The Value of Ex Situ Cetacean Populations in Understanding Reproductive Physiology and Developing Assisted Reproductive Technology for Ex Situ and In Situ Species Management and Conservation Efforts. *International Journal of Comparative Psychology*, 23(3).
- Ogle, B. (2016). Value of Guest Interaction in Touch Pools at Public Aquariums.
- Osinga, N. (2010). Harbour seals (*Phoca vitulina*) and rehabilitation. *NAMMCO Scientific Publications*, 8, 355-372.

- Packer, J., & Ballantyne, R. (2002). Motivational factors and the visitor experience: A comparison of three sites. *Curator: The Museum Journal*, 45(3), 183-198.
- Packer, J., & Ballantyne, R. (2012). Comparing captive and non-captive wildlife tourism. *Annals of Tourism Research*, 39(2), 1242-1245.
- Patrick, P. G., & Tunnicliffe, S. D. (2013). A History of Animal Collections *Zoo Talk* (pp. 5-17). Dordrecht: Springer Netherlands.
- Rabb, G. B. (1994). The changing roles of zoological parks in conserving biological diversity. *American Zoologist*, 34(1), 159-164.
- Rabb, G. B. (2004). The Evolution of Zoos from Menageries to Centers of Conservation and Caring. *Curator: The Museum Journal*, 47(3), 237-246. doi: 10.1111/j.2151-6952.2004.tb00121.x
- Rabb, G. B., & Saunders, C. D. (2005). The future of zoos and aquariums: conservation and caring. *International Zoo Yearbook*, 39(1), 1-26. doi: 10.1111/j.1748-1090.2005.tb00001.x
- Robeck, T., Steinman, K., Yoshioka, M., Jensen, E., O'Brien, J., Katsumata, E., . . . Monfort, S. (2005). Estrous cycle characterisation and artificial insemination using frozen-thawed spermatozoa in the bottlenose dolphin (*Tursiops truncatus*). *Reproduction*, 129(5), 659-674.
- Robeck, T. R., Steinman, K. J., Gearhart, S., Reidarson, T. R., McBain, J. F., & Monfort, S. L. (2004). Reproductive Physiology and Development of Artificial Insemination Technology in Killer Whales (*Orcinus orca*)1. *Biology of Reproduction*, 71(2), 650-660. doi: 10.1095/biolreprod.104.027961
- Roman, J., Altman, I., Dunphy-Daly, M. M., Campbell, C., Jasny, M., & Read, A. J. (2013). The Marine Mammal Protection Act at 40: status, recovery, and future of US marine mammals. *Annals of the New York Academy of Sciences*, 1286(1), 29-49.
- Shani, A. (2012). A quantitative investigation of tourists' ethical attitudes toward animal-based attractions. *Turizam: znanstveno-stručni časopis*, 60(2), 139-158.
- Shani, A., & Pizam, A. (2010). The role of animal-based attractions in ecological sustainability: Current issues and controversies. *Worldwide Hospitality and Tourism Themes*, 2(3), 281-298.

- Trouwborst, A., Caddell, R., & Couzens, E. (2013). To free or not to free? State obligations and the rescue and release of marine mammals: a case study of 'Morgan the Orca'. *Transnational Environmental Law*, 2(1), 117-144.
- Wells, R. S., Fauquier, D. A., Gulland, F., Townsend, F. I., & DiGiovanni, R. A. (2013). Evaluating postintervention survival of free-ranging odontocete cetaceans. *Marine Mammal Science*, 29(4), E463-E483.
- Zagzebski, K. A., Gulland, F. M., Haulena, M., & Lander, M. E. (2006). Twenty-five years of rehabilitation of odontocetes stranded in central and northern California, 1977 to 2002. *Aquatic Mammals*, 32(3), 334.