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Chapter 2

Wildlife Conservation Research at AZA-Accredited Public Aquariums in North America

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Additional information is available at the end of the chapter

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Abstract

Zoos and Aquariums in North America have evolved over the past few decades from institutions that exhibit animals primarily for public enjoyment to conservation organizations whose mission is to inspire and contribute significantly to wildlife conservation. The Association of Zoo and Aquariums, AZA, accredits public institutions in North America that house wildlife based on strict industry standards of exhibitry, husbandry, veterinary medicine and education. The role of conservation research has evolved in AZA facilities from just a handful of staff participating in a few projects to many facilities now having entire departments dedicated to conservation research. In 2003, AZA institutions reported in the Annual Report on Conservation Science (ARCS) that 83% of its member's participated in over 2,370 conservation projects in 107 countries and spent $77 million (AZA ARCS 2003). More recently the 2014 ARCS report stated that AZA institutions dramatically increased their conservation efforts from 2010 with 88% of members participating in conservation projects and spending 154 million. Many of the top accredited aquariums have strong conservation programs and are spending at least 3% of their budgets on conservation efforts with projects focusing on species and ecosystems and topics of global concern such as climate change and marine debris..

Keywords: conservation research, field research, American Zoo, Aquarium Association, zoos, aquariums

1. Introduction

Zoos and aquariums in the North America have evolved over the past few decades from institutions that exhibit animals for public enjoyment to conservation organizations whose mission is to inspire and contribute significantly to wildlife conservation. The Association of Zoo and Aquariums (AZA) in North America accredits public institutions that house wildlife

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based on industry standards of exhibitry, animal care or husbandry, veterinary medicine, and education. Founded in 1924, AZA once focused primarily on the care of captive animals and the entertainment of visitors, but now highlights the importance of field conservation work focused on saving wildlife. Although not yet an accreditation standard, AZA now encourages all member institutions to spend at least 3% of their general operating budget on field conservation directly impacting wildlife and wild ecosystems. Many accredited zoos and aquariums have general operating budgets in the tens of millions of dollars, thus even the 3% that AZA encourages institutions to spend on conservation research is substantial and equals hundreds of thousands of dollars spent per institution.

The evolution of scientific research in zoos and aquariums began slowly in the first part of the twentieth century with just a handful of institutions participating in any kind of research. Field conservation in zoos and aquariums gained momentum as society's attitudes toward wildlife and conservation changed dramatically in the later half of the century as noted by the passing of the Marine Mammal Protection Act (MMPA) in 1972 and the Endangered Species Act (ESA) in 1973. The level of conservation research in zoos and aquariums was first measured in the mid-1980s when Finlay and Maple [1] surveyed the role of research in American zoos and aquariums quoting Hediger [2] as their inspiration, "A modern zoo nowadays is not only a local place of population entertainment, but an institution which had always been indebted throughout its development to scientific inquiry, and must keep in active touch with it." By the 1980s, research in zoos and aquariums was well established with 70% of surveyed institutions stating that they participated in research or scientific activity and 59% of institutions noting it as important to their mission in official publications [1]. However, it was clear that there was room for improvement with less than half (46%) noting that their research programs were expanding, only 39% reported that they had a research committee, and only 57% published their research [1]. The largest institutions, as measured by attendance, and those affiliated with academic institutions reported the most research activities, while those reporting little to no research activity cited financial limitations and the lack of trained staff as the primary reasons for not conducting research [1].

Twelve years later the level of research in zoos and aquariums was measured again by Stoinski et al. [3]. They found that research in zoos and aquariums had increased since last surveyed in 1986. The authors noted a variety of reasons for the increase including an increased interest in conservation, the use of applied research to solve management problems, as well as an increased desire to study the wild counterparts of the animals in their collection in the field [3]. The survey found that participation in research increased to 88% of institutions with research or scientific activity noted as an objective in 83% of institutions in official publications [3]. The authors noted that since the mid-1980s the percentage of institutions conducting research increased in all facility sizes, as measured by attendance. However, they found that the percentage of institutions reporting expanding research programs decreased for all size classes except for within the largest facilities with the largest resources. In addition, the majority of zoos and aquariums surveyed in 1998 had few full time staff dedicated to research activities citing financial limitations [3]. Most notably, this survey pointed out the emergence of the importance of field research and conservation with the majority of facilities reporting studying wild counterparts of their captive collections [3].

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By 2003, AZA institutions reported in the Annual Report on Conservation Science (ARCS) that 83% of its members participated in over 2370 conservation projects in 107 countries and spent $77 million [4]. Almost a decade later, the 2010 AZA ARCS report summarized that 73% of its members participated in over 1900 conservation activities and spent $130 million. In the first decade of the twenty-first century, participation as the percent of members and number of conservation projects decreased but overall funding for conservation at AZA facilities almost doubled. The reported conservation activities include donations to conservation organizations, the rescue and rehabilitation of endangered species, education programs that directly protect species in the wild, and research vital to the conservation of endangered species in the field. While this was a significant effort toward field conservation, it still reflected an investment of only 2% of AZA accredited facilities annual budgets. To increase member participation in conservation activities, in 2010 AZA launched an initiative that strongly recommended its member institutions spend at least 3% of their general operating budget on conservation research activities that directly benefit animals in the wild. This recommendation seems to have worked. The 2014 ARCS report stated that AZA institutions dramatically increased their conservation efforts from 2010 with 88% of members participating in conservation projects and spending $154 million. Although this is an improvement over the efforts reported in 2010, it is still not the approximately 200 million that would equal 3% of AZA instructional annual budgets [5].

The 2010 conservation initiative resulted in the forming of the AZA Field Conservation Committee to define and measure field conservation. This committee views AZA-accredited zoos and aquariums as conservation centers that are concerned about ecosystem health, take responsibility for species survival, contribute to research, conservation, and education, and finally provide the opportunity to develop personal connections with wild animals for society. This view is almost completely opposite that AZA had of member institutions when it first formed. The focus now is for accredited zoos and aquariums to play a more vital role than they have in the past in maintaining the planet's diverse wildlife and natural habitats while engaging the public to participate in conservation.

The AZA Field Conservation Committee defines field research as directly contributing to the long-term survival of species in natural ecosystems and habitats. Accredited institutions may meet this criteria through the following actions: direct action, defined as conducting work in the field such as research, population management, and community-based programs; species recovery, defined as food, housing, and veterinary care of animals in captive breeding programs that are slated to be reintroduced into the wild such as in rescue and rehabilitation programs; veterinary care, defined as the direct costs of wildlife disease issues for animals that can directly impact the corresponding wild population or veterinary care for wild animals not found in the collection; conservation assurance populations, defined as the direct cost of food, housing, and care of animals being housed, which cannot be reintroduced back into the wild because of poor *in situ* (in the wild) conditions, however the institution must be actively working to determine a strategy for reintroduction back into the wild; research, defined as the direct costs of research that takes place outside of the institution and helps protect species in the wild; field conservation education, defined as costs for work done on behalf of an NGO that publicizes wildlife conservation, direct costs of conservation education programs that

take place outside of the institution that directly impacts the species or habitat of concern, and direct costs of training staff or volunteers not employed by the institution for field conservation work; advocacy, defined as direct costs of work done to lobby for wildlife conservation; and fundraising/grants, defined as fundraising or cash grants made to other conservation organizations to support wildlife conservation in the field.

Zoos and aquariums may impact wildlife conservation through direct actions and research. In addition to research activities, as public institutions, zoos, and aquariums play another key role in conservation. Accredited institutions in North America enjoy over 180 million visitors annually. The shift toward more conservation oriented institutions provides modern zoos and aquariums an amazing opportunity to positively impact the conservation attitudes and actions of their visitors. To measure this, in 2007, AZA conducted a nationwide study of the impacts of a visit to accredited institutions. The survey documented that after visiting an accredited zoo and aquarium in North America most adult visitors indicated a positive change in conservation attitudes and understanding [6].

The evolution of conservation in AZA accredited institutions has resulted in changing accreditation recommendations, standards, and board-approved policies. Examples of this are AZAs 2010 conservation initiative and the field conservation committee that encourage member institutions to be more conservation focused in their exhibits, educational messages, policies, and practices. For example, current AZA accreditation recommendations include that a member's mission should have a conservation theme, the institution should have a conservation program, and the institution should actively conduct conservation work. The question is how are institutions changing to meet these new standards? Specifically, how have the majority of AZA accredited aquariums in North America (here defined as the United States and Canada) responded? Most aquarium conservation research programs started very small primarily donating money to outside conservation organizations and with zero to few staff dedicated to conservation or field research. Until now, many major aquariums have their own multidisciplinary conservation programs/departments with multiple staff conducting field conservation and research.

2. Current status

The following is a summary of the current status of conservation in AZA accredited aquariums, specifically research and field conservation, in the wake of the 2010 AZA conservation initiative.

Current AZA accreditation standards suggest that all member institutions have a conservation theme. The missions of 20 AZA accredited aquariums are listed in **Table 1**. Fourteen or 70% have the word "conservation" in their mission statements. The other 30% have various words alluding to conservation such as stewardship, sustain, protect, or make a difference (**Table 1**).

Current AZA recommendations are that member institutions have a conservation program and should actively conduct field conservation work. The AZA Field Conservation Committee defines field research as directly contributing to the long-term survival of species in natural

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Facility	Mission
Alaska SeaLife Center	To promote understanding and stewardship of Alaska's marine ecosystems.
Aquarium of the Bay	Explore, explain, and sustain Life.
Aquarium of the Pacific	To instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems.
Audubon Aquarium of the Americas (part of the Audubon Nature Institute)	Educate our diverse audience about the natural world, enhance the care, and survival of wildlife through research and conservation.
Birch Aquarium at Scripps Institution of Oceanography	To provide ocean science education, to interpret Scripps Institution of Oceanography research, and to promote ocean conservation.
Florida Aquarium	To protect and restore our blue planet.
Georgia Aquarium	Research to contribute to the understanding of the underwater world and apply new discoveries to the conservation of aquatic life.
John G. Shedd Aquarium	To connect you to the living world, inspiring you to make a difference.
Monterey Bay Aquarium	To inspire conservation of the ocean.
Mote Marine Laboratory and Aquarium	To be a leader in nationally and internationally respected research programs that are relevant to the conservation and sustainable use of marine biodiversity, healthy habitats, and natural resources.
Mystic Aquarium	To inspire people to care for and protect our ocean planet through conservation, education, and research.
National Aquarium	Drive Marine conservation through engagement
New England Aquarium	To increase understanding of aquatic life and environments, to enable people to act to conserve the world of water, and to provide leadership for the preservation of sustainable use of aquatic resources.
Oregon Coast Aquarium	To create unique and engaging experiences that connect you to the Oregon coast and inspire ocean conservation.
Point Defiance Zoo and Aquarium	To promote and practice effective conservation on behalf of the world's wildlife.
Seattle Aquarium	Inspiring conservation of our marine environment.
SeaWorld® San Diego (research department only)	To apply basic physiological research efforts and state-of-the-art reproductive technologies toward wildlife species management and conservation.
Steinhart Aquarium	Explore, explain, and sustain life.
Tennessee Aquarium	The Tennessee Aquarium inspires wonder, appreciation and protection of water, and all life that it sustains.
Vancouver Aquarium	Conservation of aquatic life through display, communication, public programming and education, research, and direct action.

Table 1. Twenty aquarium mission statements.

Facility	F.C.	Research	Taxa and areas of focus
Alaska SeaLife Center	7	8	Climate change; marine mammals; fish; seabirds; invasive species
Aquarium of the Bay	3	1	River, bay and ocean studies; sharks
Aquarium of the Pacific	6	2	Birds; sea turtle; reefs; marine mammals; sharks; white abalone
Audubon Aquarium of the Americas (part of the Audubon Nature Institute)		2	Fish; marine mammals; sea turtles; sharks; sea horses
Birch Aquarium at Scripps Institution of Oceanography	10	NR	Marine mammals; fish; harks; sea turtle; so white abalone; coastal awareness
Florida Aquarium	7	NR	Reefs; marine mammals; sea turtle; coastal birds
Georgia Aquarium	6	NR	Penguins; sea turtles; marine mammals; sharks
John G. Shedd Aquarium	19	2	Invasive species; reptiles; marine mammals; invertebrates; fish; sea horses; penguins; sharks
Monterey Bay Aquarium	11	1	Sharks; rays; ocean conservation; fish, shorebird; seabird; sea otters; seafood watch
Mote Marine Laboratory and Aquarium	9	9	Manatees; reefs; fish; sharks; sea turtles; invertebrates; ocean acidification; toxicology
Mystic Aquarium	17	8	Amphibians; penguins; marine mammals; fish; invertebrates; reptiles
National Aquarium	15	6	Restoration; invasive species; marine animal rescue; sharks; seabirds; marine mammals
New England Aquarium	10	15	Marine mammals; sea turtles; sustainable seafood; fish; sharks; climate change; reefs; aquatic protected areas
Oregon Coast Aquarium	4	1	Invasive species; marine reserves, sea otters; marine animal rehabilitation
Point Defiance Zoo and Aquarium	4	6	Citizen science; fish; marine mammals
Seattle Aquarium	15	9	Citizen science; ocean acidification; marine mammals; reefs; fish; invertebrates; sharks; coastal monitoring
SeaWorld® San Diego (research department only)	15	NR	Marine sanctuaries; marine debris; killer whales; marine mammals; fish; sea turtles; coastal birds; seabirds
Steinhart Aquarium	8	3	Amphibians; fish; seahorses; reefs; coastal birds
Tennessee Aquarium	6	6	Fish; river ecology; amphibians; sustainable seafood
Vancouver aquarium	23	7	Amphibians; marine mammals; fish; invertebrates

Legend: F.C. = field conservation; NR = not reported.

Table 2. Number of field conservation and research projects reported in 2014 [7].

ecosystems and habitats and defines research as scientific activities that take place outside of the institution and helps protect species in the wild. All of the aquariums listed in **Table 1** reported the following conservation-related activities under field conservation (F.C.) and research in the

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2014 ACRS report (**Table 2**). Note that the numbers of projects and species or areas of focus are likely underestimates of the breadth and scope of conservation activities as some projects may not fall into easily quantified categories.

The taxa involved in research and field conservation reported by accredited aquariums tend to reflect the facilities collections. For example, many institutions report studying coral reefs (**Figures 1** and **2**), fish and sharks (**Figures 3** and **4**), coastal birds or seabirds and marine mammals as most have all these taxa in their collections. Many aquarium exhibits, particularly those on or near the ocean, are primarily regional and thus the focus of their conservation efforts on species iconic and unique to their region (**Figure 5**). Recently, conservation projects have shifted from those with a primarily regional focus toward conservation projects with a global theme such as marine debris removal and those studying climate change.

All accredited aquariums in North America have conservation messages in their missions (**Table 1**) and all report activities that meet AZAs definition of field conservation and research (**Table 2**). Accreditation standards continue to push member institutions to do more by suggesting that all have conservation departments that are equal in breadth and scope to other major departments in aquariums such as live animal exhibits, husbandry, and education. Conservation research programs at major aquaria are organized and funded in many different ways and have evolved significantly over the years. In the past, very few organizations had conservation programs or departments. Up to now, many major accredited aquariums in North America have relatively large conservation programs/departments and many have met AZAs challenge to spend at least 3% of their general operating budget on conservation activities particularly in field conservation that directly or indirectly impacts conservation of aquatic wildlife. To determine how field research programs in AZA accredited aquariums were organized and funded, an informal survey was conducted for this paper. Forty percent of the aquariums listed in **Tables 1** and **2** responded. Survey results may be indicative of where aquariums are going regarding field conservation in that some are already where they want to be, some are in the process of getting 7there and some have just begun. As a side note even though some stated that they were happy with their institutions commitment to conservation, all agreed that more should be done for conservation of animals in the wild. The following are the results of the informal survey of major public aquariums in North America: 75% had a separately managed conservation department; 88% of those conservation departments were managed by an executive staff member at the vice president level or above; 75% of the executives managing the conservation department held a philosophical doctorate, Ph.D., and had direct experience conducting conservation science; 62% employed between 1 and 10 full time equivalent (FTE) staff, 25% surveyed employed between 10 and 20 FTE staff, and 13% employed over 20 FTE staff devoted to field conservation and/or research; 50% reported funding for their conservation departments came from grants and/or donations while the other 50% reported funding through general operating budgets; 62% reported spending more than 3% of the general operating budget on field conservation as recommended by AZA while 38% did not; finally, 50% were happy with the level of field conservation they conducted while 50% were not and felt their institutions should do more and/or have more impact on conserving wild systems.



Figure 1. Coral research: Seattle Aquarium biologists growing corals for display and to share with other aquariums to minimize taking of wild corals. Photo credit Seattle Aquarium.

Zoos and Aquariums are doing more for wildlife conservation and they may have the greatest conservation impact when they work together. In 2015 AZA launched a conservation initiative called Save Animals from Extinction or SAFE. The initiative is to encourage accredited zoos and aquariums to harness their collective resources, focus on specific endangered species, and save them from extinction by restoring healthy populations in the wild. AZA SAFE focuses on 10 signature species/groups of animals: African penguin, Asian elephant, black rhinoceros, cheetah, gorilla, whooping crane, sea turtle, sharks, vaquita, and Western pond turtle. Many of the major aquariums in **Table 2** listed conservation projects that involved either sharks and/or sea turtles as many aquariums have sharks in their collections and many either have sea turtles or participate in sea turtle rehabilitation. Another collaborative conservation initiative,

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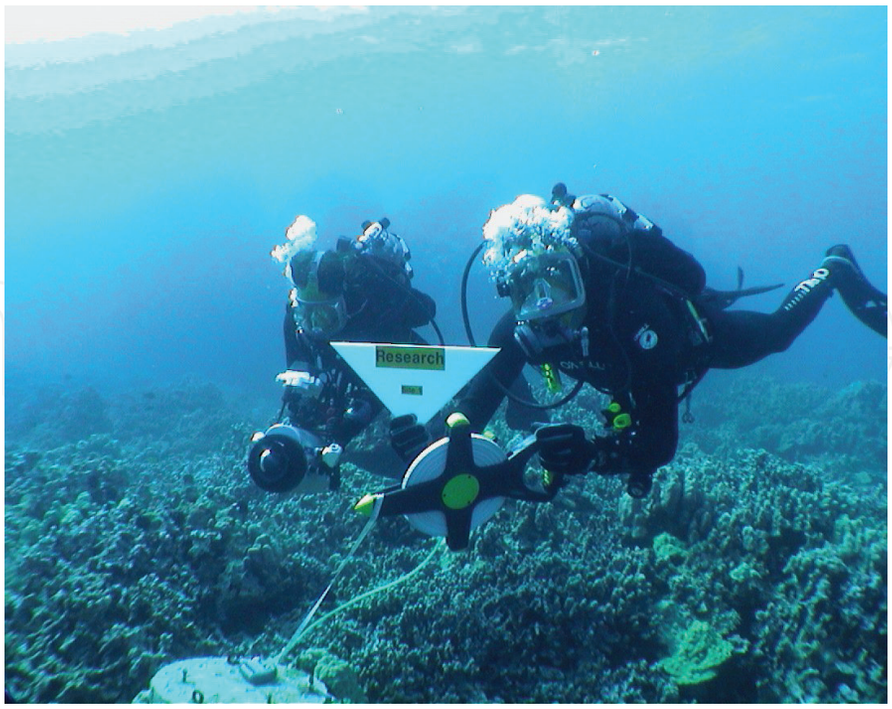


Figure 2. Aquarium researchers conducting reef surveys. Photo credit Brian McNeil.

the Aquarium Conservation Partnership (ACP) launched in 2016 as a 2-year-proof-of-concept project designed to bring the nation's leading aquariums together to achieve meaningful



Figure 3. SCUBA diver setting bait to attract free swimming sixgill sharks at the Seattle Aquarium for genetics and abundance research. Photo credit Veronica von Allworden.



Figure 4. Free swimming sixgill shark with visual marker and acoustic tag for movement and abundance research under the Seattle Aquarium. Photo credit Veronica von Allworden.



Figure 5. SCUBA diver conducting population surveys on giant Pacific octopuses. Photo credit Veronica von Allworden.

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conservation impact for ocean and freshwater ecosystems. The ACP is a voluntary, unincorporated project that was initiated by Monterey Bay Aquarium, Shedd Aquarium, and National Aquarium. The ACP currently comprises 15 sponsoring/collaborating aquariums and ACP's first objective is to reduce ocean and freshwater plastic pollution or marine debris.

3. Conclusion

The most effective conservation research programs in public aquaria are those that use their resources wisely, partner with other institutions, and focus their efforts on field or *in situ* research that has the most impact on aquatic wildlife. Zoos and aquariums also have the opportunity to affect conservation through their visitors. The keynote speaker at AZAs 2015 annual convention was Dr. M. Sanjayan, executive vice president and senior scientist at Conservation International. In his speech he implored accredited zoos and aquariums to remember the impact they can have on conservation and to not lose sight of their conservation mission when steeped in daily activities of running a major public institution. Dr. Sanjayan calls accredited zoos and aquariums to conservation action primarily because of the unique opportunity; they have to reach the 183 million visitors a year. These institutions can directly educate and influence the kids going through their gates to understand conservation so that they grow up to make the right choices for wildlife and the environment. Virtually, every accredited zoo and aquarium has a mission focused on conservation but often the day to day running of such an operation overshadows conservation efforts. Dr. Sanjayan implored zoos and aquariums must put their mission first and foremost and focus in wildlife conservation.

Zoos and aquariums must do more for conservation and are continuing to shift focus from entertainment and educational facilities to what AZA states as "conservation centers" where real conservation work is done and animals and ecosystems are impacted in the wild. It is clear that AZA institutions are doing more than they have in the past but they must increase the breadth and scope of their field conservation programs to remain relevant in a changing world and to ensure that the amazing animals and ecosystems that they share with visitors reflect what is still in nature. Rather than being living museums to showcase what used to exist in the wild, zoos and aquarium must ensure by direct action that those species and ecosystems survive in the wild. It seems that the current trend in major North American aquariums is to move toward more direct conservation action but the fact that 50% surveyed are not happy with the level of conservation work that they are doing and almost 40% are not spending even 3% of their budgets on field conservation and research illustrates how much more needs to be done.

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