

REINFORCING MARINE CONSERVATION MESSAGES: CASE STUDY AT THE
HOUSTON ZOO

A Professional Paper

by

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ABSTRACT

The Houston Zoo has been involved in conservation efforts worldwide for many years. However, in 2015, the Houston Zoo pledged to make conservation its priority and improve upon the existing conservation programs. In 2015, the Houston Zoo developed partnerships with 28 conservation organizations in 10 different countries. The sea lion team at the Houston Zoo adopted a conservation initiative of its own in 2014. The efforts focus on monofilament and illustrate how institutional policy is essential to allocate and leverage limited resources through volunteer effort and external partnerships. The Houston Zoo sea lion team has built a credible and successful conservation initiative by partnering with NOAA in creating in-situ conservation action. Daily sea lion presentations have been modified to include marine debris messaging to create continuity of implementation throughout the sea lion team practices. The ambassador qualities of our California sea lions appeals to the affective learning domain to promote emotional connections to the animals and the natural world. Awareness and action are increased by engaging the cognitive learning domain through the Houston Zoo's Interactive "WOW" signage placed strategically throughout the exhibit. The Houston Zoo reaches an extensive audience (2.46 million visitors in 2015) by strengthening the relationship between marine conservation and zoos, using both in-situ and ex-situ methods. This transferable conservation project model documents the project planning phase for use by others in the zoo community.

Key Words: conservation, marine conservation, conservation messaging, ambassador animals, monofilament, marine debris, NOAA, zoo, project model

DEDICATION

This professional paper is dedicated to Lee. Lee was a professor of history and my step-father. His passion for education and lifelong learning sparked my curious and studious nature. Thanks to Lee, I learned security in my own abilities and to believe in myself, but I also learned humbleness. Always my number one fan, any accomplishment warranted a very enthusiastic cheering. Lee passed away 13 years ago, but he left enough encouragement to last a lifetime. Though Lee is not here now to rain praise upon me for my accomplishments, I know he would be proud and my scholarly efforts would be sure to elicit a “way to go Brat! Way to go! You done good, baby!”

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Finally, thanks to my family and friends for their encouragement and to my husband for his unwavering love, support, and devotion.

NOMENCLATURE

AZA	Association of Zoos & Aquariums
HZI	Houston Zoo, Inc.
NOAA	National Oceanic and Atmospheric Administration
RSPCA	Royal Society for the Prevention of Cruelty to Animals
WAZA	World Association of Zoos and Aquariums

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Introduction

This professional paper is a case study of the development of a project at the Houston Zoo, which integrated three main goals of zoos: education, conservation and animal welfare. The Marine Debris project was initiated by keepers and applied widely accepted concepts in a manner that was unique and successful. The purpose of this paper is to document (a) the planning process, (b) ex-situ educational efforts at the zoo and (c) in-situ conservation efforts at marinas. My intent is to develop a transferable model for developing targeted conservation messaging projects at zoos.

Purpose of Zoos: Paradigm Shift

Historically, zoos and aquariums have been a source of human entertainment and leisure (Carr & Cohen, 2011). These types of facilities introduced unique opportunities to its visitors to see exotic species that otherwise might not be encountered. Today, though entertainment and leisure are a result of visits to a zoo, it is no longer the main purpose for the modern zoo. Education, conservation, and animal welfare are three main facets of the roles of zoos and aquariums. The adoption of these roles contributes to the shift in public perception that has been, and is still in the process of changing. Patrick et al. (2007) found 131 of 136 studied zoo mission statements contain specific reference to the theme of education and 118 facilities mention the theme of conservation itself. If zoos and aquariums wish to remain successful as conservation and education institutions, evidence will have to be made readily apparent to the average guest.

Animal activists challenge the purpose and mere existence of zoos today and the animals that remain within their care. Activists are a major threat and challenge to the future of zoos and aquariums. For this reason, it will be necessary for zoos to present their conservation credentials to ensure the entertainment message does not obscure the transmission of conservation or education messages. At the same time, sufficient attendance must be encouraged to ensure the economic viability of zoos (Carr & Cohen, 2011). The Association of Zoos and Aquariums (AZA) directive in 2013 urged that all AZA-accredited institutions increase their commitment to conservation with the hopes that a level of support will allow each zoo to be defined individually and collectively as organizations committed to conservation of species in the wild (Maple, 2014). The term “zoo” refers to zoos and aquariums.

Attendance at American zoos ranges into the millions per year. Collectively, zoos within the World Association of Zoos and Aquariums (WAZA) reach more than 700 million visitors annually. This large audience has great potential to make zoos powerful allies in educating the public on issues related to environmental sciences, as well as general scientific research (Yocco et al., 2015). Additionally, zoos can impact the conservation knowledge, attitudes, and behaviors of numerous people (Luebke & Matiasek, 2013). If the zoo industry is to be successful in a complete shift in public perception, the zoo community as a whole should make an effort to improve their conservation performance (Hutchins & Smith, 2003). If any gaps between the image of zoos and the reality exist, it is the responsibility of these institutions to rectify the situation (Carr & Cohen, 2011). Another contributing factor to this shift in perception

that is taking place is the movement from antiquated, visually-restricted, barred exhibits to naturalistic exhibits that reflect the natural habitat of the species being exhibited.

Visual barriers are removed, creating an element of proximity to the animal. The quality of exhibits and quality of staff stand out as the most important factors in influencing conservation outcomes (Wagner et al., 2009).

Roles of Zoos: Education, Conservation, Animal Welfare

A major role of the modern zoo is education (Carr & Cohen, 2011). Education within zoos can take the form of both formal and informal learning opportunities. Many zoos have education departments that are accredited for teaching students of school age in a classroom setting. Zoo resources are used to create outreach programs that bring the zoo experience to the classroom. Programs exist for home schooled children as well.

Numerous day camps and summer camps also exist to provide a more formal education experience in the zoo setting. From an educational perspective, problems with direct relevance for the target group should be addressed to encourage local involvement and action (Keulartz, 2015). More zoos are adopting and applying this technique in their educational programs. As an example, the Houston Zoo has special pollinator and Attwater prairie chicken series offered throughout the year.

Informal learning takes place throughout a guest's visit in the form of educational signage, animal demonstrations, and keeper chats (Anderson et al., 2003). Today, in order to meet evolving industry standards, zoos strive to connect with guests on a personal level so as to not only improve the overall entertainment experience, but

more importantly, guest learning. Staff qualities such as accessibility, expertise, clarity and relevance of information provided to visitors show far-reaching impacts (Wagner et al., 2009). Some zoos even have docent programs where volunteers have been specially trained to both handle and present animal facts in a meaningful and memorable way. Zoo docents are adult volunteers who provide educational encounters to zoo guests. Falk (2005) describes a process termed “free-choice learning” which is an informal learning process that allows zoo visitors to freely choose what and how to learn (Carr & Cohen, 2011). Daily keeper chat schedules are published on websites, mobile apps, or information boards at zoos to allow guests to plan their visit, based on individual interests. These are scheduled opportunities for visitors to see specific animals and interact with the animal care staff to ask questions and engage in conversation.

Formal and informal education target two learning domains (Luebke & Matiasek, 2013): the cognitive domain (increasing awareness, understanding, or knowledge about environmental issues and conservation actions) and the affective domain (promoting emotional/affective connections to animals and/or the natural world). In studying how zoos contribute to visitor understanding of biodiversity, Moss et al. (2015) found their most compelling evidence for teaching specific actions by which visitors can become involved to help protect biodiversity. Animal related experiences are necessary to engage visitors in active conservation behavior and better reconnect the visitor with the natural world (Roe et al., 2014). Roe et al. (2014) also found from visitor responses that they are not only receptive, but have a strong expectation of learning during their zoo visit. Zoos, though well-meaning, have made strong causal claims regarding the

educational impacts of visiting zoos and aquariums on the basis of insufficient empirical evidence (RSPCA, 2007). Whether the education aspect is met through informal or formal settings, it is undeniable that zoos strive to incorporate education into the guest experience. Zoos with educational credentials are able to prove educational roles of the zoo mission, and the educational aspect will benefit the industry as a whole as more zoos obtain these credentials that qualify the institution as an educational organization.

Conservation has emerged as the highest priority of the zoo profession (Maple, 2014), as voted by AZA members in 1980 (Serrell, 1988). Zoos are uniquely positioned to reach large audiences, but the communication of conservation involvement must be done so in an effective manner. Today, zoos exist to aid in the conservation of species threatened by extinction (Carr & Cohen, 2011). Conservation is emerging as the main role and focus of many zoological institutions within WAZA. Membership in WAZA will be instrumental, as it will take a collaborative effort to achieve transparent and measureable conservation outcomes achieved only by working together effectively (Fa et al., 2014). To be effective in conservation endeavors, zoos must do more than raise awareness of conservation challenges. Awareness alone will not change visitor behavior and it might even prove counter-productive if visitors are not afforded an opportunity to act (Sterling et al., 2007).

Conservation within zoos and aquariums takes on many forms of involvement and the level of involvement varies between institutions. Some zoos are pioneers, setting the standard for others through creative measures. Some zoos focus solely upon local conservations issues, some global, but the zoos with best conservation practices are

involved in both local and global efforts. Involvement ranges from raising funds, to creating conservation partnerships, to in situ efforts, or ex situ efforts. Actions by zoos that clearly improve conservation outcomes include efforts to increase awareness of specific actions that zoo guests can take. For example, by carrying a refillable water bottle, plastic waste can be reduced. Such actions result in a behavior change of the guest, and can improve conservation outcomes (Skibins et al., 2013). The results from a study by Skibins et al. (2013) supported the ability of zoo wildlife tourism to produce conservation outcomes. These kinds of studies are required to provide the empirical evidence to support claims of conservation and education impacts as a result of visiting zoos. Yet another example of empirical evidence for zoo impact on conservation related behavior changes is described by Wagner et al. (2009), called Measuring Mission, which is a process created for assessing the zoo's mission impact. It confirms that high-quality exhibits interpreted by expert, readily available staff can influence conservation knowledge and motivation of zoo guests. Viewing rare and endangered animals, having fun, and learning how to help preserve natural habitats and animals (Wagner et al., 2009) directly impact visitors' conservation motivation. Thus, it can be said that a visit to the zoo empowers visitors to implement a conservation behavior at home (MacDonald, 2015).

Zoos that contribute to in situ conservation efforts typically support animals in their natural habitats via funding efforts that collectively generate more than US\$350 million for wildlife conservation every year (Gusset & Dick, 2011). Some more developed projects might involve collaboration between researchers and the zoo. Zoo

keepers may have opportunities for field work to help wild populations by gathering ecological information which leads to a better understanding of the needs of the particular species. Other facilities may create partnerships with one another to all support one conservation initiative

Among the most obvious roles of zoos, is the welfare of the animals in their care. Though conservation and education are the most visible priorities of zoos today, welfare, paired with a growing emphasis on science, looms as the next frontier (Maple & Bocian, 2013). As the zoo field has evolved, so too has the care provided to the animal residents. Modern zoo veterinary medicine continues to improve as more is learned through seminars and annual conferences. Professional training for animal care staff, international symposia, and accrediting bodies like AZA and WAZA which form official committees for animal welfare strategic plans and approaches (Kagan et al., 2015) contribute to improved animal care. As zoos assess the welfare status of resident animals, it is largely focused on what is animal care, that is, what is provided to animals (Kagan et al., 2015). Access to food, water, and shelter, and veterinary care are included in the assessment. The majority of American zoos have a full veterinary staff on grounds 7 days a week. The modern zoo has an animal nutrition department dedicated to ensuring the dietary needs of all animals in the collection. Species-specific needs are met through prescribed diets. Further contributing to welfare, animal keepers provide enrichment to stimulate animals mentally and physically, while encouraging natural behaviors. As such, the components of welfare can be achieved and can ensure that animals in zoos thrive, not just survive, physically, psychologically, and socially (Kagan et al., 2015).

Case Study: Houston Zoo Background

Conservation messaging at Houston Zoo Inc. (HZI) has the potential to reach wide audiences through guest education efforts, as it has made record attendance for the 8th consecutive year in 2015, with 2.46 million visitors, making it the second most visited zoo in the country. A portion of every ticket sale goes directly to the conservation efforts of HZI; effectively, when zoo visitors visit the zoo, they are involved in conservation practices. This resonates with a recommendation by Gusset et al. (2014) to assure that it is understood by guests that visiting the zoo is an act of conservation and that each visit contributes to conservation in the wild.

In 2015, the Houston Zoo developed partnerships with 28 conservation organizations in 10 different countries. Some notable wildlife successes which increased survivorship of wild animals in 2015 (Appendix A) include: over 600,000 Houston toad eggs released into the wild; HZI supported the protection of 250 wild elephants in Borneo; planted 12,000 trees in Madagascar to save lemur habitats; planted 100 species of plants that attract pollinators in 9 gardens; released 176 Attwater's prairie chickens back into the wild; recycled 2,233 electronic devices to help save gorilla, chimpanzee, and okapi habitats; and provided medical care for 124 sea turtles. . The Houston Zoo, Oregon Zoo, and Seattle-based Woodland Park announced a unique partnership, the first of its kind, with Borneo-based wildlife organizations to protect the endangered Borneo pygmy elephant. This work is carried out by Sabah Wildlife Department and the conservation organizations HUTAN KOCP (Kinabatangan Orangutan Conservation

Project) and Danau Girang Field Centre and will focus on researching how human-elephant conflicts arise and can be mitigated through community outreach, policy, technology, and occasionally, elephant relocation (Draper, 2016).

Ex situ conservation efforts are those that aim to protect endangered species outside their natural habitats. The Houston Zoo participates in three notable ex situ conservation projects and includes the following: Attwater's prairie chicken (*Tympanuchus cupido attwateri*), sea turtles, and the Houston toad (*Anaxyrus [Bufo] houstonensis*). The capacity of involvement to each effort by HZI varies. As an example, HZI participates in "head-starting" and management of captive assurance colonies of the Houston toad. An educator's guide was created as a "cross-discipline curriculum" and aligned with state education standards for easier application in the formal classroom (Rommel et al., 2016). Different efforts are detailed on the Houston Zoo website with links inviting web-visitors to learn more about how the zoo assists, successes, and identify how guests can contribute to the efforts. Some listed opportunities for contribution include: how to report a stranded turtle, behavior changes (e.g. use reusable shopping bags), and a direct web link to donate. Each of these is an excellent way to empower visitors with actions they can incorporate into their daily lives (Roe et al., 2014). These are only a handful of examples how the Houston Zoo is striving to be a leader of conservation in the zoo industry.

In addition to raising funds by dedicating a portion of ticket sales to conservation practices, the Houston Zoo also hosts many fundraising events throughout the year. In 2015, 30 conservation funding events were hosted by the Houston Zoo. A popular

conservation funding event that is well attended is the Feed Your Wildlife Conservation Gala funding event, which raised \$872,000, setting yet another HZI record, in support of zoo conservation programs.

Sharing the conservation successes of the Houston Zoo with guests is only one way to create inspiration to take action. To find true success in impact, it is imperative to communicate the sustainable practices of the Houston Zoo. In 2015, all 23,850 pounds of fish fed to the California sea lions (*Zalophus californianus*) was 100% ocean-friendly and sustainably caught fish. The admissions tickets are now made of 100% recycled materials. A practice which will have one of the greatest impacts, is that the entire zoo has gone plastic-bag free, preventing an estimated 80,000 plastic bags from making it to landfills and waterways. Since going plastic-bag free in June 2015, the sale of reusable bags has increased by 200 bags per week. As guests realize how these practices contribute to a cleaner environment, adoption of reusable bags can be expected to increase.

Zoo staff is intimately involved in the conservation initiatives supported by the Houston Zoo. The staff seems to be especially proud of the Houston Zoo's Staff Conservation Fund Campaign. It began in 2004 as a mechanism for staff involvement in the generation of zoo conservation dollars. No other zoo that the Houston Zoo is aware of operates such a successful program where zoo employees donate a portion of their hard-earned wages to conserve wildlife. So far, 30 programs have been funded, involving 47 staff members, confirming the sense of pride the staff has for the Staff Conservation Fund Campaign. Eight of these conservation programs are geared towards

marine species conservation. Conservation is intertwined at nearly every level of operation at the Houston Zoo and strives every year to improve conservation impacts. These practices serve as distinct evidence that the Houston Zoo is a conservation-based organization and fulfills its obligation and expectation in the roles of a modern zoo.

Focal Program: Marine Debris

As a conservation-based organization, the Houston Zoo fulfills its obligation and expectations as a modern zoo through employee driven conservation efforts such as a project designed to raise awareness of marine debris. The targeted messages in this project follow guidelines and information provided by the lead federal agency, the National Oceanic and Atmospheric Administration (NOAA). Targeted messaging is a way of communicating conservation needs and challenges to specific subsets of audiences (Luebke & Matiasek, 2013). The perspective of the targeted audience is incorporated through relevancy. Conservation efforts and their relevancy to the targeted group are imperative in inspiring behavioral changes related to conservation impacts. Targeted messaging has the potential to inspire and enable zoo visitors to take conservation actions (Luebke & Matiasek, 2013).

Marine debris is any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes (NOAA, 2011). The impacts of marine debris are far reaching and can affect marine animals through entanglement, death or injuries associated with consumption by choking or gastrointestinal blockages, and even

affect the smallest marine life at the base of the food web (Ocean Conservancy 2009). The Ocean Conservancy International Cleanup for 2008 found 69% of entanglements were caused by fishing related items, including line, nets, rope, hooks, and crab/lobster/fish traps (Ocean Conservancy 2009). While large marine debris items are cause for concern, breakdown of the debris due to weathering and action of the ocean currents also poses a threat to the marine environment.

Microplastics are a form of marine debris also of concern (NOAA 2009) due to effects on the marine food web. The NOAA Marine Debris Project (NOAA 2011) defines microplastics as particles composed of synthetic polymers less than or equal to 5mm and divides microplastics into two sources, primary and secondary. Primary microplastic resources are those in which microplastics are intentionally produced either for direct use or as precursors to other products. (E.g. pre-production pellets, industrial abrasives, exfoliants). Secondary microplastic resources are formed in the environment from breakdown of larger plastic material, especially marine debris and the rate of production of secondary microplastics likely depends on characteristics of the plastic, the extent of weathering, and on the energetics of the local environment (NOAA, 2009).

Although the actual impacts of microplastics are not well studied, workshop participants outlined the following potential problems in the marine environment: (1) the documented occurrences of microplastics in the marine environment, (2) the long residence times of these particles (and, therefore, their likely buildup in the future), and (3) their demonstrated ingestion by marine organisms (NOAA, 2009). A concern more recently realized is that microplastics may also serve as sources or sinks of contaminants

to the oceans (NOAA, 2009). If microplastics are ingested by marine animals, it has been documented to cause physical blockage or damage to feeding appendages and digestive tract, leaching of plastic component chemicals into organisms after digestion, and ingestion and accumulation of sorbed chemicals by the organism (NOAA, 2009).

Large marine debris and microplastics come together in what is known as the Great Pacific Garbage Patches. The ‘garbage patches’ (both the eastern and western) are areas of marine debris concentration in the North Pacific Ocean. The size and content of these areas are difficult to accurately predict (NOAA, 2011) because little scientific research has been completed. The garbage patches are not consistent in location or concentration, so cleanup efforts are not easy. Also, the areas are generally very large and much of the debris found within the patches is in the form of microplastics. Netting the surface of the ocean would be ineffective in removing the microplastics because it would collect small marine animals with it, causing more harm than good, and is also highly inefficient for the area required. Garbage patches are currently monitored by the NOAA Marine Debris Program (MDP) through rigorous scientific survey and volunteer at-sea visual survey (NOAA, 2011), which are necessary in order to compare marine debris, composition, abundance, distribution, movement, and impact data on national and global scales (NOAA, 2011). From a regional perspective, Houston is situated near Galveston Bay and coastal regions of the Gulf of Mexico. Preliminary models indicate that this shoreline in Texas is at high risk for impacts of marine debris (Nixon and Barnea, 2010). Offshore winds and currents, by the same action as the large gyres of the

Pacific, drive floating objects into this region. These conditions make our selected site ideal for the described in situ efforts.

The employee driven conservation project designed to target marine debris integrates the existing conservation, education and welfare practices of HZI. The objectives of this case study are the following:

1. Develop a transferable project model by documenting the project planning phase.
2. Document ex-situ efforts of education at the zoo, including animal ambassadors and interactive exhibits.
3. Document in-situ efforts of marine debris collection at local marinas in the region.

Methods

Project Planning

A collaborative team first had to be defined to determine who would be involved in this project in the initial stages. To ensure success, the project took small steps in its growth and began with the HZI's Sea Lion staff. The core team included one supervisor, three full-time keepers, and one part-time keeper.

The planning process used by the Houston Zoo sea lion team to build a sustainable and successful conservation initiative program was based on the Logic Model guidelines, which link outcomes to activities (Kellogg Foundation, 2004). After the project model was completed, a mind map was created. The use of mind maps can bring new, creative dimensions to the project management process (Dutt, 2014). It is an

especially useful tool in exploring relationships between ideas and elements and allows for relevant issues to be identified and choices analyzed in light of the bigger picture (Dutt, 2014) during the initial phases of a new conservation project. The mind map for the monofilament initiative, created using a free online platform called WiseMapping, outlines a project six month timeline expected to implement the first phases of the project, as well as identifies an overview of steps needed prior to beginning the work.

Ex-situ Efforts: Ambassador Animals and Interactive Signs

The project team focused on a strategy using ambassador animals to link affect and action. Through the showcasing of captive animal species whose wild counterparts are affected, audiences can be moved from awareness to action. Animal ambassadors are those that Skibins & Powell (2013) refer to as ‘flagship’ species. These animals possess a level of charisma that resonates with the target audience and interactions with humans are capable of raising public awareness and action for conservation (Skibins & Powell, 2013). Animal ambassador programs through zoos and aquariums can be effective conservation messaging tools. The tool is effective when humans forge an emotional connection with the animal that translates into action or general support for conservation (Skibins & Powell, 2013).

At the Houston Zoo, animals are presented as ambassadors for their species in the wild. Though ambassador animals were once considered only to include those that are large and charismatic, zoo animals of a range of species are used during interactions with the guests. The sea lion team has recognized differences among individual animals

and has used those notable differences to enhance the emotional appeal (affective domain) during performances and direct guests to actions specified on interactive signs near the exhibit. Guests could be observed interacting with the signage following the sea lion presentations. Additionally, some were observed sorting through the snack containers and bottles to determine what items could be recycled.

Infographics that integrate visuals and text can increase audience engagement with message content for more effective processing and persuasive arguments for change to communicate environmental issues (Lazard & Atkinson, 2015). The combination of visuals and text make data digestible and far easier to retain (Talent Development, 2015). The use of infographics helps bridge knowledge producers with knowledge users, who are often inundated with information and increasingly pressed for time (Otten et al., 2015).

Modern and engaging signage is conducive to experiential learning, more so than graphics of the past (Serrell, 1988). Ross & Gillespie (2009) state that the challenge for zoos in terms of signage is to meet the needs of visitors for entertainment while providing educational opportunities, which effectively convey conservation messages and zoological facts. The sea lion team collaborated with HZI graphics department to create interactive signage that is both informative and engaging. The sea lion team was responsible for the written content, but graphics then took the information and presented it in a fashion appealing to the average guest.

In-situ Efforts: Partnering with Existing Programs

The Houston Zoo had an existing partnership with the National Oceanic and Atmospheric Administration (NOAA) to help with local sea turtle rehabilitation program within the Galveston Bay area. Members of NOAA collected monofilament from specially designed bins once weekly and also complete a sea turtle survey. NOAA had a sea turtle hotline available for fishermen who unintentionally catch sea turtles.

Fishermen learned the appropriate way of handling sea turtles and how to report such incidents by not cutting the line, but getting help by professionals instead. The sea lion team only assisted in the monofilament aspect of this effort, in a voluntary basis. They participated in monthly clean ups at one jetty, which provided opportunities to educate the local fishermen. Monofilament was collected from the bins placed by NOAA and trash in the jetty rocks was also collected. The sea lion team was trained to understand the perspective of fishermen and present information in a non-threatening manner.

Results

Transferable Model for Project Design

A project model was defined (Figure 1) to help create shared understanding of and focus on program goals and methodology, relating activities to projected outcomes (Kellogg Foundation, 2004). This process allowed the sea lion team to identify necessary inputs and how each would lead to the targeted objectives.

After an initial survey of available literature was completed by the sea lion team to learn about marine debris and its known impacts, the team confirmed the desire to

focus specifically on monofilament. Several team planning meetings were conducted to narrow the focus of the project. Common themes were outlined in the meeting minutes to determine that the focus of the project would target monofilament.

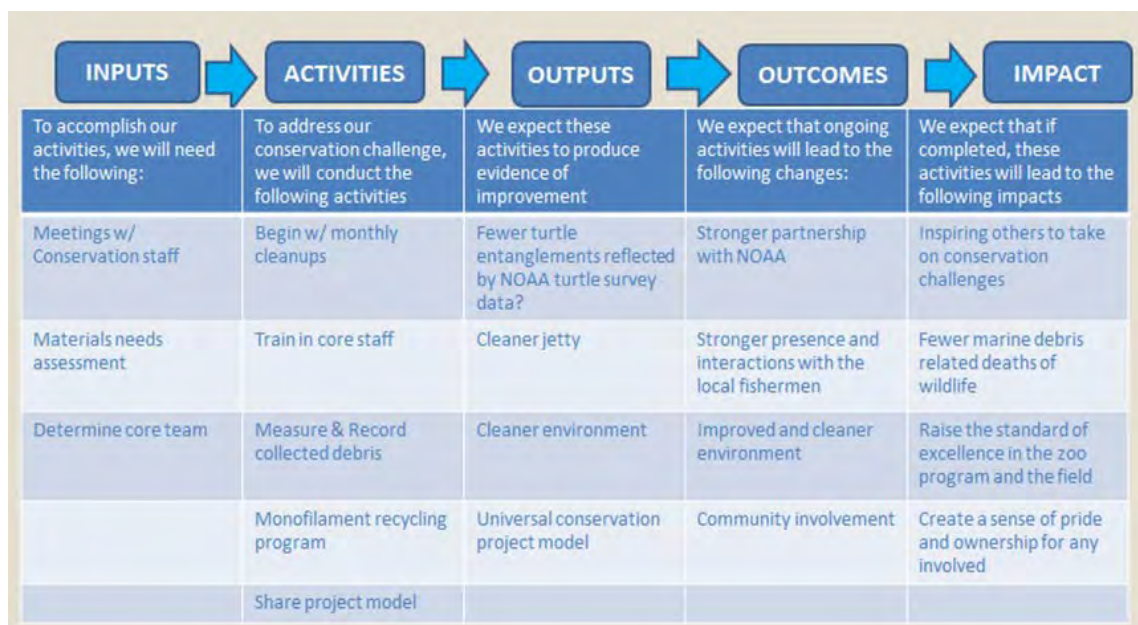


Figure 1. Project planning model (adapted from Kellogg Foundation 2004)

Monofilament was a recurring theme in the meetings, likely due to the common background experience the staff has with a young pup, named Astro, who likely suffered an entanglement event associated with monofilament. In memory of Astro, the team voted unanimously to focus on monofilament reduction efforts. In this way, the sea lions at the zoo would serve as ambassador animals, reinforcing the link between emotions invoked during keeper talks and conservation actions in targeted messages at interactive exhibits visited by guests.

The “mind map” exercise stimulated team leaders to think creatively about how to take action (Appendix B). The first branch of the mapping process posed the question of “Where to start” which led the team to decide whether to assist with an existing initiative rather than create a new initiative. The next branch on the mind map identified the need to announce interest to the HZI Conservation Department in becoming actively involved in a sea lion team initiated effort. The associated sub-branches of the mind map led to plans for meetings and identifying who to contact and invite. The last branch of the initial phase outlined the staff that would be involved initially, the core staff, and what training would be required. Training was required so that consistency in practice could be achieved. The team found it useful to reconfigure the mind map to match the growing needs of the program as it developed.

During monofilament clean ups, the main focus was to collect the monofilament from the bins, with a secondary goal of cleaning up the jetty rocks to clear away marine debris. Monofilament collected from the bins and rocks often has driftwood, other marine debris, and non-recyclable rope intertwined with the fishing line. Thus, it is important to sort through the monofilament prior to recycling to remove non-recyclables. To quantify the amount of marine debris at the cleanup site, monofilament, trash, and recycling are weighed during each visit.

The sea lion keeper talks were modified as a result of the Mind Map exercise, to create continuity of implementation throughout the sea lion team practices. Theming during the presentation provided an avenue to inform guests of the monofilament project, to serve as an inspiration and to demonstrate how HZI actively participated in

conservation efforts. The team designed a strategy, realizing that as guests learn about sea lions, a connection between the guest and the animal develops. The level of interest increases and it is at this point that the guests would be directed to the interactive signage to learn more about human impacts on the marine environment.

Team Building through Conservation Action

As a result of in-situ objectives, the sea lion team joined the sea turtle survey partnership and pledged to carry out monthly cleanups at the Surfside Jetty. The in-situ efforts for the monofilament initiative adopted by the sea lion team were limited only to the Surfside Jetty, near Galveston, Texas. The Surfside Jetty is a mile long stretch with five monofilament collector bins made available for fishermen. The monofilament was collected by the sea lion team, sorted, and weighed, and then recycled. In a one year period, the sea lion team at the Houston Zoo removed 283.5 pounds of recycling, 324.75 pounds of trash, and 23.3 pounds of monofilament (Figure 2).

The jetty cleanup efforts began with only five individuals, but have since expanded to involve other departments at the zoo. So far, nine other departments have received training and have contributed to these efforts to reduce marine debris along the Texas coast. Some departments, such as Graphics, which have not been directly involved in the in situ efforts, but have contributed greatly, have done so by helping the sea lion team communicate successes and results to the zoo visitors.



Figure 2. Infographic of 2014-2015 sea lion team monofilament data (Image credit: Houston Zoo)

This meaningful conservation activity provided keepers with first hand experiences that they could share with guests in keeper talks. For example, the fishermen were very interested in the cleanup efforts and even paused with their own fishing to help clean up a section of the jetty. The recycled monofilament was sent to a recycling company that pledged to make the monofilament into other products besides monofilament.

All monofilament collection efforts by the sea lion team were done voluntarily. Each team member pledged to participate in some capacity as a contribution to the team-building objectives of making meaningful conservation impacts together. They felt their effort contributed to the success of the nationwide NOAA marine debris campaign. Their enthusiasm was transmitted to guests during keeper talks.

Emotional Appeal of Ambassador Sea Lions

The sea lion presentation skillfully placed conservation messaging in a dynamic game engaging ambassador animals, keepers, and guests. The charismatic, curious, and playful personality of California sea lions was showcased as animal ambassadors to captivate the audience and create the necessary connection bridging awareness and action. The guests were invited to assist the sea lion in a game of “reduce, reuse, and recycle”. Marine debris and monofilament were described to the guests and examples of each were placed in the pool. The guests interacted as items were retrieved by the sea lion, indicating which bin the animal should place each object.

After an engaging game, the guests were challenged to pledge to start recycling efforts during their visit at the zoo. Providing immediate and clear action items was helpful in making the take-away message more explicit. The awareness of visitors was enhanced by drawing on their own experiences with trash. The sea lion team integrated messages about debris found in the sea lion pool and debris found in the ocean. During keeper chats, the guests’ attention was directed to a sign (Figure 3), demonstrating how the problem of marine debris accumulation was a problem even at the zoo. The debris

collected in the sea lion pool consisted of common items carried by zoo guests. Interestingly, similar objects were found during the sea lion jetty cleanups. Cups, bottles, toys, cigarette butts, and straws were some of the most common items found on the jetty cleanups. When guests made this connection during keeper chats, the response was generally one of surprise to realize they personally could make a difference through reduced use of these types of products.

Interactive Signs Inspiring Action

As part of the conservation messaging, the Houston Zoo has introduced interactive “WOW” signs (Figure 3), which attract guests outside of keeper talks. The origin of the name for the interactive signage comes from the initial response guests may have upon approaching the sign. On this sign, there was a transparent display box four feet high and containing items that were dropped directly in the sea lion exhibit by zoo guests. Sea lion staff collected items dropped by guests for several years to create this parallel between the exhibit and the ocean. The signage was designed to stimulate guests to make the link between the damage humans inflict in controlled environments (i.e. the zoo) and to imagine to what those results might look like in the uncontrolled setting of the ocean. It showed how guests’ actions could impact the natural world. As visitors looked at the shadow box display of items accumulated in the sea lion exhibit, staff observed them drawing their own conclusions about what the natural environment might look like, without efforts to remove the marine debris. Additionally, guests spontaneously expressed surprise at how everyday items were the ones to end up as marine debris.



Figure 3. Houston Zoo Interactive “WOW” signage- ‘It’s Not an Ocean Away’ (Image credit: Houston Zoo)

These displays were also designed to stimulate guests to generalize from sea lions to other species impacted by marine debris (Figure 4). The interactive sign illustrated three items comparing human and animal perspectives to show how an animal could mistake a plastic bag for a jelly fish. While our goal was to use the sea lions as ambassadors to deliver a message, the ultimate goal was for the information to be generalized, creating the largest potential impact on behavior of guests. Through creative presentation of perspective, zoo guests were able to bridge these gaps to realize the biggest plight is that marine debris affects whole ecosystems in addition to individual species. Spontaneous guest comments reflected this sentiment: “I did not know plastic bags could pose such a large threat to so many animals.”

This large interactive sign (Figure 4) was 18 feet long and 6 feet tall, suitable for groups of people to gather and discuss the ideas. School groups sat in front of the sign while the instructor incorporated the interactive signage into the teachable moment (Figure 5). It was very popular amongst zoo visitors and usually had a line of people waiting to use the interactive features. Infographics were incorporated into this sign to highlight important and interesting marine debris statistics. The middle portion of the sign had a round globe of water with plastic beads or nurdles. A handle operated by the user drove a pump that simulated wave action to demonstrate the fate of plastics in the ocean environment. The last portion of the sign asked “Do you see what I see?” and showed marine debris items from the human perspective. When the wheel was turned, it

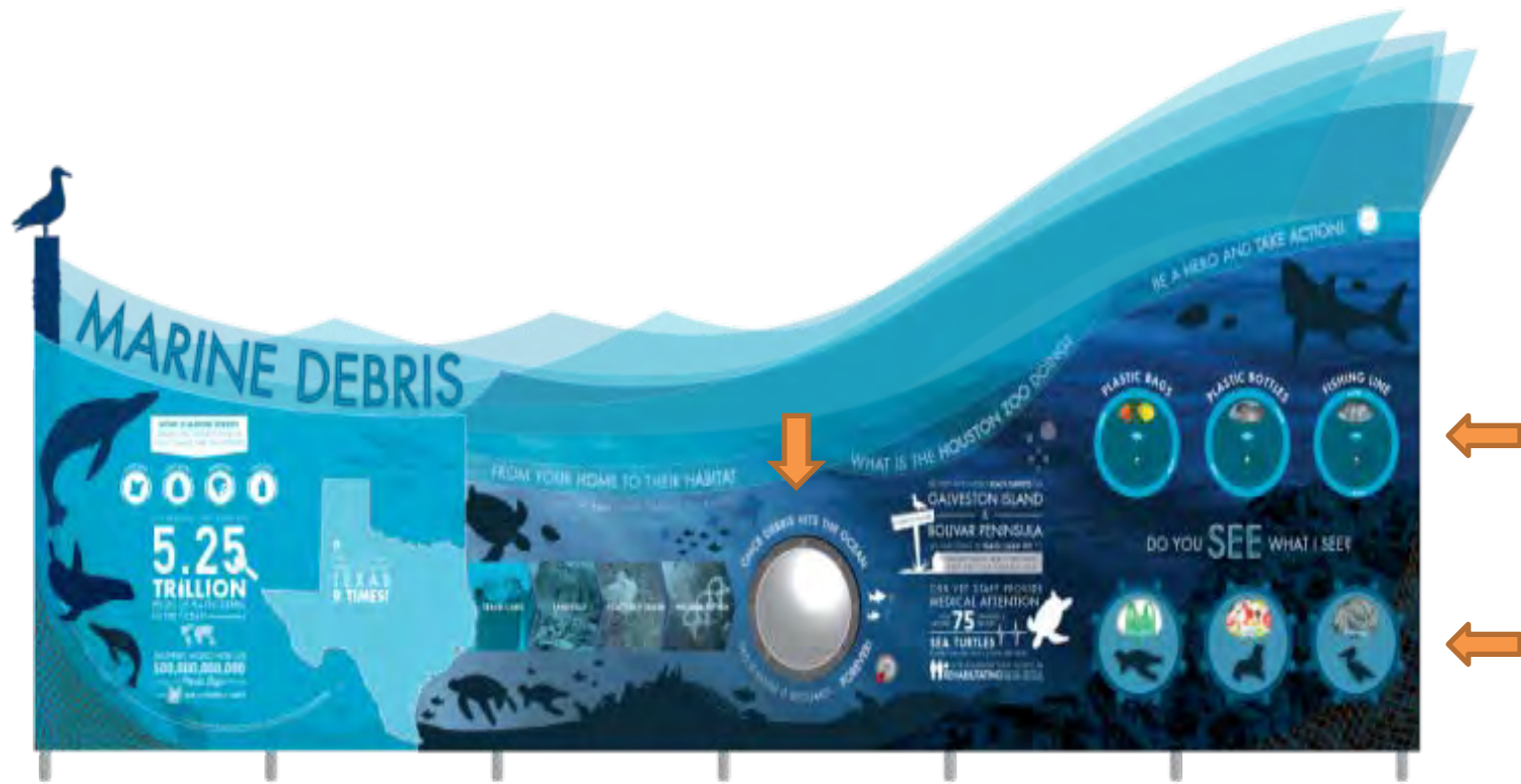


Figure 4. Houston Zoo Interactive “WOW” signage with interactive features indicated by orange arrows (Image credit:

Houston Zoo)

showed the marine debris item from the animal perspective. For example, one wheel showed a plastic grocery bag suspended in water. When the wheel was turned, it revealed a jelly fish to show how sea turtles might mistake these bags for their normal prey. Some of the most common comments heard as guests were observed interacting with the sign often involved intent to modify behavior. For example, children asked a parent something like “next time you take me to the store, can we take a canvas bag instead?” Comments like these were encouraging that the signage, at the very least, encouraged zoo visitors to consider and re-evaluate their own behavior.



Figure 5. A school field trip group gathers around the interactive WOW sign to learn about the fate of marine debris (Image credit: Heather Crane)

Finally, the Marine Debris conservation messages were integrated into activities at other locations where guests could learn about other action items an individual could start to create a positive impact on our environment. There were themed signs throughout the zoo with a “TAKE ACTION” logo (Figure 6). Any sign with the “TAKE ACTION” badge identified behaviors for zoo visitors that were easy to adopt on the same day as their visit. Each visitor that interacted with these signs was encouraged to “be a hero, take action today.”

Though infographics are not a completely new concept, the popularity seems to be growing. At the Houston Zoo, information provided in this format captivated and inspired guests. Based on spontaneous comments, the transition from outdated textual animal facts to streamlined infographics seemed to be a much appreciated improvement. The appreciation was apparent when guests completely veered off track to see what the sign had to offer. Visiting educators stopped staff to ask when the signs around the zoo were installed and to comment that these installments enriched their field trip lesson plans.

The success of these interactive signs began with the project planning phase. The mind map and project plan helped to clearly identify the focus of the program and how to best communicate the ideas to the visitors, within the context of an existing initiative for the Education Department to upgrade signs all around the zoo. The use of the project planning tools helped to target the enthusiasm of the sea lion team. In general, the personalities of members of the sea lion team reflected a high level of enthusiasm. One drawback to the high level of enthusiasm was the difficulty for team

leaders to determine where to focus the efforts of the team. Effective planning eliminated confusion associated with excitement and helped the team to channel this enthusiasm to integrate in-situ and ex-situ efforts.



Figure 6. Houston Zoo “Take Action” logos indicate and identify a specific action a guest can take today to make a difference (Image credit: Houston Zoo)

Discussion

This case study of the Marine Debris project at the Houston Zoo illustrates how institutional policy can be implemented and is essential in order to allocate limited resources (Schultz & Joordens 2014). The sea lion team’s vision began as a small

project, involving five people in 2014, and was supported by institutional policy that became defined in 2015. The timing of the institutional policy to make conservation a priority aligned perfectly to make the sea lion team initiative more robust. This project has flourished and now involves more than 10 departments, volunteers, and local fishermen, involving nearly 50 people to date. The partnership with NOAA was instrumental in the generating a credible, successful, and sustainable program.

The collaboration between the zoo departments addressed the team building mentioned by Rommel et al. (2016). Initiatives of the sea lion team were successfully integrated into the ongoing efforts of the Education Department. As recommended by Rommel et al. (2016), zoo staff collaborated with a federal agency to identify themes that were part of a broader national education campaign.

In building a conservation project, the project model (Kellogg Foundation 2004) and mind map (Dutt, 2014) were very effective in focusing effort. An important aspect of the planning phase for the monofilament initiative was to ensure the efforts were not a standalone project. Through collaboration with the education department and the existing messaging, this also created a connection amongst the separate departments, resulting in working to achieve a common goal. This approach is recommended for other teams to strengthen existing programs and better fortify inter-departmental growth of relationships.

Rommel et al. (2016) recommended that conservation practitioners build a team that understands the principles of behavioral change. Rommel (2014) also identified key intermediate steps to remove barriers which may affect the desired response of the

community members. In the marine debris initiative, the team designed interactive signage to explicitly tie together the in-situ and ex-situ efforts and relating human impacts to the natural environment. Involvement in conservation practices is good use of zoo resources, but prevention is the key to solving the marine debris dilemma. To accomplish prevention, human behavior must be addressed, thus it proved to be especially beneficial to communicate our efforts to the large audiences of the Houston Zoo visitors.

Communicating the results of the efforts to our visitors creates a feeling of inclusion that has the potential to lead to ownership. As guests learn about the challenges marine debris presents to the environment and how they can help, each is empowered to make their own difference. Rather than an implicit action, the signage provides explicit actions each zoo visitor can take to reduce the amounts of marine debris that makes its way into our oceans. Actions are made explicit through the “TAKE ACTION” badges found throughout the zoo. Identifying problems without a solution can be overwhelming for a guest that would like to contribute, but might be unsure how to get started. The key is to identify easy behaviors that make large impacts over time. The “TAKE ACTION” badges point the guest to actions that can be taken immediately, reducing the potential for becoming overwhelmed by the problem being outlined on the signage.

What remains to be seen is the true impact these programs have on zoo guests. Evaluation of project outcomes is should be an important part of educational initiatives (Kellogg Foundation 2004, Rommel et al. 2016). Empirical data should be collected before making claims that these programs have conservation outcomes. Evaluation

strategies for conservation outcomes can be applied to zoological institutions and would contribute to the conservation credentials of zoo-based conservation organizations. The wildly popular interactive “WOW” signage would also benefit from evaluation. It is known that the signage is successful in capturing interest, but is it effective in communicating conservation messaging? A formal survey of the Houston Zoo interactive “WOW” signage would be beneficial in determining what methods are best for future signage and for evaluating how messaging creates conservation outcomes among zoo guests.

The paradigm of zoos has shifted from displaying animals as a tourist attraction to displaying ambassadors for biodiversity conservation (Skibins & Powell, 2013). Though many ambassador species are considered “charismatic”, almost any species is capable of contributing to conservation messaging through a zoo ambassador program. A major contribution of animal ambassadors to conservation messaging goals lies within the affective domain. When paired with the cognitive domain, the impact made upon millions of people that visit accredited facilities is far-reaching. Affective experiences can impact a person’s concern and willingness to engage in conservation behavior and can include animal viewing experiences, engaging interactive activities, demonstrations, or keeper talks (Luebke & Matiasek, 2013). These experiences then have potential to impact the knowledge and attitudes about an animal, exhibit, or conservation issue. It is through both direct (endangered species breeding, captive animal welfare) and indirect (through influencing guests learning experience) impacts that animal’s personalities

affect the conservation missions of zoos and implies that animal behavior has an untapped potential for affecting conservation (Watters & Powell, 2012).

The use of zoo resources for conservation practices is an effective mode of involvement and is a testament to the dedication towards local and global conservation. In this case study, ticket sales, conservation projects, fundraising, and conservation practices have been highlighted as methods for conservation involvement of a zoological institution as a conservation-based organization. When combined, in situ efforts and ex situ efforts are powerful means of moving guests from awareness to action. The in-situ action reveal important qualitative measures. In only one year, the overall cleanliness of the jetty is improved and maintained. Fisherman that frequent the jetty are beginning to show buy-in from HZI's public outreach efforts through the adoption and use of the monofilament collection bins, as well as efforts to keep the surrounding area of their fishing spot clean. Meaningful and strategic ex-situ conservation messaging has the potential to reach over 2 million guests each year, potentially creating significant positive impacts on awareness and action.

Conclusions

The Houston Zoo Marine Debris case study provides a transferable model for other zoological institutions to adopt and implement to create conservation successes. The accomplishments of the sea lion team monofilament initiative were made possible by the project planning phase and using the Logic Model that directed the initial keeper

enthusiasm to focus on outcomes of activities. The Mental Model process was utilized to guide creativity in a productive manner.

Success was also attributed to the partnership with a federal agency. NOAA was already engaged in disseminating conservation messages to the general public and coordinating in-situ marine debris collection activities. The partnership was mutually beneficial, a key element for others who wish to take on conservation challenges. The project planning, collaboration, and partnerships inside and outside the zoo magnified the efforts of a small team. I recommend this team-building approach for others as a means for taking on large conservation efforts. As the participation of keepers in local in-situ conservation efforts became known throughout the zoo, it contributed to potential for team-building and resulted in generation of interest and buy-in of the project throughout the zoo. Keepers were able to incorporate these experiences and pair ambassador sea lions to inspire and engage guests. Information was also provided to the Education and Graphics Departments in the collaboration for design of interactive signage. The affective domain was utilized in harnessing the emotional appeal of guests through the “reduce, reuse, recycle” game with sea lion ambassadors. Guests were directed to interact with the signs to learn specific actions to make positive impacts on the environment.

The interactive signs were appealing to the guests as part of a series of “WOW” signs that were coordinated throughout the zoo. One of the key intermediate barriers that the signage is effective at addressing is the explicit behavior changes identified by the “TAKE ACTION” badges that each individual can adopt. Interactive features of the sign

were engaging, and thus very popular with families. Furthermore, the interactive features appealed to educators who used the signs during school field trips.

The robust conservation programs of the Houston Zoo undoubtedly match the recent policies adopted to make a difference in terms of education and fundraising in support of local and global conservation efforts. Further evaluation as part of the logical planning model is needed to determine if these initiatives actually have impact. Given the large annual attendance of zoos, there is great potential to reach vast audiences.

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APPENDIX A. Wildlife successes of 2015 (Image credit: Houston Zoo)

HOUSTON ZOO

SAVING WILDLIFE SUCCESSES

2015

OVER
600,000
HOUSTON TOAD
EGGS RELEASED
INTO THE WILD



SUPPORTED
800
LOCAL CHILDREN
IN ZIMBABWE TO ATTEND
CAMPS THAT EDUCATE
ABOUT SAVING PAINTED DOGS



EDUCATED
2500 CHILDREN ABOUT SAVING
ANIMALS IN THE WILD
IN ZOO CAMPS

115
LETTERS SENT
BY GUESTS TO ENCOURAGE
COMPANIES TO USE
100% PHYSICAL
CERTIFIED SUSTAINABLE
PALM OIL



HOUSTON ZOO
SEA LIONS ATE
23,850 POUNDS
OF OCEAN-FRIENDLY +
SUSTAINABLY CAUGHT
FISH




WENT PLASTIC-BAG FREE
ENSURING THAT OVER
40,000 SINGLE-USE
PLASTIC BAGS
ARE REPLACED BY
REUSABLE TOTES
SAVING
PELICANS
FROM INGESTING OR
BEING ENTANGLED
BY PLASTICS



OVER
2 MILLION
PEOPLE HELPED
SAVE WILDLIFE BY VISITING
THE HOUSTON ZOO

ADMISSIONS TICKETS
NOW MADE OF
**100% RECYCLED
MATERIALS**
SAVING TREES
THAT BEARS NEED
TO SURVIVE



SUPPORTED THE
PROTECTION OF
250
WILD ELEPHANTS
IN BORNEO



PLANTED
12,000 TREES
IN MADAGASCAR TO SAVE
LEMUR HOMES
SAVING POLLINATORS
PLANTED 100 SPECIES OF PLANTS
THAT ATTRACT
POLLINATORS IN 9 GARDENS



176
ATTWATER'S
PRAIRIE CHICKENS
RELEASED BACK INTO THE WILD



2,233
ELECTRONIC DEVICES
RECYCLED
TO HELP SAVE
GORILLA, CHIMPANZEE
AND OKAPI HABITATS




+ PROVIDED MEDICAL CARE FOR **124** SEA TURTLES



APPENDIX B Mind map (Part I & II) exploring first steps in creating a sustainable conservation effort

