

Environmental Education: The Need, The Challenges, and What We've Learned

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Abstract

*Bermuda's fragile environment is under threat. Rising sea levels due to global warming, ocean acidification, invasive lionfish, plastic debris and locally generated water pollution are just a few of the issues that should concern all of Bermuda's residents. Now, more than ever, **environmental education** should be a critical part of every child's education. Adults also need to be made aware of these issues and appropriate courses of action.*

*In response to this need, the **Bermuda Zoological Society (BZS)** has developed several programmes utilising experiential education and designed to increase environmental awareness and appreciation. Each of our week-long summer Aqua Camps for preschool to senior-one aged **children** addresses different natural history themes. Our "**Kids on the Reef**" programme provides middle-school students with a life-changing, two-day reef ecology, snorkeling and free-diving experience. Our "Schools Programme" free classes and field trips dovetail with the Cambridge Curriculum and teach the material using engaging, hands-on activities. And our Bermuda Natural History Course provides adults with stimulating lectures and field trips given by the island's experts. Through these efforts our hope is to inspire appreciation and stewardship of Bermuda's fragile environment.*

KEY WORDS: *Environmental education, children, adult education, Kids on the Reef, experiential learning, sustainability, Bermuda Zoological Society*

The Need

As global leaders, scientists, environmental groups and concerned citizens try to grasp how human activities are harming the environment and develop solutions to mitigate these effects; consequently, the need for environmental education and increased environmental awareness is now more necessary than ever. With Bermuda's fragile environment in mind, this article discusses why environmental education is particularly critical for Bermuda's residents, what programmes the BZS has developed to address this need, the challenges and successes the society has had in implementing these programmes, and what BZS has learned in the process.

The rotating red-and-green splotch on the television screen grows. Its single malevolent black eye appears to focus on Bermuda. We watch its inexorable progress with fear and fascination. We know hurricanes; we know what to do. We clear our yards, close shutters, board up large windows, stock up water, fuel, and provisions. Then, we hunker down and wait in the dark, protective caves we have created. When the fury has passed, we venture out to assess damages and to check on neighbours. Life returns to normal and we forget our fears. We do not consciously connect a monster storm with environmental change, with global warming, with human behaviour. Yet, we should. Our future depends on understanding how our environment is being threatened and what we can and should be

doing about that threat (Glasspool, 2008).

Bermuda is particularly vulnerable to current environmental woes (Stuart Hayward, personal communication 2016; Glasspool, 2008). A small island surrounded by the Atlantic Ocean, Bermuda suffers not only from the action or inaction of its inhabitants, but also from the actions of mankind globally. Rising sea levels due to global warming threaten Bermuda's shores; locally, sea levels have risen 15 cm (6 in.) in the past 80 years – quite a huge rise (David Wingate, personal communication 2016).

Furthermore, the coral reefs which protect us and are vital to the food chain may be weakened by ocean acidification; a warmer ocean also causes coral bleaching and stronger storms (Glasspool, 2008). Coral reef fish populations are at risk, owing to over-fishing and the introduction of non-native predatory species such as lionfish. Additionally, ocean-borne plastic debris leads to the death of marine animals through ingestion and entrapment. For example, brought to the Bermuda Aquarium Museum and Zoo (BAMZ) are sea turtles that have starved to death because their stomachs are full of plastic or their shells are badly damaged as a result of long-term entanglement in fishing gear. Plastics and synthetic fibers are now being found in even fish and shellfish targeted for human consumption (Rochman et al., 2015). How can individuals not be concerned?

Changes in Bermuda's terrestrial environment are also threatening the health of local wildlife and humans (Bacon, 2012a; Bacon, 2012b). We are affected by the pollution we in Bermuda have inherited and continue to add to. Pollution's effects on Bermuda's wildlife are some of the worst reported globally (Fort et al., 2015; Douglas Fort, personal communication 2011). Local studies of toads, pond fish, and terrapins have revealed an alarmingly high incidence of physical deformities, suppressed immune function and endocrine disruption (altered reproductive hormone levels) directly linked to pollutants (Bacon et al., 2013; Fort et al., 2015; Fort et al., 2016). Moreover, the safety of our fresh water – that precious commodity in Bermuda – is now problematic, owing to pollution. For example, drinking well water is now illegal because nitrates from our many cesspits have seeped into the water lenses. We must also be concerned about what pollutants are in our water tanks as they can produce effects similar to those produced by polluted pond sediments (Bacon, 2012a). These issues are all very serious. Obviously, we cannot afford to be ignorant of our environment.

Environmental dangers to physical well-being can be seen and measured. However, another challenge to our welfare, Nature Deficit Disorder – the effect of “the loss of children's free-ranging exploration of ‘wild lands’ in cities and suburbs” – faces us (Chawla, 2015a, p1). Children and adults need to connect with nature for their health. In speaking with teachers, parents and students, BZS educators hear that many children and adults spend little time, if any, outdoors in nature. Therefore, they do not reap the benefits of lower blood pressure, less depression and stress, and improved concentration (Chawla, 2015a). They also do not connect to the environment and the ocean as their forebears did and, therefore, do not appreciate the importance of the natural world.

The Challenges

It is difficult to teach the values of conservation and preservation to persons who do not appreciate the natural world around them or who are afraid or loathe to venture into it (Chawla, 2015b). Traditional classroom techniques or interpretive signage do little to change such attitudes (Chawla, 2015b). However, hands-on, experiential environmental education can lead to heightened awareness and ultimately action. Thus, one of the major challenges we faced and still face as educators for the BZS is how to develop environmental awareness, concern, and ultimately, passion that leads to action. How do we convince Bermudians that they can make a difference, that action rather than apathy is what is needed?

Another significant challenge for our “Schools Programme” was getting our staff, as well as local and visiting experts, in touch with Bermuda's students. Public school teachers must contend with a very tight Cambridge curriculum. When we revised our Schools Programme four years ago, many teachers told us that they felt they did not have

the time for a field trip to the Aquarium or a visit to a local nature reserve. In addition, we found many teachers' backgrounds in science and ecology were not well developed and that opportunities for professional development in the areas of biology, ecology and natural history were needed.

A further challenge we currently face at BZS is finding how to reach the general public –people who are not members of the BZS or other conservation organisations. Members are converts. How do we convert individuals who remain ignorant of the environmental issues that face us (in the sense of not knowing, not that they cannot learn)?

Internationally, conservation experts are recognising these challenges and seeking solutions. Zoos and aquariums, especially, recognise the need to change what they are doing (Chawla, 2015b; Clayton, 2015; Wong, 2015). In the past, they merely provided information assuming that would change people's attitudes, but that approach has been proven to be ineffective. At the 2015 San Diego Zoo Global Conference entitled "The Future of Informal Conservation Learning Symposium," hot topics for discussion groups included "transforming zoo visitors into conservation advocates" and "building a conservation movement through visitor engagement" (San Diego Zoo Global, 2015). The BZS and BAMZ are fully aware of this need and are working to convert Bermuda's residents, particularly Bermuda's youth, into conservation advocates who will appreciate and care for their island environment.

What We Have Learned

Although much remains to be done, some exciting progress in environmental education is quietly taking place in Bermuda. The BZS and BAMZ are playing a leading role in local environmental education, research, and conservation efforts by reaching out to students and adults alike. We now have new and promising ways of creating local campaigners for conservation.

The value of camps

We have learned that our camps can have a significant impact if we can get children doing things that make them interact with nature – not just young primary school-aged children, but teenagers as well. In 2016, a record number of 625 preschool through secondary school-aged children attended our Aqua Camps. Aqua Camps are held weekly each summer and are predicated on experiential learning. Each camp is themed so that students experience a different natural history topic each year and the camps are conducted by motivated, passionate educators. The themes include Mangroves, Ponds, Beaches, Sea turtles, Coral reefs and more. Parental feedback about our Aqua Camps has been extremely positive; last year 95% of the 88 parents who responded to our survey either strongly agreed (59%) or agreed (36%) with the statement "your child has gained a greater appreciation of Bermuda's natural environment".

"Thank you so much for the very organised and educational week. Love the photos, and we will definitely be back next year!" **Aqua Explorers Parent**

Camps designed for middle- and senior-school students are now based on Trunk Island, our amazing 'living classroom', rather than at BAMZ; the island is ideal for inspiring older students to connect with nature. They learn how to complete fish surveys around the island, identifying and counting members of various species, and how the effects of over-fishing are threatening fish stocks globally. And we have recently created a week-long residential camp – "Aqua Conservationists" – for M3 and S1 aged-students to give them the opportunity to learn about and participate in local (Bermuda-based) conservation projects. For example, in addition to numerous snorkeling experiences, the campers examine the origin of the plastic octopus pots used to catch octopuses that wash up on Bermuda's beaches, install Longtail igloos to create much needed nest sites for these charismatic birds, and participate in an evening survey of adult toads, noting their various deformities. The students also get the opportunity to volunteer in BAMZ's zoo and aquarium sections to see if they might wish to apply to our Junior Volunteer Programme. And they become aware that they can make a difference.

“This camp was incredibly awesome, and I loved every single moment of it. I learned so much about myself and what I want to do with my life, like how much I actually love the ocean and how much I want to protect it for generations to come.” **15-year-old Aqua Conservationists Camper**

Another venture is the Nonsuch Island Natural History camp in Castle Harbor, a joint venture with the Bermuda Audubon Society. The camp is usually attended by a dozen students aged 15-18 for eight days. Making daily field trips to a variety of habitats such as Spittal Pond, Paget Marsh, North Rock and Harrington Sound allows them to see first-hand the unique nature of Bermuda’s varied habitats and their inhabitants. Continuing the emphasis on hands-on learning, they are introduced to the methods, challenges, and personal satisfaction associated with scientific fieldwork. In the evenings, students work in the Nonsuch lab and participate in presentations on Bermuda’s environment by local scientists.

“Nonsuch Camp provided an amazing platform to immerse myself in Bermuda’s Natural History with other like-minded people. It was one of those special moments in life from which you take away lasting, powerful messages that infuse your subconscious and affect everything you do and the decisions you make. One of my passions these days is to ensure young Bermudians can benefit from similar experiences, which in turn will help conserve and protect Bermuda’s environment. Nonsuch Camp did that for me!” **Dr. Ian Walker, Principal Curator and Veterinarian, BAMZ**

Total immersion with Kids on the Reef

A unique and exciting environmental education initiative that the BZS provides during the school year is the “Kids on the Reef” programme. A part of the I Am Water Foundation, the programme was introduced to Bermuda in 2013 in partnership with the BZS, supported by XL-Catlin Bermuda. Dr. Alex Amat, the programme coordinator and a BZS educator, explains, “Kids on the Reef” is all about taking kids out of their comfort zone, giving them the tools they need to be confident in the water and to learn about Bermuda’s coral reefs” (cited in Simpson 2015, n.p.). Targeting public middle-school students aged 11-13, the two-day workshops literally put students into Bermuda’s waters. Students are first briefed in a classroom about coral reef ecology and the need to protect our oceans and reefs. Yoga instruction also helps them to learn and practice breath and body control. Then they have the ultimate experience of snorkeling around Gibbet’s or Trunk Island and free-diving on the outer reef at North Rock. Participants have included students from all the island’s public middle schools.

“Kids on the Reef” participants come face to face with the wonders of Bermuda’s marine environment. Hanli Prinsloo, CEO of I Am Water, a conservationist and South African free-diving champion, believes the experience is also life-changing (I Am Water Foundation, 2014). Many of these young people, although living on an island surrounded by marvelous reefs, have never snorkeled and have no concept of what lies under the ocean’s surface. First and foremost, they have to overcome their fears, but once in the water, something magical happens. Videos posted on U Tube and the I Am Water website (I Am Water, 2014) reveal the impact on these students; their enthusiasm is palpable. When questioned about the best part of the adventure, their comments are revealing.

“I saw some fish!”

“I got up close to a fish.”

“I saw real coral.”

“I saw things I never saw before.”

All of them seem to exude a new confidence in themselves and to reflect a new appreciation of the ocean.

“Swimming with barracudas has allowed my students to challenge common misconceptions and misplaced fears. Students who have struggled to perform well in the traditional classroom have transformed into confident, passionate explorers upon their first glimpse of life below the water’s surface. Witnessing coral

bleaching and pollution has allowed young people to better understand the challenges our reefs are facing. There are numerous benefits to the 'Kids on the Reef' programme. By increasing environmental awareness, these fun-filled workshops help students to become responsible citizens and ocean stewards." **Akinyi Apopa, Middle School Teacher and "Kids on the Reef" Volunteer**

The BZS Schools Programme- Linked to the curriculum

Classroom instruction is still needed, but we have learned that altering modes of instruction can make a big difference in its effectiveness. BZS educators have witnessed how using live animals to demonstrate topics such as adaptations or pollution's effects can help children care and make the topic come to life. Having students do meaningful hands-on activities whenever possible takes them from being passive witnesses to a lesson to being partners in the learning process. During the 2015-2016 academic year, BZS educators provided for students over 7,100 of what we call "educational experiences," including guided visits to nature reserves, classes at BAMZ, and in-school visits/demonstrations that connect students to their environment (Table 1 and Table 2) (Bermuda Zoological Society, 2016a). Thanks to the generosity of our members and donors, we are able to provide these classes free of charge to all of Bermuda's students.

Table 1: Number of educational experiences given by the BZS Schools Programme during the 2015-16 academic year by age group.

School Year 2015-2016	
Bermuda College Students	106
Senior School Students	635
Middle School Students	1,919
Primary School Students	2,655
Preschool Students	1,591
Homeschool Students	283
Total number student educational experiences	7,189
Public School	4,802
Private School	2,387

Table 2: Schools that participated in classes or field trips conducted by BZS 2015–2016 academic school year

Preschools		Middle Schools	
<i>Public</i>	<i>Private</i>	<i>Public</i>	<i>Private</i>
Devonshire Preschool	Bloomfield	Clearwater Mid. School	Bermuda High School
Lagoon Park Preschool	Bright Beginnings	Dellwood Middle School	Saltus Grammar School
Lyceum Preschool	Building Block Academy	Sandys Middle School	Somersfield Academy
Southampton Preschool	Chatterbox Nursery	TN Tatem Mid. School	Victory Christian Academy
St. David's Preschool	Once Upon a Time Chapter 1	Whitney Middle School	
St. George's Preschool	Once Upon a Time Chapter 2		
Victor Scott Preschool	Play with a Purpose		
Warwick Preschool	Saltus Foundation		
	Warwick Academy Foundation		
Primary Schools		Senior Schools	
<i>Public</i>	<i>Private</i>	<i>Public</i>	<i>Private</i>
Dalton E Tucker Primary	Bermuda High School	Berkeley Institute	Bermuda High School
East End Primary	Mount Saint Agnes Academy	CedarBridge Academy	Mount Saint Agnes Academy
Elliot Primary	Saltus Grammar School		Saltus Grammar School
Francis Patton Primary	Somersfield Academy		Warwick Academy
Gilbert Academy	Warwick Academy		
Heron Bay Primary			
Northlands Primary			
Paget Primary			
Port Royal Primary	<i>Public continued</i>		
Prospect Primary	St. Georges Preparatory		
Purvis Primary	Victor Scott Primary		
Somerset Primary	West End Primary		
St. David's Primary	West Pembroke Primary		
		Other	
		Bermuda Homeschool Association	
		Bermuda College	

Our BZS “Schools Programme” classes are now linked closely to the Cambridge Curriculum, meeting its biology schemes of work objectives, and we have worked to develop strong relationships with numerous teachers. We have learned that we can accommodate the time constraints of that curriculum (and others) in our offerings and that we can help teachers achieve their curricular goals while engaging their students and delivering conservation messages. We have also learned to be mentors for both teachers and students; our classes and field trips show both groups how to interact respectfully with nature without being afraid. The BZS also regularly provides half-day snorkeling trips for several schools, providing these students with invaluable in-water learning experiences.

“For the past four years, three during my tenure as Primary Six teacher, we have attended classes hosted by BZS at the Aquarium, which has greatly aided students in knowledge and understanding of Science. We arranged for review lessons in the content areas of Habitats and Adaptations, Food Chains, Caring for the Environment, Characteristics of Living Things and, most recently, Skeletons and Muscles and Flowering Plants. The lessons, experiments and hands-on assignments during class have allowed students to gain a deeper understanding of what was being taught by highly trained experts. This experience also afforded a unique learning opportunity

to be outside of the traditional classroom and in an environment where students can see first-hand the direct application of what they were currently studying. As a result of this amazing experience, we found that students demonstrated proficiency in understanding the concepts taught, with a class average of no less than 80% on MOED (Ministry of Education) Common Summative Assessments. This is further evidenced among students when taking (Cambridge Curriculum) Checkpoint exams as well as we often see results indicating that the Biology strand of the Science exam exceeds test level expectations. Alandra Kaliyma Swan, Primary 6 Teacher

Empowering adults through adult education and participation:

However, we recognise that we cannot and should not concentrate on Bermuda's children's education only; we must also reach out to the adults in the community. Our Bermuda Natural History Course is outstanding and we recently revamped it into two-week long modules rather than a five-week long commitment to make it more accessible for teachers as well as the public. The course features evening lectures by local experts with week-end field trips. The lecturers discuss Bermuda's wildlife, island geology, coral reefs, the impact of man and natural disasters on the island, and more (Bermuda Zoological Society, 2016b). Teachers of biology, geology, and social sciences who complete course modules receive professional development credit.

Bermuda's residents are also encouraged to participate in Reef Watch, our citizen scientist programme, which trains people to conduct surveys of different patch reefs annually, measuring coral and algal cover and fish numbers to take a 'snapshot' of the health of the reef. The programme actively engages the public in helping to collect useful scientific data for BZS scientists, and it empowers them to feel that their efforts can help protect and preserve our reefs by being able to warn researchers of reefs in trouble.

Conclusion

Where do all these efforts at effective environmental education take us? The hope is to create generations of good stewards of Bermuda's fragile environment. We cannot make people care, but by engaging their minds, breaking down barriers, and offering ways to take action, we can create a sense of responsibility, possibly even a passionate commitment. If they come to understand the intricacy of our environment, its inseparable relationship with the ocean around us, and how human well-being is tied to environmental health, they may come to recognise the benefits of conservation and preservation and become advocates and activists. We must all be both local and global citizens because our future and the future of our planet depend on our protecting the environment.

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