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MPAs, aquatic conservation and connecting people to nature

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ABSTRACT

1. The human affinity for aquatic species and environments is exemplified through the ubiquity of aquatic themed popular culture including a significant portion of global tourism providing access to places linked to aquatic environments. Yet this affinity does not appear to translate to the widespread support required for the achievement of ambitious aquatic biodiversity conservation goals.

2. Achieving conservation goals is contingent upon broad awareness of the values of biodiversity and what can be done to conserve and use it sustainably as embodied by Aichi Biodiversity Target 1.

3. This paper identifies seven lessons to support marine protected area (MPA) managers and ocean conservation professionals to implement programmes that "Inspire a New Generation" (ING) to learn about, value and conserve aquatic environments: (1) Prioritize Experience; (2) Embrace Technology; (3) Integrate; (4) Focus on Youth; (5) Make it Relevant; (6) Make it Positive; and (7) Engage Other Sectors.

4. These lessons are discussed alongside examples of ING programmes from MPA management authorities and aquatic conservation organizations. The effective application of these lessons requires appropriate levels of institutional commitment and investment in order to achieve success in ING as a precursor to the achievement of aquatic conservation goals.

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KEY WORDS: marine protected area; inspiring; engagement; awareness; attitudes; behaviour; aquatic; conservation; biodiversity

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INTRODUCTION

Perspective can change when viewing nature with a blue lens. Whether looking across a vista framed by the blues of the sky and underlying water, peering down through the water from above or immersed in the watery world below the surface, one can achieve a clarity and inspiration not previously envisaged. Undoubtedly, this is what Jacques Cousteau perceived and then shared through his films to inspire millions of people around the world.

This affinity for aquatic species and environments is now exemplified through the ubiquity of aquatic themed popular culture including a significant portion of global tourism providing access to places linked to aquatic environments. Yet does this affinity translate into the public awareness, attitudes and behaviours required to support the achievement of conservation goals? It would seem not to be the case given the ongoing and pervasive threats to aquatic environments (Steel *et al*., 2005; Copejans *et al*., 2012).

Despite global agreements to conserve biodiversity (United Nations, 2002; CBD, 2010a), biodiversity loss continues at unprecedented levels, particularly in the aquatic realm (IUCN, 2014a). Transformational change in the way conservation and sustainable development are approached is required if the Aichi Biodiversity Targets and the newly agreed Sustainable Development Goals are to be achieved (United Nations, 2015). A key driver of biodiversity loss is a lack of awareness of the values of biodiversity and the steps people can take to conserve and use it sustainably, which is the focus of Aichi Target 1 (CBD, 2010b). The *Promise of Sydney*, the main outcome from the 2014 IUCN World Parks Congress offers a range of transformative solutions to conservation and development challenges, notably the innovative approaches for *Inspiring a New Generation* (ING) (IUCN, 2014b) that seek to address Aichi Target 1.

This paper explores experiential and virtual approaches to ING in an aquatic context. Particular focus is given to marine protected areas (MPAs) to illustrate important lessons for MPA managers and aquatic conservationists to apply towards delivering programmes and initiatives to inspire people to experience, learn about and care for aquatic environments.

Critically MPA management authorities and ocean conservation organizations require the appropriate commitment and investment of resources to support development of new and innovative ways to build the awareness that will inform positive attitudes and behaviours. It is those attitudes and behaviours that in turn will support achievement of Aichi Biodiversity Target 11 to protect 10% of coastal and marine environments by 2020 and the aspiration to strictly protect 30% of the marine environment by 2030 as agreed at the 2014 IUCN World Parks Congress (IUCN, 2014a).

This paper will by no means be exhaustive, but reflects the authors' own experiences. The authors invite feedback and sharing of information on other programmes to further develop the knowledge base available to the marine conservation community in implementing additional ING initiatives.

HISTORY AND IMPORTANCE OF ING

We live in a strange dichotomy in the 21st century. Through increasing wealth and technology, our power to explore and share new experience and knowledge is unsurpassed in human history. Yet human beings, in particular youth, are increasingly becoming disconnected from nature. This dichotomy is more surprising and disappointing as youth are the greatest risk takers, most willing to undertake new experiences and the most capable using new technology to communicate, connect, share and learn from each other.

The following summarizes the causes, evidence and impacts of a lack of connection with nature as well as the solutions and benefits that a connection with nature brings, as summarized in a number of excellent collections and literature reviews (Moss, 2012; Parks Canada, 2014; C&NN, 2015). It is worth noting that there is comparatively little work on the study of human interaction with aquatic environments.

Causes of disconnection to nature

Society's disconnection to nature has many, sometimes related causes with urbanization

perhaps the most pervasive. In 2014, 54% of people globally live in urban environments, growing to an estimated 66% by 2050 (United Nations, 2014). However, only 1/3 of this increasingly urban population is located in coastal environments. This complicates the challenge of connecting urban populations to the marine environment both from physical and socio-economical perspectives (Wheeler *et al.*, 2012; Beatley, 2014). If people cannot easily access aquatic environments, they cannot experience, connect to and value them.

Other factors often cited as reducing access to nature include:

- technology, notably increased screen time (Goldenberg *et al.*, 2010; Moss, 2012);
- culture of risk aversion/child safety concerns (British Market Research Bureau, 2006; Moss, 2012);
- fear of the unknown (Nelson and Callicott, 2008; Cheng and Monroe, 2012; Lopoukhine *et al.*, 2014);
- doomsday messages about our natural environment;
- economic development/increasing wealth including travel to exotic localities instead of more traditional holidaying (Pilgrim *et al.*, 2008; Lopoukhine *et al.*, 2014);
- decreased mobility (Hillman *et al.*, 1990; Wridt, 2004; Karsten, 2005);
- increasingly busy lifestyles and structured recreation time;
- more structured education focused on literacy and numeracy, increasingly in younger children.

The impact these factors have on access to nature varies depending on geography and how they interact with each other. For example, in addition to reduced time engaged in outdoor activity, outdoor activity itself has changed owing to a culture of risk aversion and increasingly busy and structured lifestyles, with less free time for unstructured exploration, risk taking and just being within nature.

Evidence and impacts of disconnection with nature

Evidence for a disconnection from nature, or 'Nature Deficit Disorder', as described by Louv (2005) is far reaching and compelling and includes:

- increased screen time (Pergams and Zaradic, 2006; Moss, 2012; Parks Canada, 2014);
- increases in the amount of time spent indoors (Moss, 2012; Parks Canada, 2014);
- significant reductions in children's freedom to explore and unstructured outdoor play (Gaster, 1991; Hofferth and Sandberg, 2001; Wen *et al.*, 2009; Barker *et al.*, 2014);
- negative mental and physical health impacts (Holick and Chen, 2008; Moss, 2012).

Beyond impacts to individuals and society, a lack of awareness and knowledge of nature, and aquatic environments can result in reduced understanding of the need for and value of MPAs and marine conservation. This can manifest itself in a lack of public and political support for MPA initiatives, doubt and conflict over the need for MPAs and reduced progress to implement, or removal of protections from MPAs. At its extreme, this has led to public and policy debates and the actual repeal of existing protection with negative implications for the achievement of ambitious marine protection goals (Holmes, 2003; Mascia and Pailler, 2011; NSW Department of Primary Industry, 2011; Commonwealth of Australia, 2014; IUCN, 2014c; Mascia *et al.*, 2014).

Benefits of connecting to nature

The benefits to individuals and society of a connection to nature are many and profound and counter the above-mentioned evidence and impacts of a disconnection from nature. These benefits span our: (a) economy; (b) physical and mental health; (c) spiritual and cultural identity; (d) personal development; (e) community welfare; and (f) environment (Parks Canada, 2014).

It is in the context of this last benefit that this paper considers some notable examples of ING programmes to connect people through MPAs to aquatic environments. The ultimate aim of such programmes is to generate the knowledge and experience behind the positive environmental attitudes and behaviours that support MPAs and ocean conservation goals.

INSPIRING A NEW GENERATION THROUGH THE AQUATIC ENVIRONMENT

Human society's view of aquatic environments as places to explore, recreate and commune with nature is a relatively recent phenomenon. The modern day paradigm of heading to the beach to beat the heat or holiday at coastal resorts, contrasts strongly with the long held and often reinforced view of the ocean as a threatening place of danger and the unknown. It was not until the late 17th century that sea air gained acceptance as a treatment for various medical ailments. Moving from sea voyages to the development of resorts in the service of health (Kevan, 1993), the foundations were laid for the modern view of coastal environments as places to enjoy outdoor pursuits, relax and escape from the daily rigours of life (Lencek and Bosker, 1999).

Another major way people traditionally experience aquatic environments is virtually through nature documentaries. The most notable maker of aquatic documentaries is perhaps Jacques Cousteau who pioneered their production at the dawn of the television age. His work laid the foundations for the vast and growing catalogue of nature documentaries focused on aquatic environments that now permeate film, television and the Internet that reflect our affinity to aquatic environments.

However, even with the modern view of coastal environments as highly desirable locations to live and recreate, efforts to connect people to nature through direct experiences in aquatic environments face long-entrenched fears and prejudices. Despite modern knowledge that has demystified sea monsters, fear of the unknown runs strong with media and popular culture amplifying dangers like rip currents, sharks, jellyfish, and crocodiles. While it is likely that more people than ever have had a personal aquatic experience as part of a recreational activity or holiday neither the issues our aquatic environments face nor the actions needed for their conservation are widely understood. We are a long way from achieving Aichi Biodiversity Target 1 (Leadley *et al.*, 2014).

What can MPA managers and aquatic conservationists do to further increase peoples' exposure to aquatic environments? More importantly how can they ensure that their work to increase awareness leads to a change in attitudes and behaviours to achieve aquatic conservation goals? Table 1 lists seven key lessons linked to actions and illustrated by real world examples that can be applied to that end. The lessons actions and examples drawn from the literature, the outcomes of the 2014 IUCN World Parks Congress and the vision of the IUCN #NatureForAll programme are elaborated in subsequent sections Many of these examples are relevant to more than one lesson, however, for simplicity's sake, they are associated with the lesson they best exemplify.

The IUCN #NatureForAll programme (IUCN, 2016) is an evolving joint initiative of the IUCN Commission on Education and Communication and the IUCN World Commission on Protected Areas. #NatureForAll is taking forward the recommendations of the ING Stream from the 2014 IUCN World Parks Congress. Readers are invited to become involved with the #NatureForAll network at www.NatureForAll.global.

PRIORITIZE EXPERIENCE

Even for Jacques Cousteau, the person most associated with virtual exposure to aquatic environments through his documentaries, it was the experience of swimming with goggles in the Mediterranean that inspired him to his life's work (Cousteau Society, 2015). This affirms that it is direct experiences in nature that are fundamental to the creation of the sense of affinity that can lead to support for conservation efforts (C&NN, 2012). Today, the opportunities to directly experience MPAs and aquatic environments have never been more plentiful. During the late 20th and early 21st centuries, water-based recreation and sports have enjoyed an unprecedented explosion of diversification and levels of involvement. From more traditional swimming, line fishing, beach combing and canoeing close to home, to global tourism and the sailors, surfers, and divers who push the bounds of aquatic experience from pole to pole,

Table 1. Lessons to inspire a new generation within MPAs and aquatic environments. The table summarizes the key lessons highlighted in this paper, key actions to apply to those lessons and links those lessons to the real world examples highlighted in the text that best exemplify those lessons. It is important to note that many of the examples highlighted address more than one lesson. For example the Eye on the Reef app and programme involves direct experience, embraces technology, integrates experience and technology, is relevant, positive and engages across sectors

Lesson	Action	Examples highlighted in text
(1) **Prioritize Experience**	• Offer a diversity of experiences, focused on youth, but appealing across demographics to facilitate lifelong journeys in connection with MPAs and aquatic environments	1) Alternative Spring Breaks 2) Gulf Islands National Park Clam Gardens
(2) **Embrace Technology**	• Use technology as a means to connect young people with nature delivering a gateway or enhancement to natural experience in MPAs and aquatic environments that do not replace or detract from experiences in nature	1) XL Catlin Seaview Survey 2) Seafloor Explorer 3) *Okeanos Explorer* & Telepresence 4) ROV Competitions 5) Cascade Game Foundry/Infinite Scuba 6) Blue Ocean Film Festival – films, television and online channels 7) Earth is Blue
(3) **Integrate**	• Integrate experience-based and digital programmes/tools such as digital interpretation enhancement • Build connection between and across programmes to reinforce each other. Attitudes and behaviours change when knowledge is imparted repeatedly through multiple delivery mechanisms that include information delivery and experience, for example linking tourism activity with citizen science • Build in scalability through integration of tools and programming across organizations, that maximizes the impact achieved • Scalability is also achieved by building in the ability for people to take independent actions through goal oriented activities and through external partnerships to enhance programme reach	1) Live, from Beneath the St. Lawrence River! 2) Ocean Swim/Ocean Science 3) Apps/Citizen Science (Eye on the Reef)
(4) **Focus on Young People**	• Bring children into nature at an early age. While it is important to engage with broad audiences, a significant part of ING investment should	1) Marine Estate Agents 2) WorldRise 3) Youth Ocean Conservation Summits 4) Bitonga Divers/Ocean Revolution

(*Continues*)

Table 1. (Continued)

Lesson	Action	Examples highlighted in text
	be focused on youth, particularly primary school age children • Empower young people – ING programming and broader organizational planning and operations should facilitate the engagement, participation and input of young people as leaders	
(5) **Make it relevant**	• Seek to understand your audience, their interests, concerns and drivers • Put things in a local context by establishing the connections between MPAs and ocean conservation and peoples everyday experiences in their communities • Work with advertising/communication, social marketing and behavioural economics experts to design, implement and evaluate ING programmes	1) Ocean Guardian School Program 2) Solitary Islands Oral History
(6) **Make it positive**	• Ensure programmes and how they are communicated are solutions oriented and designed to provide constructive engagement for audiences and participants • Design and implement fun and engaging activities closely linked to a solutions outcome • Make it entertaining and find the fun in nature • Provide opportunity for people to find their own fun in nature and connect on their own terms	1) Sharknet 2) NSW Marine Parks School Holiday Programme 3) Eye on the Reef 4) Ocean for Life
(7) **Engage Other Sectors**	• Explore linkages and synergies to enlist subject area/industry specific expertise that leads to mutual benefits between MPA agencies and sectoral partners (health, tourism, fisheries, extractive (oil and gas), shipping, etc.) • Utilize the urban gateway to nature (museums, zoos, urban parks, events, local government, etc.) to reach more than half of the global population	1) Ocean in Google Earth 2) Urban Gateway to Nature – zoos, aquariums, local government, museums

there are few aquatic environments that have not been experienced in some way.

Tourism is recognized as having strong potential for ING benefits through introducing people to MPAs and aquatic environments. Tourism, often referred to as the world's largest industry, employing one in 11 people and contributing close to 10% of global GDP is expected to grow at least 4% per annum over the next 10 years (WTTC, 2014). Given that the majority of tourism occurs in coastal areas (Honey and Krantz, 2007), its power to contribute to ING in a marine context cannot be understated.

However, does all this activity impart the knowledge and understanding that forms the basis of attitudes and behaviours that reflect a real connection to aquatic nature? The evidence is far from conclusive that tourism or high participation rates in recreation translates into overall improvements in awareness, attitudes and behaviours (Powell *et al.*, 2008; Eijgelaar *et al.*, 2010). Yet, it is clear from a wealth of anecdotal evidence that for many, it is an experience in nature that was the catalyst for their knowledge and attitudes that form the basis for conservation values and environmentally friendly behaviours (Thompson *et al.*, 2008; James *et al.*, 2010; Wheeler *et al.*, 2012). There is evidence that well-designed tourism programmes that take advantage of social psychological theories can lead to increases in knowledge and positive changes in attitudes and behaviours (Powell and Ham, 2008). This deliberate design, along with enhanced implementation of sustainable coastal tourism practices, has the potential to deliver tourism-related programming that enhances awareness and behavioural change as it relates to marine conservation.

Direct experience in nature more deeply engages a wider array of our senses (touch, sight, sound, smell) in an active rather than passive way (Lopoukhine *et al.*, 2014). It is therefore logical for MPA management authorities to prioritize programmes related to direct experience to support the advancement of ING aims. Programmes seeking to achieve beneficial changes to awareness, attitudes and behaviours should seek to facilitate positive and enjoyable experience that enhance knowledge transfer.

The Alternative Spring Break experiences offered through the United States National Oceanic and Atmospheric Administration (NOAA) managed by Florida Keys and Gray's Reef national marine sanctuaries are an example of ING within MPAs that seeks to provide a more meaningful tourism-based experience while delivering a positive solutions oriented, experience to inspire and empower young people. These community service oriented spring breaks host university students to clean up marine debris in the Florida Keys, while students visiting Gray's Reef National Marine Sanctuary off the coast of Georgia participate in mentoring middle-school students who are learning about ocean science technology through building underwater robots.

Some protected area managers are offering meaningful experiences that connect people with nature and culture while also contributing to conservation outcomes. In British Columbia, Parks Canada is working with local First Nations and others to restore the Gulf Islands National Park clam gardens. Science and traditional knowledge indicate that the intertidal clam gardens, historically managed by First Nations people, showed an increase in shellfish size and abundance (Groesbeck *et al.*, 2014; Lepofsky *et al.*, 2015), and provided many other cultural and ecological services, serving as places for youth to learn from Elders.

In 2014, Parks Canada began working with local WSÁNEĆ and Hul'q'umi'num Nations to restore two clam gardens as part of a long-term experiment to restore cultural and ecological landscapes (Figure 1). A key to the project is to involve youth, primarily from First Nations, empowering them as stewards of these places, providing an opportunity to learn from the past to protect their future. Parks Canada has had to invest significantly to build relationships to overcome a justified level of mistrust, learning and adapting to ensure the project is respectful of First Nations culture[1].

Participants visited clam gardens with Elders, archaeologists, ecologists, and geologists to monitor clam populations, learn about the history of these spaces, and restore them following the

[1]https://www.youtube.com/watch?v=j2wPVx4sCN0

Figure 1. Gulf Islands National Park clam gardens, British Columbia, Canada.

guidance of local knowledge holders. The key to the project's success is Elders and youth working together. Ultimately, the fate of these spaces depends on older generations to provide a guiding hand, empowering future generations to be the leading light going forward.

EMBRACE TECHNOLOGY

One of the greatest challenges of marine conservation is that most people do not have direct access to MPAs and most people never put their heads underwater. Thus it is very difficult to generate support for marine protection if people can't see what it is that is worth protecting, what the issues are, and what successful conservation looks like.

Converging technologies across traditional media and cyberspace are increasingly how we as human society communicate and where the societal discourse of ideas is primarily shaped and influenced (Freeman and Jarvis, 2013). In other sectors, traditional and technology driven media have been demonstrated to have significant influence over knowledge, attitudes and behaviour (McCombs, 2004).

As critical as direct experience of MPAs and aquatic environments are to influencing awareness, attitudes and behaviour, MPA management authorities and ocean conservationists should embrace rather than shy away from technology (Moss, 2012). To successfully inspire a new generation, MPA management authorities and aquatic conservationists must learn to harness mass and digital media technology as both a gateway to MPAs and aquatic environments and for ongoing reinforcement of their values, relevance and importance.

Recent technological developments are beginning to completely change scientists' ability to monitor marine environments at large scales and over time series. At the same time these remote sensing, tracking devices and cameras used by scientists are also transforming the way conservation organizations, marine park managers and scientists can engage local communities and policy-makers.

One of the most high-profile scientific projects that demonstrates this adoption of new technology for both scientific and public engagement aims is the XL Catlin Seaview Survey (XLCSS)[2]. This

[2]xlcatlinseaviewsurvey.com

project has improved the efficiency of seascape assessment and monitoring of coral reef ecosystems to enable work to be carried out at kilometre scale (Gonzalez-Rivero *et al.*, 2014). In just three years the global survey has monitored and assessed more than 1000 km of coral reef in more than 25 countries.

The XLCSS is establishing a rigorous baseline of ecosystem health in a time of rapid global change. Using diver propulsion vehicles (DPV), customized with a specially designed camera system (SVII) to acquire benthic imagery (Figure 2), the XLCSS framework has developed a series of technologies for rapidly collecting imagery, which is analysed using specially developed software to produce spatially explicit information on benthic composition, habitat classes, and structural complexity for multiple transects of up to 2 km in length per day.

The scientific data, are made publicly available on the XL Catlin Global Reef Record (globalreefrecord.org). The SVII camera system's 360-degree panoramic imagery is uploaded into Google Street View – giving up to a billion monthly users unprecedented access to virtually explore surveyed environments. The imagery is also suitable for usage by emerging virtual reality technology.

The XLCSS team has also developed a small, easily transportable, 360-degree camera system, the SVX, that can be used by any competent diver. The aim is to make the technology and training publicly available to all conservation organizations, marine park managers, scientists and citizen scientists. It enables them to record local marine environments and reveal them both in Google Maps and using low cost virtual reality headset technology, such as Google Cardboard, to engage local communities and policy-makers. Public engagement programmes have already been successfully carried out, by XLCSS and its partners, in marine protected areas in locations including the Great Barrier Reef, Florida Keys National Marine Sanctuary, Barbuda, Hawaii and the National Marine Sanctuary of American Samoa.

New technologies allow data from imagery to be captured at rates faster than researchers and managers can analyse information and apply their learning. Seafloor Explorer delivers the wonder of aquatic realms via a website or mobile app and enlists the help of volunteers (citizen scientists) to identify and classify seafloor dwelling creatures and their habitats to generate the information required for conservation and management. This technology connects the public to the creatures that frequent or live within the bounds of MPAs, supports ocean conservation and builds understanding of one of the key tools of ocean conservation (Huffington Post, 2012). Similarly, the use of Telepresence from aboard the US NOAA Ship *Okeanos Explorer* allows advanced broadband satellite communication from a remotely operated vehicle (ROV) on the sea floor

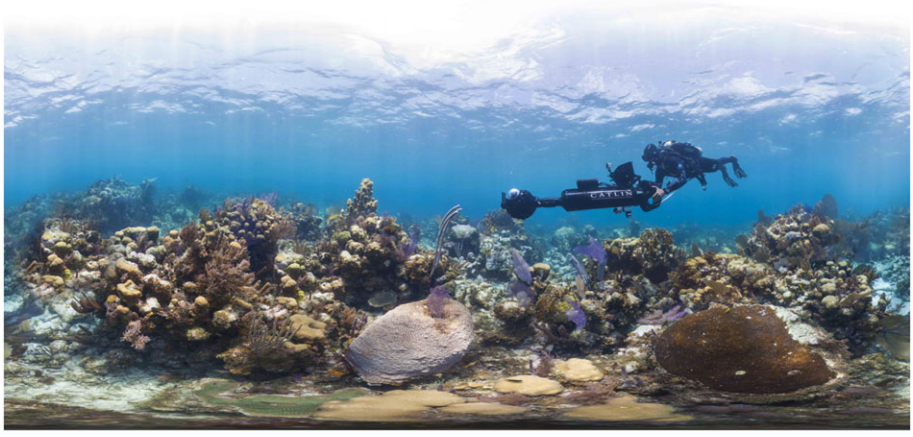

Figure 2. The SVII surveying Glovers Reef in Belize.© **XL Catlin Seaview Survey**

to transmit real-time audio and video to students and land-based researchers. Participants from anywhere in the world can 'dive' to the deepest depths of the ocean and converse with shipboard explorers bringing science, and the excitement of discoveries into classrooms, newsrooms, and living rooms.

ROVs provide additional and expanding potential to engage audiences. In 2014, NOAA's Thunder Bay National Marine Sanctuary in the Great Lakes joined forces with the Marine Advanced Technology Education (MATE) Center for the 13th Annual International Student ROV Competition**.** Sixty US and international teams representing students of all ages convened to compete designing ROVs used to explore Lake Huron's shipwrecks, science, and conservation works underway in the sanctuary.

Students were challenged to think of themselves as 'entrepreneurs', forming companies to design, build, and market their 'product', while developing their science, technology, engineering, and maths (STEM) skills. Along the way, they learned how to manage a project, work as a team, think creatively, and problem-solve – all important 21st century workplace skills. The teams were evaluated on their ability to effectively communicate their vehicles' design via underwater missions, technical reports, poster displays, and engineering evaluation interviews.

The awareness and experience benefits of events like these are not limited to participants, but can reach other audiences through traditional and digital media tools that showcase the event.

Video games are today a major entertainment channel. The Cascade Game Foundry (CGF)[3]. a small independent software company whose mission to enable global exploration from home led to collaborating with Dr. Sylvia Earle[4] and partners to create a ocean simulation game called *Infinite Scuba*[5] (Figure 3). The game features virtual versions of real-world dive locations enabling those aged 8 and up to explore[6] the mystery and beauty of the world's oceans.

CGF has released two dive sites, both based on Dr. Earle's Hope Spots[7]: Chuuk Lagoon in Micronesia, the biggest 'graveyard of ships' in the world, and Glover's Reef, a partially submerged atoll that forms part of the outermost boundary of the Belize Barrier Reef.

Players do what real divers do[8] – identify wildlife, find artefacts, take photos, pick up trash, and manage their air supply, depth and location with more skills coming in future dive site releases. Players are rewarded for tasks by unlocking pages of the game's Field Guide, which includes stories on the dive site's local history, culture, wildlife, and environmental challenges, as well as profiles of famous divers like Dr. Earle. Players can also dive as Dr. Earle herself in the game, complete with her favourite 'ruby flippers'[9].

A portion of the sale price for each game sold is donated to Mission Blue, an initiative of the Sylvia Earle Alliance to protect key places in the marine environment. CGF provides live game demos to schools, educational initiatives and conservation conferences directly, encouraging kids to learn about science and the ocean, and providing free copies of the game to teachers and students.

'In the early days scuba diving… there was the realisation that I was seeing something really special, especially when we went to North Solitary Island…. and what motivated me to try to do something about saving it was that there was to be the world spear fishing championships… …I agitated really hard in the community and at political levels... and I succeeded in stopping the spear fishing championships …having done that, I should do the next best thing,...that is to try and have some sort of preservation of the marine environment established. So the movies that I made, I used as a tool for trying to persuade, move public opinion…' Harvey Lee – Solitary Islands Oral Histories, NSW Marine Parks.

There is little doubt about the power of sight and sound through film, television and online channels

[3]http://www.cascadegamefoundry.com
[4]http://mission-blue.org/about/
[5]https://www.infinitescuba.com/
[6]https://www.youtube.com/watch?v=Feu6TVoykrs
[7]http://mission-blue.org/hope-spots-new/
[8]https://www.youtube.com/watch?v=vazIGupFf_s
[9]https://www.infinitescuba.com/img/scuba/screenshots/Infinite Scuba Screenshot 6%281%29.png

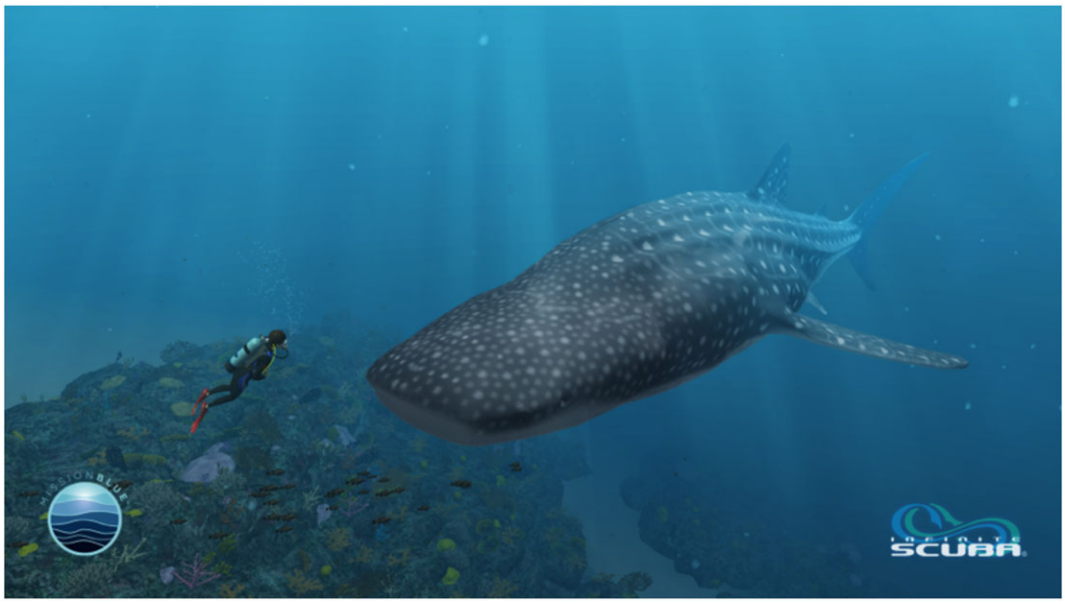

Figure 3. Dr. Sylvia Earle swimming with a whale shark in Belize in Infinite Scuba.

to make an impact and influence people (Freeman and Jarvis, 2013; Henley, 2013). The ongoing legacies of Madison Avenue, Hollywood and Bollywood attest to this power (Wunder and Sheil, 2013). The early ocean films of Jacques Cousteau and initiatives like the Blue Ocean Film Festival[10] have exploited this power to capture people's imagination and therefore an audience. So how effective is film at supporting MPAs and aquatic conservation? Can they really effect positive change to awareness, attitudes and behaviours? If so, are there things that can be done to increase its value as a tool to inspire and engage the public about MPAs and nature?

There is debate about the efficacy of nature based films to affect attitudes, beliefs and ultimately behaviours to favour conservation (Burgess, 1990; Palmer, 2010; Henley, 2013). Some literature is critical of the view that films support conservation, asserting that the explosion of nature based programming has coincided with increasing loss of global biodiversity (Freeman and Jarvis, 2013) as well as people's disconnection from nature. There is also a real dearth of empirical evidence, and the evidence that is available often has conflicting or inconclusive results making it difficult to unequivocally extol the virtues of film (Burgess, 1990; Wright, 2010; Jepson *et al.*, 2011).

Nevertheless, it is difficult to deny that the rapid growth of nature based films is driven by the fact that there is an audience for nature based films and entertainment indicating an interest and affinity from global audiences to experience nature at least vicariously via a screen (Bouse, 2000). The key challenge is how to harness this audience interest using lessons from communications experts and behavioural sciences to deliver positive changes in awareness, attitudes and behaviour (Wunder and Sheil, 2013).

Social media makes use of digital app based technology to reach broader and younger audiences. In 2014, the US NOAA Office of National Marine Sanctuaries (ONMS) launched the 'Earth is Blue' social media campaign, consisting of daily posts of ocean and Great Lakes photos to Instagram, Facebook and Twitter, as well as a weekly video highlighting some component of sanctuary programmes and the activities that occur within them. The campaign has been tremendously successful, expanding outreach through media frequented by younger generations. In the campaign's first year, ONMS's social media following expanded 123% across Facebook, Twitter, and Instagram, enabling

[10]http://www.blueoceanfilmfestival.org

ONMS to reach a much broader and more diverse audience. Importantly the campaign provides continuously updated content, with daily posts promoting activities through which people can experience MPAs first hand and communicating knowledge about sanctuaries and MPAs through stunning and engaging imagery and accompanying captions. The programme continues to evaluate ways of expanding to new media platforms such as Tumblr to reach young audiences.

INTEGRATE

In considering both experiential and virtual programmes it became evident that some of the most striking examples of ING programmes within MPAs or aquatic environments are those that integrate experience and technology. The Live, from Beneath the St. Lawrence River! activity is offered at Parks Canada's Marine Environment Discovery Centre at Les Escoumins, in collaboration with Explos-Nature, a non-profit organization dedicated to environmental education and research in biological sciences.

Visitors meet the divers in an outdoor amphitheatre against the background of the whales and birds of the Saguenay–St. Lawrence Marine Park. Entering a projection room, visitors participate in a unique live-streamed underwater dive along the gorgeous, biodiverse seabed of one of the most beautiful diving sites in North America. From the comfort of their seats visitors speak directly with the diver-interpreters to ask questions about the anemones, starfish and the other marine organisms[11] they see in high definition on the big screen.

The use of cutting-edge technologies fosters a special connection between the divers and visitors who are more likely to engage in other marine park activities like whale watching and kayaking after experiencing the live dive. The marine park's next goal is to broadcast the activity[12] to other parts of the country.

Integrating both experience and technology is one type of integration that is required. Integration at the programme level aiming towards continued and reinforcing engagement can increase the scale of impact and longevity. For example, a simple activity sheet that facilitates experience and learning is useful, however, there are enhancements which can significantly increase impact. Providing a mechanism to submit a completed activity sheet to win a prize, linking it to a relevant digital application and including the address of the marine park's website with a call to action to learn more by visiting the website can increase the level of public engagement. Additionally, integration across technologies and communications channels is equally important such as a film supported by a strong social media campaign (Henley, 2013). ING actions through MPAs should not occur in isolation but be part of an integrated programme of continuing and increasing levels of engagement.

While films, television and traditional media still are valuable tools in the simple dissemination of information, new digital tools such as apps, have eclipsed these technologies with their ability to deliver real and meaningful engagement where user and service provider interact with each other and the broader community. The old adage of 'we learn better, by doing' rather than passively absorbing information, no matter how compelling, is at the core of what apps and properly integrated engagement programmes have the power to deliver. The appeal of mobile apps is first to deliver tailored, user specific information directly to where it is of most value to the user. App users can then communicate their own information back to app designers and/or share it with the broader community of app users. Citizen science using digital technology achieves integration of digital and direct experience, allowing people to actively engage rather than passively absorb information, while exploring, learning, developing knowledge and engendering a connection. To date, use of this technology is still under-utilized within the marine protected area and ocean conservation sector (Edwards, 2015).

There is as yet very little information, either through programme monitoring and evaluation, or in the scholarly literature on the value and impact

[11]https://www.youtube.com/watch?v=ENpt585-0Zo&feature=youtu.be
[12]http://www.pc.gc.ca/eng/amnc-nmca/qc/saguenay/index.aspx

of digital technology to influence people's awareness, attitudes and behaviour, particularly in regard to environmental social marketing. An improved understanding of mobile technologies with regard to environmental social marketing, and specific case-by-case understanding by MPA authorities and conservation practitioners of the audiences they are attempting to communicate with are required (Bowerman and DeLorme, 2014).

Another example of successful integration, is the Ocean Swim/Ocean Science (OSOS) programme which started in 2012 as the first high school credited swimming course in American Samoa. Initially provided by NOAA's National Marine Sanctuary of American Samoa at one school during the school year, OSOS was scaled-up to be open to students across American Samoa through a summer programme. This expansion was made possible through partnerships between the sanctuary and other local organizations, such as the American Samoa Aquatic Association, which teaches students water safety and how to feel confident in their ability to safely enjoy the ocean environment. The ocean science component of the programme includes hands-on experiences through field trips and classroom sessions that integrate material from local partner agencies like the National Park Service, the Department of Marine and Wildlife Resources, the Coral Reef Advisory Group, the American Samoa Environmental Protection Agency, and the American Samoa Community College through delivery of guest lectures and presentations. Students learn about the ocean environment and what they can do to take care of it while improving their health, safety and enjoyment of the ocean. The three-week intensive course culminates with a Youth Ocean Summit, during which the students present what they have learned to their communities and peers through multi-media presentations.

Scaling-up and integration of engagement efforts broadly across sectors and communication platforms will be central to success. There are myriad MPA and ocean ING projects, events and organizations and the challenge is to connect and catalyse them to deliver a larger collective impact than they deliver on their own.

FOCUS ON YOUNG PEOPLE

While it is important to engage broadly across the community and different demographics, research has shown that providing youth experiences and engagement in nature at an early age lays the foundation for a lifelong connection to, and affinity for natural environments. Beyond helping to establish a connection to and understanding of MPAs and aquatic environments, young children derive a range of other benefits from nature-based experience and education at an early age.

The Marine Estate Agents programme by the New South Wales Solitary Islands Marine Park invites primary school students living near the marine park to complete a series of tasks in their Marine Estate Agents passport. The Marine Estate Agents Programme passport tasks students with learning about marine biodiversity, threatened species, important marine habitats and protected area management of the Solitary Islands Marine Park (SIMP). Participating schools also attend excursions to learn more about their blue backyard. Some of the tasks included: (1) writing a letter to a newspaper editor about a marine creature; (2) creating a poster showcasing the SIMP; (3) observation of changes in the environment; and (4) learning about how marine debris affects the marine park. The schools receive recognition for their students' engagement in the programme and submit a follow-up evaluation that prompts further longer-term commitments to ocean literacy, sustainability and conservation (Chantelle Burns, personal communication, 2015).

MPA management authorities and aquatic conservationists must empower young people as current and future leaders in inspiring a new generation. Young people have the ideas, innovation and energy to take ING in relation to MPAs and aquatic conservation forward. Furthermore, young people have grown up in the current media and technology-saturated environment and can apply the skills and knowledge of how to integrate technology broadly into experiential and digital ING initiatives in relation to MPAs and aquatic environments.

Worldrise[13] is an Italian NGO founded and run entirely by inspired early career professionals from multidisciplinary backgrounds united by the commitment to value, conserve and protect the marine environment.

Worldrise designs, manages and promotes marine conservation projects to build awareness and foster an appreciation of the ocean while involving and professionally empowering, through constructive working experiences, the next generation of conservation leaders.

The project 'Full immersion Cinque Terre'[14] summarizes Worldrise's mission and promotes the exceptional beauty and biological values of the Cinque Terre MPA. Working in partnership with the diving industry helps them carry out effective educational briefings and participating marine science students from the University of Genoa acquire scuba diving certifications and skills in environmental education and data collection and analysis.

Youth Ocean Conservation Summits (YOCS)[15] seek to inspire a new generation of conservationists, equipping them with knowledge, skills, and resources necessary to successfully implement ocean conservation projects in their local communities (Figure 4).

These events, held annually at Mote Marine Laboratory, and at regional locations across the United States, engage youth, providing them with opportunities to learn from and collaborate with peers and professional mentors. Summit attendees develop solution-based projects to address threats facing marine ecosystems and participate in skill building workshops focused on fund raising, public speaking, marketing, marine research, conservation messaging and careers in marine science. Projects emerging from the Summits include habitat restoration, organized coastal cleanups, school recycling, endangered species awareness, water quality monitoring, and marine debris prevention programmes and projects.

Figure 4. Youth Ocean Conservation Summit alumni work on a mangrove planting project in southwest Florida.

The Youth Ocean Conservation Team[16] – a virtual network of past Summit attendees – enables participants to remain connected. Through this network and a monthly e-newsletter[17], students have access to funding opportunities for their projects[18], educational resources, and the ability to connect with other young people working on ocean conservation initiatives worldwide[19].

Ocean Revolution partners with Bitonga Divers to increase the ocean literacy and ocean capacity of young people and communities within Mozambique. Bitonga Divers is a youth led, locally run organization set up to train local Mozambicans for the professional scuba diving

[13]http://www.worldrise.org/
[14]http://mission-blue.org/2015/02/protecting-italys-underwater-treasure/
[15]http://www.yocs.org/

[16]http://www.youthoceanconservationteam.org/
[17]http://eepurl.com/bawfWv
[18]http://www.stowitdontthrowit.blogspot.com/2015/02/2014-youth-ocean-conservation-summit.html
[19]http://eepurl.com/4ByNz

industry, but with the ultimate aim of familiarizing them with their marine environment and promoting marine conservation within local communities while allowing for local people to benefit from its resources in a sustainable manner (Bitonga Divers, 2015a). There is a long history of local sustainable use of ocean resources within Mozambique including recognition of spawning areas, fishing seasons and protected areas. This sustainable heritage is now under threat with new users accessing marine resources, a lack of effective governance and strong economic drivers for the exploitation of marine resources (Timothy Dykman, personal communication, 2015).

Despite this, there is a strong recognition of and desire to do the right thing. The youth of Bitonga Divers use the principles of inspiring a new generation to capitalize on economic opportunities from the expansion of tourism to grow sustainable and responsible livelihoods for Mozambicans (Bitonga Divers, 2015b). Through its work to train Mozambicans for the professional dive industry, Bitonga Divers are creating a group of activists and capacity within Mozambique to engage in sustainable ocean management. Divers go out into the community to deliver highly thought of and sought after village talks that help Mozambicans learn about and connect to their marine environment. They increase recognition of the need for and capacity to deliver sustainable management of the marine environment (Timothy Dykman, personal communication, 2015).

Ocean Revolution helps scale up the work of Bitonga Divers through links to universities to help train marine scientists and policy-makers, and government departments to increase broader ocean governance capacity. Wider benefits are facilitated through Ocean Revolutions' international connections that can allow for networking and the exchange of ideas from one region to be applied elsewhere, thus increasing impact.

Through these initiatives, Bitonga Divers and Ocean Revolution help to build the knowledge and awareness among Mozambicans that enables them to engage in marine conservation including efforts to create and manage MPAs. It ensures that local people are knowledgeable about the importance of a healthy marine environment and the pressures affecting it. More importantly they engender awareness of local rights and enable local people to maintain them while constructively contributing to marine conservation outcomes (Timothy Dykman, personal communication, 2015).

MAKE IT RELEVANT

In order to achieve positive action, it is necessary for MPA authorities and ocean conservation professionals to understand the barriers to making an impact on people's awareness, attitudes and behaviour, and what benefits they would derive from increased awareness, a positive attitude to MPAs and marine conservation, and taking action to support it. An understanding of the barriers and benefits from the perspective of target audiences can help determine and refine messages, as well as implement tools that can highlight benefits while downplaying or minimizing barriers (Bowerman and DeLorme, 2014). Furthermore, tailoring messages that speak to the intended audience and stand out in a crowded marketplace of ideas in today's overloaded media and advertising environment is a challenge all organizations face, but must be addressed head on.

An important consideration is to design solutions oriented programmes that connect people to MPAs and aquatic environments in the context of where they live and what is relevant to their day-to-day lives. Recall that only a third of people live in coastal environments and even those that live close to the coast, particularly those in large cities are not necessarily aware of, or experiencing the aquatic environment on their doorstep. Experiencing MPAs does not have to be limited to physically swimming in an MPA, but can include engagement via community activities designed to build awareness about and reduce environmental impacts that have far-reaching impacts on aquatic environments. The Great Pacific Ocean Garbage Patch at the centre of the North Pacific gyre created from the plastic refuse of modern society is a manifestation of a huge environmental problem. It is also a massive opportunity to highlight unsustainable consumptive patterns that connect

urban environments to seemingly far-away aquatic systems, thereby engaging people in aquatic conservation issues in their own neighbourhoods.

The tremendously successful Ocean Guardian School Program is one such example that furthers the educational and protection goals of NOAA's National Marine Sanctuary System by providing small grants to support hands-on watershed/ocean stewardship projects in kindergarten to year 12 public, private and charter schools. Initiated in 2009, the programme's ability to integrate into any community, has seen it expand across six states covering 71 schools involving more than 30 000 students.

The programme strives to raise awareness about the goals of the national marine sanctuary system, the land–ocean connection and the environmental issues affecting marine health, inspire positive environmental stewardship behaviour, encourage projects that will become ongoing self-sustaining programmes, and educate students about Ocean Literacy and Climate Literacy Principles and how these relate to ocean stewardship.

Ocean Guardian has been successful because of its ability to scale up and link to other organizations and the broader community. For instance, California's Carmel Unified School District was challenged to become the first Ocean Guardian School District in the nation achieving integrated stewardship practices across each of its campuses. In addition, eight schools initiated the first Zero Waste Week (ZWW) to raise awareness about how single use plastic and other types of litter affect the health of local watersheds. The programme now has schools from around the country as well as international schools joining the campaign to have a Zero Waste Week.

A crucial component of the programme is the evaluation process highlighted by measurable data and programme requirements which sets the Ocean Guardian School programme apart with established expectations and accountability among the participating schools, which in turn helps bring about real environmental and behavioural changes at school and in the communities. Recent follow-up surveys have found many schools continue, or even expand their stewardship programmes well after the grant has finished showing the lasting effect of this programme.

The Solitary Islands Marine Park (SIMP), in Northern New South Wales, Australia, has adopted an age-old practice, used by traditional owners and societies in general before the advent of mass communication, to capture oral histories and use them to inform natural resource management. The project, Not So Solitary, investigates people's connection to the coast and ocean, their values and sense of place, as well as environmental changes that they have observed over time. It also explores the influence of community in the establishment of the SIMP. The oral histories provide opportunities to explore, in detail, people's relationship to nature and its importance to every aspect of life. More than just a place to enjoy for varied reasons, or to recharge one's batteries, the ocean provided traditional owners of Sea County in the region with sustenance and fundamental life lessons. The Solitaries region has continued to facilitate a range of diverse benefits to many. The recollections assembled as part of Not So Solitary have also been translated into visual art, poetry and song and used to demonstrate the relevance of a healthy marine environment and values of the MPA to both local and wider audiences (IUCN, 2014d; Nicola Johnstone, personal communication, 2015).

MAKE IT POSITIVE

When people are involved in reducing waste that often finds its way into the aquatic habitats and MPAs, they become engaged in a solution putting a positive spin to negative subject matter. Positive messaging and a solutions orientation are essential to ensure the public does not perceive the problems facing aquatic habitats as beyond their power to engage in constructively. In addition, the application of lessons from the field of communications can ensure that messages are compelling to intended audiences (Freeman and Jarvis, 2013).

In order to capture an audience MPA managers need to design experiences and initiatives that find the fun in nature, are broadly appealing and allow public audiences to engage with nature on their

own terms, creatively and unconditionally. This means showing people the enjoyment and benefits that can be derived from MPAs and aquatic environments, particularly showing other people taking advantage of the benefits that aquatic environments provide.

Tourism and recreational activities are obvious candidates that allow people to find the fun in aquatic environments. The Earth is Blue social media campaign of NOAA's. ONMS is a great example of an initiative to promote and share such activities. Community clean-ups like those promoted by the Ocean Guardian programme deliver collective engagement in MPAs through fun locally based activity.

Video games such as those developed by the Cascade Game Factory and the Sharknet app entertain and engage users. With Sharknet, users learn about and generate a connection to sharks by tracking individual shark behaviour and providing updates via social media on where sharks are and what they are doing, in the same way we stay connected to friends, family and extended networks through status updates and posts.

New South Wales Marine Parks School Holiday Programming promotes direct experience of their parks and adjacent foreshores relevant across a range of ages. Programmes include recreational fishing workshops, guided exploration of intertidal habitats within the MPA and special events such as art exhibitions on the foreshore adjacent to the marine park (Chantelle Burns, personal communication, 2015).

The programmes are supported by a range of detailed region-specific education materials, including fact and activity sheets that enhance young peoples experience of exploring marine park environments. One activity provides users with the opportunity to design a zoning scheme for a fictional marine park which protects biologically important areas while still allowing ongoing use within the marine park area. Users understand not only the importance of biodiversity protection but all the considerations that go into the development and management of a marine park.

The Great Barrier Reef Marine Park Authority's Eye on the Reef app enhances not only tourist experiences, but that of all marine park users, marine park rangers and managers, marine tourism staff, scientist, fishers, tourists and other recreational reef users providing them with information, ways to understand how their actions affect the reef and take their own actions in support of conservation through recording and reporting their observations. Information collected through the Eye on the Reef programme is combined in a single data management and reporting system which enables participants to access their own data and reporting online. These data provide Marine Park managers and researchers with up-to-date information on reef health status and trends, the distribution of protected and iconic species, tourism activity and early warnings of environmental impacts (GBRMPA, 2015b).

One world, one ocean: this simple, but important, concept builds bridges across religions, cultures, and countries. By bringing together students of diverse backgrounds Ocean for Life delivers a positive message by promoting discovery, ocean science, conservation and stewardship, and to learn how the ocean connects everyone.

On 11 September 2001, three public middle school students, their teachers and two National Geographic Society staff were on their way to study ocean science in Channel Islands National Marine Sanctuary off California. Boarding American Airlines flight 77, they never made their final destination. Ocean for Life was created to honour those victims, and deliver a world-changing educational experience that addresses the causes that led to that tragedy.

Ocean for Life, run by NOAA's ONMS and the National Marine Sanctuary Foundation, provides hands-on, experience with high-quality, immersive ocean field studies to high school students from Middle Eastern, North African, and North American countries. It facilitates an appreciation for ocean science and technology, cross-cultural learning and fosters leaders in ocean science and conservation, while creating lasting bonds among multi-national students (Figure 5). All programme alumni surveyed have a better understanding of different countries and cultures, and how the world's oceans connect all humanity.

Figure 5. Ocean for Life students participating in a community beach cleanup. Photo: Claire Fackler, NOAA National Marine Sanctuaries.

ENGAGE OTHER SECTORS

Engaging with other sectors provides MPA managers and aquatic conservationists access to expanded audiences, key learning and skills from other disciplines and another way to scale up ING efforts. Many sectors that should be engaged are self-evident such as tourism, shipping, fishing and communications industries. However, given the important role of aquatic ecosystems to the health of the global environment and human society there is no limit to the sectors that can be engaged. Offering sectoral partners the opportunity to become champions of connecting people to aquatic environments can also open up opportunities to improve their bottom line.

A notable example of engaging other sectors involved putting the Ocean in Google Earth. Early versions of Google Earth saw land surrounded by a featureless blue ocean, without the diverse seascape of submerged mountains, submarine canyons, trenches and spreading ridges. Following two years of development, and supported by a high level board of advisers representing many stakeholders interested in ocean science, exploration and education, a Google team working with Dr. Sylvia Earle and her team of ocean advisers, launched several geospatial information layers in Google Earth on February 2009.

The goal was to build a tool for engaging the public in understanding the global ocean in all its facets including its role as the planet's essential life support system. This new platform brought the reality of the ocean and its complexity to desktops and later to mobile devices. Seven years later, it is routine to see media and individuals 'zoom in' on images of Earth, including ocean locations using these tools that are still expanding and evolving.

Hundreds of organizations and individuals have contributed in excess of 3000 searchable stories to the Explore the Ocean layer curated by the Sylvia Earle Alliance. These and other ocean geospatial tools can appear directly within the contributing organizations website for use in public education spaces like museums and aquaria as well as events and presentations at gatherings around the world, including virtually through Google hangouts.

Further development has seen the tools in Google Ocean:

- integrated with virtual reality and 3D tools for use in classrooms and more;
- used operationally for monitoring of Illegal, Unreported and Unregulated (IUU) fishing;
- integrated with Google Translate to broaden availability across cultures; and
- applied to "Underwater Street View" (collaborating with XLCSS) providing unprecedented visualization of ocean ecosystems from digital devices and the ability to monitor critical habitats at kilometre scale.

Advances in technology for creating imagery and data visualization continue to emerge, increasing the searchability and accessibility of data-rich geolocated content through social media and integration with traditional media. Putting the Ocean in Google Earth led users on an evolutionary journey with technology that is still in progress and with many innovations yet to come.

Many of the other examples cited in this paper involve engagement with other sectors. Catlin, a global insurer, recognizes the importance of documenting changes in our aquatic environments to support responses to climate change. The Eye on the Reef programme engages with the tourism industry to provide better visitor experiences that support reef management. NSW Marine Parks school holiday programming engages with local

government and other local organizations to connect people to the MPAs in their local communities. Collaboration with other sectors is what makes many of these programmes possible but can also significantly increase their impact.

With over half the world's population now living in an urban environment and estimates of an increase to two-thirds of the global population by 2050, MPA management authorities and aquatic conservationists should aim to develop and utilize partnerships with the urban gateway to nature which include institutions such as museums, urban parks, zoos, aquariums and local government to help connect people to MPAs and aquatic environments. Aquariums have long provided one of primary opportunities for people to see aquatic creatures up close. They have not only made direct contributions to aquatic conservation programmes, but also claim to support conservation through the education and inspiration delivered to their visitors. The evidence base is small but positive, with attendance to aquariums growing and demonstrable positive influence on their visitors (Gusset and Dick, 2011; Moss *et al*., 2014). A recent book, *Blue Urbanism*, provides many other examples of how to work with urban gateways to nature and draw urban audiences attention to the connections between their communities and aquatic environments (Beatley, 2014).

DISCUSSION

The purpose of ING efforts in relation to MPAs and the aquatic environment is to increase environmental awareness and affect people's attitudes and ultimately their behaviour to support MPAs and aquatic conservation. The examples in this paper demonstrate that both direct experience and indirect experience of MPAs and aquatic ecosystems through visual/digital media do capture people's attention and imagination. How effective the various ways for people to be exposed to MPAs and aquatic environments are at positively affecting awareness, attitudes and behaviours is a very complex question with no clear answer. Further research in this area would benefit future ING initiatives.

Many opportunities to inspire a new generation directly through aquatic experiences, or virtually through the convergent tools of education, entertainment, the media and digital technologies are only possible through the existence of MPAs that protect the natural and cultural values unique to their geographies. Therefore MPA management authorities have a special dual role to play in maintaining the natural and cultural values they were put in place to protect, and also to work towards achieving Aichi Target 1 to make people aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

The many examples highlighted throughout this paper illustrate seven lessons summarized in Table 1 that if applied will help MPA management authorities and aquatic conservation professionals work towards and achieve Aichi Biodiversity Target 1, upon which all other biodiversity conservation targets and efforts are contingent.

Prioritizing experience is key. Examinations of young people's direct experience in nature strongly supports improved and lifelong environmental awareness, attitudes and behaviour (Wells and Lekies, 2006; Thompson *et al*., 2008; James *et al*., 2010; Cheng and Monroe, 2012) The evidence is less strong for tourism, however, the industry's economic size combined with the evidence of some studies suggests more can be done to understand how tourism can improve its influence on environmental awareness, attitudes and behaviours. By offering a diversity of well-designed experiences, focused on youth, but appealing across demographics, tourism in partnership with MPA management authorities can facilitate lifelong journeys in connection with MPAs and aquatic environments.

While direct experience should be prioritized, technology with its pre-eminent place in the modern world should still be embraced. MPA managers and aquatic conservationists can use the full range of technology including media as both a gateway and enhancement to direct experience that does not replace or detract from experiences in aquatic environments.

Integration is key. Integrate technology to enhance experience-based programmes via mobile

devices of on-park experiences like the Eye on the Reef app from the Great Barrier Reef, providing digital interpretation and using digital media as a gateway to on-park experiences. Build connection between and across programmes to reinforce each other. Attitudes and behaviours change when knowledge is imparted repeatedly through multiple delivery mechanisms that include information delivery and experience, for example linking tourism activity with citizen science. Build in scalability through integration of tools and programming across organizations, that maximizes the impact achieved. Scalability is also achieved by building in the ability for people to take independent actions through goal-oriented activities and through external partnerships to enhance programme reach.

Focus on Young People bringing children into nature at an early age. While it is important to engage with broad audiences, significant ING investment should focus on youth, particularly primary school age children. Strong evidence indicates the lasting benefits for future awareness, attitudes and behaviours. ING programming and broader organizational planning and operations should also empower young people facilitating the engagement, participation and input of young people as leaders.

Achieve relevance with public audiences through working with advertising/communication, social marketing and behavioural economics experts to design, implement and evaluate ING programmes supported by strong messaging. This includes seeking to understand your audience, their interests, concerns and drivers. It means putting things in a local context by establishing the connections between MPAs and ocean conservation and people's everyday experiences in their communities.

Ensure that ING programmes and supporting messaging are positive, solutions oriented and designed to provide constructive engagement for audiences and participants. Design and implement fun, entertaining and engaging activities closely linked to a solutions outcome like schools contributing to ocean health through Zero Waste Weeks, or overcoming negativity by delivering information that de-mystifies ocean creatures like the Sharknet app does for great white sharks. Above all provide opportunities for people to find their own fun in nature and connect on their own terms.

Explore linkages and synergies to enlist subject area/industry specific expertise from other sectors that leads to mutual benefits between MPA agencies and sectoral partners. There is no limit to the sectors that can be engaged. In our increasingly urbanized world, evidence suggests effective use of the urban gateway to nature (museums, zoos, urban parks, events, local government, etc.) can extend the aquatic conservation sector's reach more than half of the global population.

What is clear is that there is no silver bullet, best approach. No single interaction with the ocean environment, whether experiential or virtual, can be guaranteed to generate significant changes in awareness, attitudes and behaviour. While the case of an individual epiphany undoubtedly does occur as anecdotal evidence suggests (Wunder and Sheil, 2013), such impacts on the bulk of society are unlikely. Rather, through the application of the series of lessons highlighted by the examples presented in this paper, MPA management authorities and aquatic conservationists can achieve the required changes in awareness, attitudes and behaviours across wide constituencies.

Commitment and investment towards ING should begin before an MPA or other conservation measure is initiated. The work of Bitonga Divers and Ocean Revolution has a broader lesson for ING through and about MPAs. Only by engaging local audiences, as well as broader constituencies, about the values of the marine environment to generate the knowledge and understanding that are the foundation of attitudinal and behavioural change, will the critical precursor of widespread support exist for the implementation and maintenance of effective aquatic conservation measures including MPAs.

Effective implementation of the lessons outlined in this paper requires the commitment and investment of resources that can deliver integrated, positive, fun and targeted experiential and virtual ING programmes and initiatives MPA management authorities that are supported by sufficient resources can exploit communications

and digital technology skills and pursue strategic partnerships with external organizations contributing expertise beyond the traditional remit of MPA management authorities.

Best of all, returns on investment are possible. Increased park visitation can result in increased visitation payments to the MPA authority that can be applied to conservation and management programmes as is done with the Great Barrier Reef Marine Park Authority's (GBRMPA) Environmental Management Charge (EMC) (GBRMPA, 2015a). However, The greatest return on investment will be the recognition of the value of healthy marine ecosystems and the commensurate support required to rapidly increase and maintain MPAs in line with the Aichi Biodiverstiy Targets and beyond to those agreed at the 2014 IUCN World Parks Congress, protecting more than 30% of aquatic habitats.

CONCLUSION

Aquatic environments face significant and increasing threats including a lack of awareness and knowledge about their value and importance to broader ecosystems and human society. Yet the conservation sector's ability to provide experiences, use technology and take advantage of the expertise from partnerships with diverse sectors to improve people's knowledge and connection to aquatic environments through MPAs has never been greater.

MPA management authorities and aquatic conservationists have a responsibility to foster literacy about aquatic environments if people are to be asked to support the actions of governments, private enterprise, communities and individuals that promote healthy ecosystems through the implementation of MPAs. Reaching ambitious biodiversity targets (Aichi Biodiversity Target 11, 10% marine protection by 2020 and 2014 IUCN World Parks Congress, 30% by 2030) is contingent upon success against Aichi Biodiversity Target 1 to ensure both decision-makers and the communities they represent understand the value of healthy aquatic environments, the threats they face and the steps they can take to address these threats. Success against Aichi Biodiversity Target 1 can be achieved through:

- prioritizing experience;
- embracing technology;
- integrating programmes and tools;
- focusing on young people;
- ensuring relevance;
- delivering positive messages; and
- engaging other sectors.

ING initiatives and programmes can deliver the positive changes in awareness, attitudes and behaviours required to achieve conservation goals.

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