JCOM

NEGLECTED SPACES IN SCIENCE COMMUNICATION

Marine and ocean sciences in Mexico: living with our backs to the sea

Ana Claudia Nepote and Pedro Medina-Rosas

Abstract

Despite Mexico has coasts in the Pacific and Atlantic oceans, people's connection towards the sea and marine environments is quite poor. Our commentary focuses on Mexico's coral reefs, relevant tropical ecosystems to human and oceanic welfare, and it emerges from the experience of the production of an itinerant coral reefs exhibit in Mexico, committed to the conservation and awareness of this threatened habitat. The UN Decade of Ocean Science for Sustainable Development starts in 2021 and represents an opportunity to increase initiatives for public communication of science on marine and oceanic issues in Mexico and the world.

Keywords

Environmental communication; Public engagement with science and technology; Science communication in the developing world

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The objectives of public communication of science include informing the public about science, strengthening the public's trust in science, tailoring messages about science and defending science from misinformation [Dudo and Besley, 2016]. However, marine and oceanic sciences are an overlooked topic in science communication not only in Mexico but globally, with very few academic publications on the public communication of marine science and scarce attention has been devoted to this field in science communication. Existing articles published in JCOM have addressed a typology of the modes of interaction between researchers and stakeholders for coastal zone management [Milligan et al., 2004], public participation issues in a citizen marine science project [Martin et al., 2016], experiences in risk communication due to sea level rise [DeLorme et al., 2018], and the need to include local cultural approaches in science communication in the Philippines [Navarro and McKinnon, 2020], however there is still an opportunity to expand consideration of the role of marine sciences in science communication, and particularly in the context of local communities.

Mexico is a country with more than 11 thousand kilometers of coasts along both the Pacific and Atlantic oceans. About 60% of the Mexican territory corresponds to its

Exclusive Economic Zone in the oceans [CONABIO, 2019]. Out of 32 states that make up the country, half are along the coastlines. This implies the enormous value for the Mexican economy of the coast, due to fishing activity, tourism developments, sports activities and the oil industry. The tourism industry by the sea generates 7.5 million jobs and contributes to 9% of the Gross Domestic Product [UNWTO, 2020]. In 2018, the World Tourism Organization [UNWTO, 2020] estimated that 11.2 billion USD of international tourism were spent in Mexico, making it one of the worlds most visited countries [Mercado Vargas and Palmerín Cerna, 2012], with beaches being one of its main destinations. Mexico's development policies have favored tourism emphasizing sun and beach tourism, mostly in the Mayan Riviera, in the Mexican Caribbean, and Nayarit in the Pacific. These policies have brought about territory transformations that affect ecosystems, societies and their cultures [Valverde and Benavides Cortés, 2017]. Among the main consequences of coastal tourism development are land use change, mangrove destruction and raw sewage dumping into the sea. These actions have significantly reduced local and regional water quality [McField et al., 2020]. However, the impacts are not only environmental, in relation to social and cultural aspects, some communities have been forced to modify their traditions and vocations, such as fishing or agriculture, to dedicate themselves to jobs that support conventional tourism.

In Mexico, the situation related to coastal and marine environments is so critical that it has become paradoxical. Almost 80% of the Mexican population live in towns and cities that are located over 350 meters above sea level, and on the other hand, most of the economic activities that sustain the country happen below this height. For example, 75% of irrigated land, 70% of livestock and 75% revenue generated by tourist activities happen below 350 meters [Azuz et al., 2011]. Mexico is an urban land oriented and centralized nation, whereas the coasts are a vacation destination symbolized by a walk on the beach [Azuz et al., 2011; Zambrano Salgado and Gutiérrez-Yurrita, 2019].

Development of marine sciences in Mexico

Knowledge of the coastal and marine ecosystem in Mexico at the end of the 20th century was scarce and fragmented [Arriaga Cabrera et al., 1998]. Despite the great potential that Mexico has for developing oceanic and marine sciences, it started late and with limited economic resources. Ocean and coast literature emphasizes the idea that "Mexico has lived with its back to the sea" due to the scarce knowledge, exploration and value that has been given to what the sea and the oceans preserve [Cifuentes Lemus, Torres-García and Frías M., 2000; Cámara de Diputados, 2008]. Recently, the need to create a national agenda that addresses the Mexican oceans and coasts main problems has been recognized, with the absence of a National Ocean Policy that could promote and articulate its decision-making central to this issue [Zambrano Salgado and Gutiérrez-Yurrita, 2019]. However, Mexico currently has only 31 decreed marine reserves whose area is equivalent to 3.29% of the territorial sea and 0.11% of the Exclusive Economic Zone, in which local communities and civil society organizations have been involved in the planning, managing and protection of their own common goods [Comunidad y Biodiversidad A.C., 2018].

The foundation of the history of Mexican sea's studies has been divided by Schwartzlose and Alvarez-Borrego [2002] into three major periods: explorations,

collections, and specializations. The explorations period began almost three centuries ago and was led by foreigners; followed by specimen collections of relevant species, such as fish and invertebrates, around 135 years ago, and most recently large-scale specialized systematic studies which date back around 35 years [Schwartzlose and Alvarez-Borrego, 2002]. The development of marine sciences in modern times was promoted through the editorial work of specialized Mexican journals created at the National Autonomous University of Mexico.

As the field of public communication of science develops globally, sub-specialties have emerged such as climate change communication [León Anguiano, 2013], communication for environmental conservation [Román Núñez and Cuesta Moreno, 2016; de Castro, 2005], or the public communication of astronomy, promoted since 2005 by the International Astronomical Union, including its eight international conferences. For the communication of marine sciences, since 2014 mostly European conferences have been held on communication practices in the marine science discipline. The first was organized in Porto, Portugal and aimed to "bring in the state-of-the-art in Marine Science Communication and to highlight new tools and practices in this field, in order to support scientists and marine science communicators in developing their communication skills to set up a more efficient dialogue with journalists, decision-makers, and the general public"; this initiative had been funded by the European Union under the theme "Oceans of Tomorrow" OCEAN 2011-3 [PERSEUS, 2020]. This conference has evolved and just held the fourth meeting in December 2020, as a fully virtual edition of the International Marine Science Communication Conference (CommOCEAN).

Coral reefs and Mexican marine science

Among the oceanic neglected ecosystems in Mexico are the coral reefs, an important component of the tourism experience. Coral reefs are fundamental planetary ecosystems, their health is critical for humans. In the last thirty years, a third of the world's coral reefs has been significantly impacted or disappeared due to the increasing ocean temperature and other climate change effects. The most recent United Nations global report on biodiversity, the Global Biodiversity Outlook, states "corals have shown the most rapid increase in extinction risk of all assessed groups" [Secretariat of the Convention on Biological Diversity, 2020]. Additional threats, such as overfishing, sedimentation and plastics affect their landscape and structure.

Mexico has coral reefs in both coasts, mostly in the Caribbean Sea and the Gulf of Mexico, with an incipient but significant coral cover in the Pacific, particularly surrounding several tropical islands. The history of the studies of coral reefs in Mexico is also recent, with more Mexican researchers studying them over the last 40 years. This increase in studies and people dedicated to their research and protection gave rise to the foundation of the Mexican Coral Reef Society [SOMAC in Spanish, 2020] in 2005. Studies are focused in the natural sciences, but recently some projects have been dedicated to improving science communication in this field.

In 2015, considering the current critical situation of the Mexican reefs a group of scientists implemented the first collaboration with environment journalists through workshops and courses about coral reefs ending with the coverage of the VIII Mexican Coral Reef Conference. In a second, larger and more ambitious project, a

collaboration with specialists on museums, education, and design created as a final product a travelling exhibition entitled *Live the Reef* [*Vive el Arrecife* in Spanish, 2020]. The purpose of the exhibition was to share the knowledge about coral reefs with people unable to visit the oceans. This collective work, where scientists from several Mexican institutions and members of the SOMAC collaborated, was dedicated to the present and future generations of Mexico encouraging them to become active agents of changes, in order to improve coral reefs' conservation and recovery, based on the concept that if people do not know or have visited this ecosystem, it will be difficult to identify its value or even feel the need to protect it.

Exhibitions on marine science

Live the Reef is the first museographic and traveling exhibition produced in Mexico focused on coral reefs, their current status, and actual research. The exhibit includes soundscapes from Mexican reefs, a library, games, and 15 interactive sections from which the visitors can learn details about the components and organisms of the coral reefs by interacting with different elements. The exhibit opened in 2018 in an interactive science museum in the Guadalajara, Jalisco metropolitan area, the second largest city in Mexico; it then moved to a science museum in Leon, Guanajuato, and later was transferred to another science museum in Aguascalientes, a nearby city. All these venues are in the center of the country and above 350 meters over sea level. The original objective was that at least half a million people could visit the exhibition in different venues. Currently, the exhibition is closed and waiting for more locations to visit, mainly due to the current economic and the COVID-19 situation, but the exhibition has also found there has been a lack of interest on this topic. It is a vicious circle, there are no exhibitions about the marine ecosystems because there is no interest in the ocean, and there is no interest in the ocean because there is no endorsement and information about the sea. Additionally, museums have very low budgets to host exhibitions. Despite this issue, currently, after visiting three venues and under two years of activities, around 50 thousand people have visited the *Live the Reef* exhibition.

Before *Live the Reef* was developed, an online survey was conducted among almost a thousand participants. The results, formative research, allowed us to identify topics and materials to include in the exhibit. We have also examined important comments left by the visitors to the exhibit, relevant for its analysis and evaluation, including those about the learning achieved about marine life by people that live far from the coast, where there are little, or no opportunities to know or visit the sea, coral reefs and other coastal habitats. These comments show that the interactive design and the book collection in the library increased the interest in the visitors to learn more about coral reefs. The use of these elements resulted in attractive and engaging ways for people, from children to adults, to learn about coral reefs and related topics.

Although museums are solid cultural institutions, they require extra funding and open attitudes to receive temporary, innovative exhibitions that allow the public to dialogue with the work of scientists and to understand how scientists solve the significant problems that society faces. The results of the exhibition *Live the Reef* motivated us to reflect on the possibilities that exist through the formats, models, and spaces for the public communication of science on about the seas and oceans. A recent project that took this concern to communicate further and approached it in

an active way was a workshop in the Mexican Caribbean. It was organized by the Mexican Network of Environment Journalists, and funded by the Earth Journalism Network, which later on supported the Mesoamerican Reef Reporting Project, to produce and improve the news coverage on the environmental health of the Mesoamerican Reef across the coasts of Mexico, Belize, Guatemala, and Honduras. The project, which was supported by the Summit Foundation, helped prepare ten journalists from these four countries to report on the findings of marine research and improve public awareness, as well as national, regional, and international responses to marine management, particularly on coral reefs. There are several groups supporting and promoting the scientific findings of the relevance of the Mesoamerican Reef, the largest reef system in America. One of them, Healthy Reefs Initiative, has been doing an admirable work, producing materials for the public and users related to the local communities in this Caribbean region, including an annual Report Card for more than 10 years, to show current condition of the different sites in the Mesoamerican Reef.

Despite important communication projects, such as the documentary *Oasis Marino*, produced by the San Diego Natural History Museum in 2000, which showed the extraordinary biodiversity of the Gulf of California and the Baja California peninsula, as well as the work promoted by the increasing number of aquaria in Mexico, we consider that there is still much work to be done to promote marine knowledge and studies, in order to be able to face the challenges that currently exist in marine and oceanic ecosystems.

What comes next for Marine Science Communication in Mexico?

Although in Mexico science communication on marine issues have been promoted for more than two decades, more initiatives are gradually emerging in the communication of marine sciences whose scope is also increasing. Another consolidated example are those carried out by the institutional offices of research centers and universities, such as the itinerant science fairs like the Ensenada Center for Scientific Research and Higher Education (CICESE) in Baja California, Mexico. However, such science fairs work, and that of research centers and universities are often linked to the media and outreach conferences, and not so much to museum exhibitions or activities.

Globally there is a concern and commitment to increase knowledge and public awareness of the seas and oceans values. This has been reflected through science-society mediations based on education and communication processes. In 2002, a group of oceanographers and educators from the United States identified the lack of ocean-related issues in their national education system. After that, they developed a framework on the essential principles for an oceanic culture. This concept has been echoed in the European community, United States and Canada [Santoro et al., 2017; Fauville et al., 2019]. The concept has taken hold and is taken as the understanding of human influence on the ocean and the influence of the ocean on people. This approach is not only concerned with increasing awareness about the oceans and our relationships with them, but also promotes tools to transform knowledge about these environments into actions that promote sustainability. Cava and collaborators [2005] proposed a framework that identifies in a general way three characteristics of a person with ocean literacy: someone who has general knowledge about the oceans, who is capable of communicating information about the oceans that makes sense to other people; and that is capable

of making informed and responsible decisions about the ocean and its resources [Cava et al., 2005; Santoro et al., 2017]. Ocean literacy has been considered a fundamental piece for the sustainable development and governance of the oceans [Dupont and Fauville, 2017]. However, this concept needs to be appropriated, adapted and promoted among Latinamerican context and cultures.

The 2015 decree by the General Assembly of the United Nations Organization for the International Day of Women and Girls in Science motivated the Spanish Institute of Oceanography to promote a program to vindicate gender equality in science. Thus in 2016 "Oceánica" was created, a project that communicates the work of scientists dedicated to the study of the oceans, both current and past, through their personal lives and their contributions to the development of knowledge. "Oceánica" also awakens scientific vocations in girls and boys, fosters their creativity, their decision-making capacity, and equal treatment in the face of gender inequalities from an early age. In 2020 they launched a call for the first edition of the National Oceanic Journalism Prize in order to recognize the works that journalism can highlight to strengthen gender equality in this specialty of science.

Approaching the start of the Decade for Ocean Sciences for Sustainable Development in 2021, Audrey Azoulay, Director General of UNESCO, has recognized the oceans as our new frontier, as there are many knowledge gaps about them despite the important role that they play in maintaining life on the planet. We believe that it is time not only to deepen our knowledge about biodiversity and ecosystems, but we will also have the opportunity to reconfigure and strengthen different social, cultural and economic connections with the seas and oceans. This decade could drive us to recover the stories and cultures of the sea that allow us to weave networks that support marine life and that contribute to strengthening identity as interconnected global citizens on this little blue planet. We acknowledge the marine cultures that are present along the Mexican seashore, understood as the set of practices, knowledge, and identities determined by the relationship of communities, social groups, and workers related to the sea [Delgado, 2020]. We consider that we have a window of opportunity to return our view to the sea and strengthen the links between the different cultures and perspectives related to the seas and oceans through the public communication of science in Mexico and Latin America.

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