

Article

Ocean Literacy to Promote Sustainable Development Goals and Agenda 2030 in Coastal Communities

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Abstract: Ambassadors for Biodiversity (EmBio) is an ocean literacy research project that contributes to the improvement of literacy on marine and coastal biodiversity, namely encompassing the areas covered by the Natura 2000 Network, by promoting coastal and oceanic resources conservation and natural and cultural values preservation of the Portuguese western Atlantic coast. This project directly promotes the achievement of the Sustainable Development Goals (SDGs) and the implementation of 2030 Agenda developed by the United Nations and adopted by most countries in the world, which define the priorities and aspirations for global sustainable development until the year of 2030, mobilizing a world-wide effort to meet a common set of goals and objectives. This paper contributes to understanding how ocean literacy, and specifically the EmBio research project, fits into the international agenda for sustainable development and the SDGs and its targets. Through an analysis and a comparison between the project EmBio and the SDGs, it was possible to identify connections on 11 out of 17 goals and 31 out of 169 targets, with a special emphasis on the SDG 14—Life Below Water. The results highlight the relevance of this project and, especially, ocean literacy for the accomplishment of the SDGs.

Keywords: ocean literacy; coastal areas; marine environment; environmental education; sustainable development goals



Citation: Ferreira, J.C.; Vasconcelos, L.; Monteiro, R.; Silva, F.Z.; Duarte, C.M.; Ferreira, F. Ocean Literacy to Promote Sustainable Development Goals and Agenda 2030 in Coastal Communities. *Educ. Sci.* **2021**, *11*, 62. <http://doi.org/10.3390/educsci11020062>

Academic Editor: James Albright
Received: 21 December 2020
Accepted: 2 February 2021
Published: 7 February 2021

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1. Introduction

The world is currently facing serious challenges that are becoming more and more complex, uncertain and with major consequences for humanity, mainly due to population growth [1–3]. Some of those challenges are socioeconomic, such as the increase in poverty, high unemployment rates, criminality increase and political crisis, as well as environmental ones, such as land-use changes, air and water pollution, climate change and biodiversity loss [4,5]. To face these challenges, people all over the world have developed different adaptation strategies to reduce the risk of exposure to these threats, which can help maintain human well-being and lead to a better quality of life [2]. One important way of addressing these issues is through behavioral changes [6], that can be achieved through environmental education [7,8]. The concept of environmental education was first brought up in the late 1960s and 1970s when the International Working Meeting on Environmental Education in the School Curriculum was held in 1970 by IUCN/UNESCO [9–12]. Since then, the definition went through numerous readjustments and updates and the concept was shaped to account for a more holistic view. Currently, environmental education can be perceived as a way for increasing public awareness, knowledge and consciousness about the environment, equipping people with tools and skills to make responsible decisions to adequately address environmental problems and to contribute towards sustainable

development [3,7,13]. According to Ferlali Ors [14], the central aim of environmental education is to raise environmental awareness in all sectors of society and disseminate positive and long-term behavioral changes. For that, it is crucial to address a substantial number of economic, social and environmental problems that society is facing [3,4], which have serious effects on human beings [15].

Environmental education plays an important role in achieving sustainable development [4,7,13,16,17], and during the United Nations Decade of Education for Sustainable Development (2005–2014) this issue was highly discussed [18,19]. The role of education in the context of sustainable development won even more attention with the approval of the 17 Sustainable Development Goals (SDGs) in September of 2015 by UN member states [18–20]. Oghenekohwo and Frank-Oputu [20] point out that achieving these goals can only be possible through non-formal education instruments and methodologies with “appropriate orientation, commitment, attitudinal change and genuine non-formal learning approaches among citizens”. In fact, an investment in education can contribute substantially to the accomplishment of the SDGs, because of the competencies, technical expertise and skills that are required for the development and implementation of policies [21,22].

Although marine ecosystems are extremely productive and diverse, they are currently under a lot of human pressure, due to unsustainable fishing practices, pollution, tourism and growth of urban infrastructures [23,24]. These practices are leading to the degradation of marine ecosystems, and even, in some extreme cases, to its disappearance [23]. For that reason, the SDG 14—Life Below Water—was proposed to ensure the protection and sustainable management of marine areas and ocean literacy becomes an important tool to achieve this goal.

Ambassadors for Biodiversity (EmBio) is a research literacy project that targets the achievement of the SDGs, by promoting the preservation and conservation of natural resources. Besides that, this project also encourages improvements in society regarding marine and coastal biodiversity literacy, as well as promoting the preservation of local traditions related to the sea, namely traditional fishing techniques and the cultural aspects of this ancient activity. Through environmental awareness activities and informative content, such as an exhibition, educational books, and lectures involving the local communities, this project was able to reach a large number of people from all age groups, meeting the project objectives.

As we enter in the “Decade of Action”, one of the political priorities in most of the developed countries focuses on the challenge of covering the SDGs at the local level, to step up responses to make a difference where it matters—in people’s lives, communities, and local organizations committed to this commitment. That can contribute to increasing the social mobilization to act individually and collectively, locally and globally to achieve these common goals [25,26].

Therefore, the key question for this paper is how ocean literacy, through this project, can contribute to the accomplishment of the SDGs at the local level and what are the links between the two. To accomplish this, an evaluation of the 2030 Agenda for Sustainable Development Report was conducted, with all 17 SDGs and respective 169 targets carefully analyzed and compared with the project products, actions and objectives. This analysis allowed us to understand how many SDGs this project targets, and how strong that connection is.

1.1. Sustainability of Marine and Coastal Areas and the Sustainable Development Goals

The concept of Sustainable Development was first presented in the Brundtland Report, also entitled *Our Common Future*, published by the World Commission on Environment and Development in 1987 [21,27]. In the report, “Sustainable Development” is defined as “[. . .] a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [21,27–30], and it encompasses social, economic and environmental dimensions [29,31].

According to Palea [32], the European Union (EU) has, since the beginning of the union project, made serious efforts to achieve sustainability and contribute to sustainable development in Europe and developing countries [33]. Even though the EU has invested in policies and programs that address sustainable development, achieving sustainability is a complex and challenging issue [34] that takes into account different scales, from local to global dimensions [35]. In fact, sustainable development is a challenging concept which incorporates a wide range of disciplines [36]. Moreover, citizens and organizations around the world, such as companies, cities or governments, are committed to incorporating sustainability into their agendas [37], as well as sharing knowledge, policies and technologies [38,39] to improve it. However, as sustainability becomes an important part of the agendas and it is a widely discussed topic across the world, a significant question arises: how to achieve “sustainable development” in the marine and coastal environment context?

Marine and coastal environments have been, for centuries, crucial for human activities and become intensively attractive, mainly due to their richness of beauty, resources and ecosystem services, and, because of that, the population living in coastal areas has increased significantly [40,41] over the last decades. Consequently, the ocean has become overexploited and polluted, which resulted in intensive transformations and degradation of habitats, that highly contributed to biodiversity and ecosystem services losses [42]. Nevertheless, as most of these problems are cross-bordered, it is important to involve local, national and international decision-makers, as well as international organizations through treaties and policies that can help achieve both conservation and economic growth in marine environments [41,43].

Having this in mind, the United Nations approved, in September 2015, an action plan to address sustainable development in every context, until 2030, [35,44,45] in all its dimensions—economic, social and environmental [46]. This action plan, known as 2030 Agenda for Sustainable Development, incorporates 17 SDGs that cover all aspects of sustainability [44], and are unfolded in 169 targets, that are usually regarded as important objectives to be accomplished in terms of environment and human development up to 2030 [47]. The SDGs (Figure 1) were built on the Millennium Development Goals and seek to reach what the previous goals did not [48], covering a wider range of issues in all countries and not only in the developing ones [49]. These goals, adopted by almost all the countries of the world [46,50], incorporate areas that influence the quality of life of all the citizens of the world, and its future generations, which require worldwide actions of governments, corporations and citizens to eradicate poverty and create a life with dignity and opportunities for all, within the boundaries of the planet [48].



Figure 1. Sustainable Developments Goals for the period of 2015–2030 (United Nations).

The SDGs were not created to deal only with marine and coastal environment threats. They encompass a range of different areas. However, efforts were made to address the concerns regarding the ocean and marine environments through the SDG 14—Life Below Water—that aims to “conserve and sustainably use the oceans, seas and marine resources for sustainable development”. With this specific goal, a more effective management of the

marine resources is expected, as well as regulation improvements to reduce the environmental problems related to the oceans, namely, overfishing, pollution and climate change consequences, such as acidification or sea-level increase.

To evaluate the progress towards the implementation of the SDGs worldwide, the United Nations releases, every year since 2016, an annual report to inform the high-level political forum, as mandated by a resolution of the General Assembly. These reports are supported by a set of selected indicators and provide a global overview of the current situation of the goals. The Sustainable Development Goals Report 2020, the last report to be released, reviews progress in the third year of implementation of the 2030 Agenda for Sustainable Development and presents highlights of progress and remaining gaps for all 17 SDGs, based on the latest available data, and examines some of the interconnections across goals and targets [51–53].

The 2030 Agenda, according to the United Nations [48], is guided by the purposes and principles of the Charter of the United Nations, including full respect for international law. It is grounded in the Universal Declaration of Human Rights, international human rights treaties, the Millennium Declaration, and the 2005 World Summit Outcome. It is informed by other instruments such as the Declaration on the Right to Development.

1.2. Ocean Literacy and Education

The oceans cover nearly three-quarters of the planet [54,55] and many coastal populations depend on them for their livelihood and prosperity [23]. Oceans provide invaluable environmental services, notably the oxygen we breathe, a large number of marine resources, and act as climate regulators [56]. However, despite the critical importance of oceans, the growing impacts of climate change (including acidification of the oceans), overfishing and marine pollution are compromising the progress in protecting the oceans of the Earth [23,24,57]. Due to the cross-border nature of the oceans, the management of marine resources requires interventions at all levels (national, regional, and global) to mitigate threats, and ocean literacy can actively contribute to this purpose.

Although ocean literacy may be considered a recent concept, there are already some publications and initiatives focused in this issue, namely the Ocean Literacy—The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages, Ocean Literacy Scope and Sequence for Grades K-12, published in 2005 in the USA, or the *Conhecer o Oceano* (Knowing the Ocean), the first initiative regarding ocean literacy in Portugal [58]. Some of these actions not only contributed to the dissemination of knowledge about the ocean and marine environment, but also to the creation of ocean and coastal management policies that help the protection and conservation of marine biodiversity and respective habitats.

Ocean literacy is understood as the ocean's influence on humans and their influence on the ocean [58], and, according to UNESCO [59], ocean literacy can lead to an improvement in "economic stability and national security, and to allow society to understand critical issues associated with important ocean-related topics spanning ecology, trade, energy exploration, climate change, biodiversity, the ocean and human health, and developing a sustainable future". In addition to this, in order to protect the oceans and marine environments, it is important to improve citizens' knowledge regarding these issues [60,61] contributing to an attitude change, but also to responsible policies, regulations and management strategies [62,63] to ensure the sustainability of the ocean.

When it comes to literacy in general, schools are the main institution responsible to teach and pass on knowledge to people—where children are included—about several areas. This kind of education is usually referred to as formal education and it is usually adopted across the world [64], even though every country has its own educational system. However, in recent decades, non-formal education has gained ground and more relevance and different "out-of-school" instructional strategies [64–66] have arisen to improve the demands for education regarding science communication. In this sense, new institutions, such as research centers, museums and other organizations, started to come up with

non-formal educational projects and materials, focused on experience-based learning, to meet educational demands. In this way, not only does non-formal education lead to numerous benefits to individuals and organizations, but it also provides a broader perspective on learning.

2. Materials and Methods

2.1. Case Study

Ambassadors for Biodiversity is a non-formal ocean literacy research project, developed on the Portuguese's western Atlantic coast, mainly in the coastal municipalities of Torres Vedras and Lourinhã (Figure 2), that targets the protection of the environment and the promotion of efficient usage of natural resources, focusing on areas with high coastal and marine biodiversity, including the habitats of the Natura 2000 Network. This project started in 2017 and aims to expand the "coastal and oceanic environmental culture" at the local level, promoting partnerships between different governmental bodies of the public domain and private entities, and enhancing the symbioses between scientific research and field actions by developing very practical activities in both municipalities. Additionally, the project also has contributed to the dissemination of knowledge of the local biodiversity and local traditions, inspiring sustainable behaviors towards coastal and marine environments by enhancing the increase in environmental awareness in schools as well as the active participation of the local community.

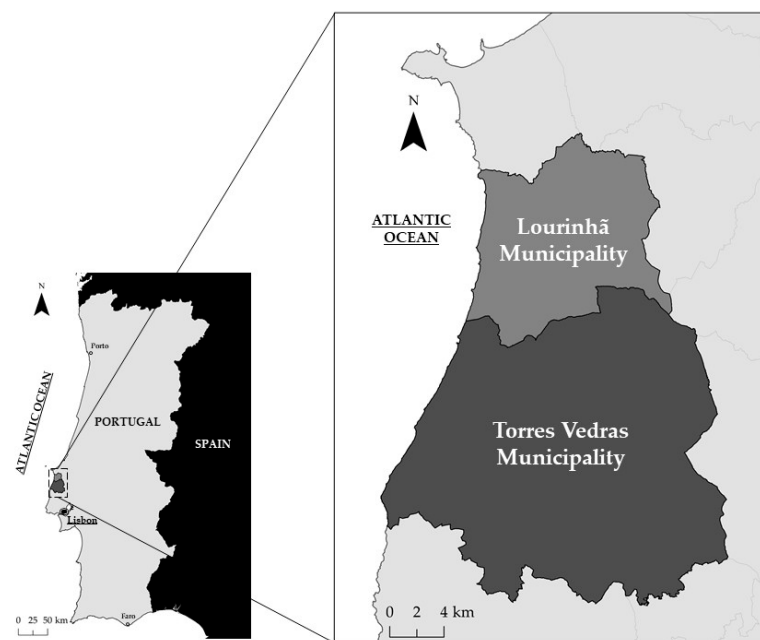


Figure 2. Location of Torres Vedras and Lourinhã Municipalities, Portugal.

To achieve that, an awareness and education plan with the active involvement of various stakeholders, based on the successful experiences of MARGov [67] and MARLISCO [68] projects, was established and put into action between 2017 and 2018. During this period, various contents and actions of awareness and environmental education were developed for and with the entire coastal community, namely an itinerant exhibition, an educational project for local schools and various awareness and action campaigns (Figure 3). Young, elderly, students, fishermen, farmers, traders, teachers, decision-makers and others were actively mobilized and involved in a genuine process of intergenerational knowledge transfer.

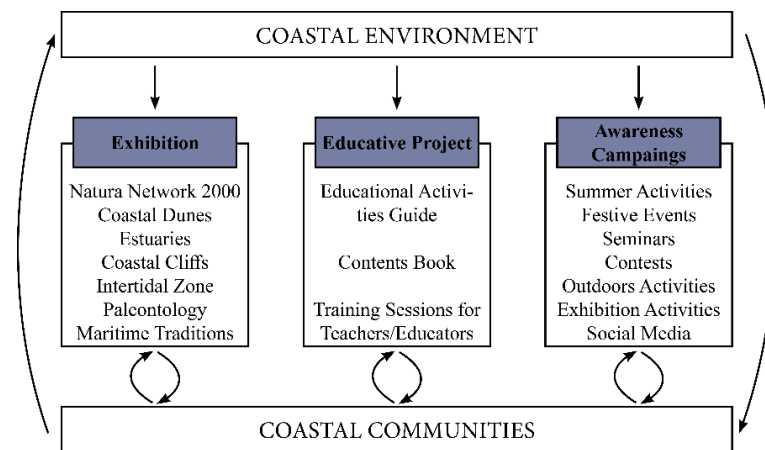


Figure 3. Conceptual Scheme of Ambassadors for Biodiversity (EmBio) Research Project.

Besides the non-formal aspect of the project, it was the strong relationship established with the local communities and all the knowledge held by them that made the difference and contributed to its success, not only because of the knowledge of specific local communities, but also because of the existing traditional/cultural knowledge often held by the elderly.

2.1.1. Itinerant Exhibition

The exhibition “Biodiversity—Knowing to Preserve the Coastline of Torres Vedras and Lourinhã” is an itinerant exhibition (Figures A1 and A2) about the region’s natural and cultural heritage and coastal and marine ecosystems. It was specially designed to be displayed in public spaces such as shopping centers, squares, public events and in local schools to reach the greatest possible number of people. It has an informative and playful character and aims to create edginess and restlessness and motivate people to explore it, searching for answers and triggering mechanisms of questioning.

The exhibition, as well as the project in general, is organized in seven themes—Natura 2000 Network, Coastal Dunes, Estuaries and Riverside Zones, Coastal Cliffs, Intertidal Zone, Paleontology and Maritime Traditions—and it is displayed in four parallelepiped-form modules, made from natural wood. Besides that, some of the local entities and project partners were invited to participate in the exhibition and kindly donated some pieces to incorporate in the exhibition, such as fossil replicas and traditional fishing materials. During the period of the project, the exhibition was displayed in 18 schools and one shopping center, having reached more than 180,000 people. After the project time frame, the exhibition will be held by the two municipalities and will be available to be displayed in schools, cultural or educational organizations, public spaces, or other places, in order to be further visited and explored for the entire community.

2.1.2. Educative Project

The educative project, mentioned here, consists of capacitating and training educators and students about nature and ocean conservation, to empower them to change their behavior and attitudes regarding these questions. To accomplish these aims, three actions and products were developed—A Guide of Educational Activities, a Contents Book and a Training Session for Teachers and Educators.

Compiling a total of 24 activities designed for students, the Guide of Educational Activities (Figure A3a) aims to promote environmental education in the sense of accountability, understanding and resolution of issues and problems related to marine and coastal ecosystems and it is composed of tools and supporting materials that contain information and suggestions of activities related to biodiversity and ecosystem preservation, to support teachers and educators in the conception, preparation, development and evaluation of their Environmental Educational Projects.

A book that theoretically explores the contents of the project was also published in 2019, transcribing to a publication the contents of the itinerant exhibition, with a higher demanding level (Figure A3b). This publication is subdivided into the seven major themes of the project and operates autonomously, as a book on the natural heritage of Torres Vedras and Lourinhã Municipalities. However, it may alternatively be an important complement for the itinerant exhibition and the Guide of Educational Activities.

Finally, two certified training courses were carried out for teachers and educators, one short-duration course of 8 h for 74 participants, and 18 h training for 40 participants, focusing on the topics presented in the exhibition, the activities guide and the contents book, having both theoretical and practical approaches (Figures A4 and A5).

2.1.3. Action and Awareness Campaigns

Awareness and action campaigns play a key role in environmental citizenship and result from a combination of different components, particularly regarding information, awareness, attitudes, beliefs, education, training and knowledge. The development and dynamization of activities on the field—that induces a confrontation with reality—contributes to a critical reflection of the participants, allowing for greater environmental awareness towards biodiversity and nature preservation, leading to the creation of new and more responsible skills and behaviors on this theme [67].

During the project implementation, a program of campaigns/activities was developed aimed at the overall community, to consolidate the knowledge of the participants on biodiversity in coastal and marine ecosystems, raising awareness about the main threats, problems and risks associated with their conservation. Until 31 December 2018, more than 30 awareness actions were carried out, including beach clean-ups, thematic scavenger hunts, field lessons/living laboratories, visits to the itinerant exhibition and seminars (Figure A6). Those activities were developed in partnership with various entities and associations in festivals and events related to the theme of the project, or on commemorative dates relating to biodiversity and environment (e.g., World Oceans Day, International Day of Biodiversity), and reached more than 500 people, from children to seniors.

2.2. Research Methods

Nowadays, most of the policies in both developed and developing countries, are progressively focusing on SDGs [44] and a considerable number of actions and projects are developed every year by companies, organizations and academia that seek the same purpose. Yet, it is important to acknowledge that every country has different priorities, depending on their economic and social status, and, consequently, has different ways of addressing these issues. Not all projects focus on the same subject and, while some target the basic human needs in developing countries, like poverty, hunger or health problems, others aim to improve economic growth or to create more equal and fair societies.

Besides that, one of the main objectives of the SDGs, that is common to all countries, regardless of their location, is to improve environmental sustainability and the quality of life for everyone. Moreover, to achieve this, Education for Sustainable Development, identified in the target 4.7 of the SDG 4 (Education), is considered as crucial for success as all other 17 SDGs [69,70]. However, according to [71], despite the ambitious agenda of the United Nations regarding the SDGs, with the establishment of goals, targets and metrics, little has been done and said about education, as predicted in the agenda.

As noted by Vladimirova and Le Blanc [19], global reports produced in recent years have stated the connections between education and all 17 SDGs, with some of these links being intuitive, and others not so much. Having this in mind, the main goal of this research is to understand how an ocean literacy project targeting the conservation of coastal and marine ecosystems (EmBio) can contribute to the implementation of the SDGs and what connections exist between them. To accomplish this, the research was divided into two phases, as shown in Figure 4.

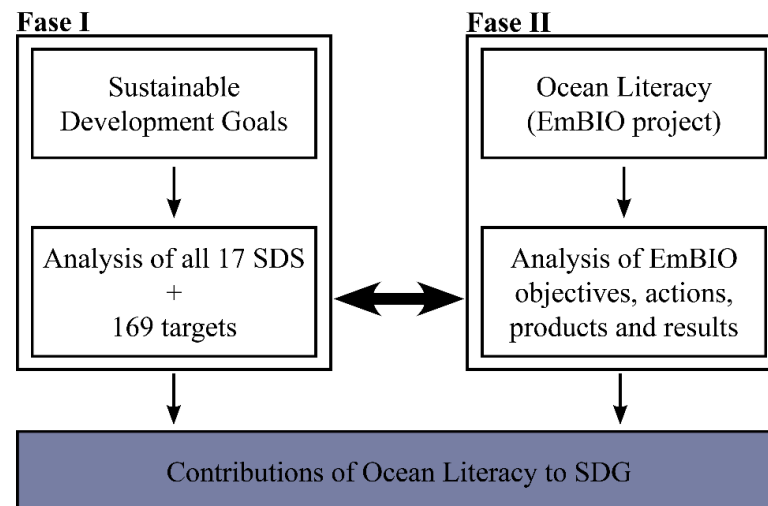


Figure 4. Methodological scheme of the research.

The first phase of the research focused entirely on the SDGs. Firstly, an evaluation of the 2030 Agenda for Sustainable Development Report was conducted, where all 17 SDGs, as well as their respective 169 targets, were cautiously reviewed and analyzed.

This step, similar to the Barthélemy et al. [69] methodology, was extremely important to understand which were the goals and the targets proposed by the United Nations, in order to provide context to the authors of this paper about the strategic options for the next step in the methodological process.

The second phase of this research had as the focal point the analysis of EmBio actions, products and objectives. The actions and products of the project refer to everything produced, material or immaterial, which, among others, include the exhibition (displayed in 18 schools during the school year 2017/2018), the Guide of Educational Activities (launched in September of 2018) and all the action and awareness campaigns developed over 2017 and 2018, and the conceptual options supporting all the processes.

Finally, the information gathered in the previous phases was subject to a detailed and integrated analysis, based on specific criteria (Table 1), to understand how many SDGs the EmBio research project contributes to, and how apparent that connection is. In this analysis, each action, product, and objective of the project was analyzed according to every target of the 17 SDGs. If there was not any connection between the action, product or objective and the target considered, that target was not included in the Table 2, reporting the results. Otherwise, if the actions, products, or objectives addressed directly or indirectly the target considered, that target was included. Thus, it is possible to understand if the project reflects the targets of the SDGs and which of those are well or poorly represented, which is registered in Table 3.

Table 1. Inclusion and exclusion criteria used in the analysis of the actions, products and objectives of the project according to the targets of the Sustainable Development Goals (SDGs).

Criteria	Description
No connection	The actions, product and objective of the project do not have address the target of the SDGs
Indirect connection	The actions, product, and objective of the project address indirectly the target of the SDGs
Direct connection	The actions, product, and objective of the project address directly the target of the SDGs

Though ocean literacy is not explicitly referred to in the SDGs, the intensity of the presence of these goals, more than anything else, reveals how relevant this project is for sustainability, as it is referred in the next section.

3. Results and Discussion

The main objective of this research was to show how important ocean literacy is for the accomplishment of sustainability in coastal and marine environments, through the analysis of SDGs and the actions of one case-study—the EmBio research project. By looking at Table 2, it is possible to conclude that this specific project was able to address 11 of the 17 SDGs, which means that more than 60% of the total goals are achieved.

Nevertheless, if we look deeper into the evaluation, only 32 targets have connections with this project, which is 19% of the total targets. This shows a clear connection between the case-study and the overall SDGs. However, for the purpose of this research, just looking at the number of targets reached may not be the most adequate approach, once all goals and targets have a specific meaning that requires a sounder interpretation.

Table 2. Sustainable Development Goals and specific targets achieved with the EmBio.

Sustainable Development Goal	Specific Targets	Description	EmBio Project
4 Quality Education	4.7	By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and culture's contribution to sustainable development.	EmBio project has a strong educational component that was developed with the close involvement of the local community, as well as schools and other educational associations. In addition to training and empowerment of participative and responsible citizens, throughout the itinerant exhibition, the educational activities guide, and the book of contents related to biodiversity and nature conservation it was possible to accomplish this target.
5 Gender Equality	5.1	End all forms of discrimination against all women and girls everywhere.	During the EmBio project timeframe, a set of educational products was developed, considering the principles of gender equality, in which didactic materials were equally designed for boys and girls, aiming to deconstruct the stereotype of the society. In addition to that, in all activities and awareness campaigns that were conducted, there was no discrimination against women and girls, and the whole community was encouraged to participate, regardless of their gender.
8 Decent Work and Economic Growth	8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programs on sustainable consumption and production, with developed countries taking the lead.	Traditional fishing is a very popular activity and is deeply rooted into the cultural identity of the region, contributing to the local economy of the region, and, because of that, several actions and awareness campaigns were conducted with the support of several local fishermen, where the participants were taught and shown traditional fishing techniques and its importance for the local economy and sustainability of marine resources. The exhibition and the guide of educational activities also appeal to these issues, as well as the sustainable consumption of species at risk, once this theme is highly important to the Western region of Portugal. The dissemination of the natural values of the region and the field activities presented on the guide can promote different kinds of sustainable tourism, with a natural, scientific and educational motivation.
	8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.	

Table 2. Cont.

Sustainable Development Goal	Specific Targets	Description	EmBio Project
10 Reduced Inequalities	10.2	By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or another status.	The Itinerant Exhibition has been made available to several schools of the municipalities of Torres Vedras and Lourinhã, allowing youngsters and children from all ages to explore it and it was also displayed in several free public places, namely libraries, socio-cultural spaces, fairs, events, and a shopping center, enabling other elements of society to contact with the exhibition. Additionally, the awareness-raising campaigns that were carried out were open and free, and everyone was encouraged to participate, despite of their age, gender, disability, race, ethnicity, origin, religion or economic condition. In these campaigns, some elderly associations, social and parish centers and youth associations were also involved.
	11.4	Strengthen efforts to protect and safeguard the world's cultural and natural heritage.	Being an ocean literacy project that aims to protect the environment and promote the efficient usage of resources, as well as to contribute to local knowledge about biodiversity and local traditions, the EmBio project fulfils the targets 11.4, 11.A and 11.B with all its products and actions. In addition to that, the project seeks the expansion of an "Environmental Culture" at the local level, promoting partnerships between different government bodies, the public domain and private entities, and enhances symbiosis between scientific research and on-hands action, with the development of practical activities that encourages closer links between the communities and the municipalities. Besides that, the project addresses some old and almost extinct sea traditions and shows their importance to the youngest and more urbanized communities, presenting their past and the economic and cultural roots of both municipalities.
11 Sustainable Cities and Communities	11.A	Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.	
	11.B	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels.	
12 Responsible Production and Consumption	12.2	By 2030, achieve sustainable management and efficient use of natural resources.	One of the components of the EmBio project is the local traditions related to fisheries and, as stated before, the project had specific actions which aimed to promote the sustainable consumption of endangered fish species, as well as to spread relevant information and awareness for sustainable development and lifestyles in harmony with nature.
	12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.	

Table 2. Cont.

Sustainable Development Goal	Specific Targets	Description	EmBio Project
13 Climate Action	13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.	EmBio project addresses climate change alongside the general and scholar community, and the various themes that it entails, referencing threats and risks of climatic nature that endanger the natural ecosystems of the studied area. Additionally, through the products developed under the project—the exhibition, the guide of educational activities and actions and awareness campaigns—it was possible to raise awareness near the community towards the impacts of climate change for marine and coastal environments, and means of mitigation, adaptation, impact reduction and early warning regarding this issue.
	13.2	Integrate climate change measures into national policies, strategies and planning.	
	13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	
	13.B	Promote mechanisms for raising capacity for effective climate change-related planning and management in the least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.	
14 Life Below Water	14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.	By being a literacy driven project that focusses on coastal and marine areas, EmBio has a very important role in achieving the SDG 14. Besides raising awareness regarding sustainable behavior in coastal and marine environments and increasing environmental awareness in schools, as well as the active participation of the local community, this project also promotes the increase in knowledge about the importance of these ecosystems, their biodiversity and characteristics, threats and forms of preservation of marine species, making a significant contribution to the conservation of these habitats and better environmental practices. The project made also several efforts to aware the society about the importance of wastewater treatment plants and the consequences of using improperly fertilizers and pesticides in water quality. In addition, it was developed several beach clean-ups, with marine litter monitoring, with schools, youth associations and beach users, being a hands-on approach to the problem of marine litter.
	14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.	
	14.3	Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.	
	14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.	
	14.5	By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.	
	14.A	Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular, small island developing States and least developed countries.	

Table 2. Cont.

Sustainable Development Goal	Specific Targets	Description	EmBio Project
	14.B	Provide access for small-scale artisanal fishers to marine resources and markets.	
	14.C	Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want.	
15 Life on Land	15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.	A significant part of this project focuses on terrestrial areas, particularly coastal areas. Additionally, riverside areas equally represent one of the target areas, and, in the various materials produced and awareness campaigns that took place, threats to these ecosystems have been referred to, as well as techniques of recovery and conservation. The project directly addresses questions about freshwater and transition ecosystems, like water pollution, invasive species, land degradation and erosion and the sustainable usage of resources.
	15.5	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	
	15.8	By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.	
	15.9	By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.	
16 Peace, Justice and Strong Institutions	16.10	Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.	All the products of the project EmBio are available to the public through digital platforms on the Internet, like the website of the project, as well as on the Facebook page and official websites of the municipalities of Torres Vedras and Lourinhã. The products can also be requested personally in the Environment and Education offices of both municipalities. Therefore, any citizen can have access to all materials without any charge.

Table 2. Cont.

Sustainable Development Goal	Specific Targets	Description	EmBio Project
17 Partnerships for the Goals	17.6	Enhance North–South, South–South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	The coordinating team of the EmBio project established protocols with the University of Cape Verde (Cape Verde) and the University of Brasília (Brazil), to promote and boost the replication of the project in these countries. In addition, this team integrates the “Environmental Studies Network in Portuguese-speaking Countries” (REALP), which allows us to disseminate and report the project and its results in developing countries that speak Portuguese, by transmitting knowledge and reinforcing/ supporting capacitation. The protocols cover several areas, such as courses of 1st, 2nd and 3rd cycle, postgraduate courses, internships, cooperation in the field of scientific research and attendance in conferences and seminars.
	17.9	Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North–South, South–South and triangular cooperation	
	17.17	Encourage and promote effective public, public–private and civil society partnerships, building on the experience and resourcing strategies of partnerships	
	17.18	By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	

Since this project has a strong educational component, where teachers and educators from many different fields, as well as students from different grades, were involved and challenged to participate in it, the connection to the SDG 4—Quality Education—is obvious. Yet, when the definition of SDG took place in 2015, 10 targets were designed for this specific goal, and only one of them is addressed within this project (SDG 14—Life Below Water). Although this result may seem odd at a first glance, once the targets are run through, it becomes obvious that most of the targets of SDG 4 focus on actions of formal education, rather than non-formal ones. Here, education is seen as a basic need fundamental to achieving sustainable development [49], one of the focuses of the members of the UN. Ensuring free, equitable and quality primary and secondary education, as well as superior education for everyone in the world is a priority, especially for developing countries.

Despite this, ocean literacy is extremely important to achieve sustainable development. Even if some of the topics regarding the ocean and marine ecosystems are taught in classrooms relying on traditional instructional methods, ocean literacy is not commonly included in common teaching practices [8]. In addition to this, ocean literacy programs are often considered non-formal education—like EmBio project—based on new methodologies, outside of classrooms, that seek changes in individual behaviors of children and adults. Proper ocean literacy can lead, in fact, to individual behaviors that are crucial to promoting conservation of marine and coastal environments and only when everyone understands the vital role of the ocean, can restoration and preservation efforts be made [58].

Contributing to Sustainable Cities and Communities (SDG 11) and dealing with Climate Change (SDG 13) are also important goals that deserve special attention when it comes to ocean literacy, particularly the last one, considering the ocean plays a crucial role

when it comes to climate change mitigation. It is well known that urbanization and human activities have brought huge challenges to natural ecosystems and accurate strategies to reverse or minimize these pressures are necessary, especially in a place with a large coastal area, like Portugal. Not only can ocean literacy promote the protection of natural heritage through community involvement and mobilization, but it can also lead to the development of programs that seek the resilience of communities regarding environmental risks and climate change.

Even though ocean literacy answers to several of SDGs and the respective targets, SDG 14 and 15 are, without a doubt, the ones that require the most attention and that is no surprise. EmBio is a research project that focuses highly on the protection of the environment and the promotion of efficient usage of natural resources, focusing on areas with high coastal and marine biodiversity. Looking at the premise of SDG 14, which is conserving and guaranteeing the sustainable use of the oceans, seas and marine resources, the connections between this goal and the case-study of this research are obvious and can be enhanced by some of the project numbers. During the project period, it was possible to reach more than 10,000 students and 60 teachers in the 18 schools where the exhibition was displayed and, besides that, around 1800 guided visits to the exhibition were conducted, with students of all ages. Additionally, more than 1000 people participated in the awareness campaigns and the social media platforms had more than 1500 followers (Figure A7). Although these numbers do not represent a direct link with the SDGs, they are important to evaluate the effectiveness of this project, as well as the role of ocean literacy in behavior changes. As more people are reached, the awareness increases, and the chances of management policy implementation are also bigger.

Although the study area focuses on marine environments, coastal areas also play a vital role in EmBio research project and ocean literacy in general, as these ecosystems are rich in biodiversity. However, because of that, coastal areas are extremely vulnerable to human pressures and climate change, which can lead to ecosystem destruction and biodiversity loss. Coastal areas are included in the SDG 15, which aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss. Ocean literacy becomes, in this sense, a fundamental tool to achieve this goal, as shown in Table 2.

To accomplish sustainable development, a stronger commitment to partnership and cooperation between different countries of the world is necessary and, to achieve this, coherent policies are needed. So, the SDG 17 was created to improve cooperation between developed countries and developing ones. Even though ocean literacy does not necessarily contribute directly to this purpose, the EmBio research project allowed some collaborations with developing countries, namely Brazil and Cape Verde, to promote and boost the replication of the project in these countries. EmBio became, as such, an example of how a project can contribute and lead to partnerships and can help improving sustainability and promote peaceful and inclusive societies.

Due to the nature of this project, not every SDG is fulfilled in the same way, even if all SDGs have the same weight and importance to achieve sustainability. In Table 3, it is possible to understand, in a summarized way, which are the SDGs aligned with the overall EmBio project, as well as the level of contribution to each of them (strong, average and weak) and the main issues covered. The more direct connection the project has with the targets, the stronger the contribution to the respective SDGs, as shown in the table below.

Table 3. Level of contribute of the project to each SDGs and the main issues covered.

SDG	Contribute	Main Issues Covered
4—Quality education	••	- School community involvement - Citizens training and empowerment - Youth engagement

Table 3. Cont.

SDG	Contribute	Main Issues Covered
5—Gender Equality	•	- Gender non-discriminations
8—Decent Work and Economic Growth	•	- Promotion of traditional fishing economies - Sustainable economy growth
10—Reduced Inequalities	•	- Social inclusion
11—Sustainable Cities and Communities	••	- Promotion of efficient usage of resources - Promotion of partnerships between different government bodies, Community engagement - Circular economy - Promotion of local products - Culture and history preservation
12—Responsible Consumption and Production	•	- Sustainable consumption of endangered fish species - Promotion of local products
13—Climate Action	••	- Community awareness - Mitigation and adaptation strategies - Climate change education
14—Life Below Water	•••	- Sustainable behaviors - Environmental knowledge and practices - Promotion of environmental awareness - Promotion of ocean literacy - Marine ecosystem conservation - Marine pollution control
15—Life on Land	••	- Coastal ecosystem conservation - Environmental knowledge and practices
16—Peace, Justice and Strong Institutions	•	- Information dissemination and accessibility
17—Partnerships for the Goals	•	- Partnerships with developing countries - Partnerships between local organizations

••• Strong alignment •• Average alignment • Weak alignment.

The products, materials and actions developed under the scope of Ambassadors for Biodiversity project cover a great deal of the targets of the SDGs established by the United Nations. Even though the level of commitment to them is different (and should be highlighted), the issues covered in each SDGs are important and relevant in their own way. Ocean literacy does not necessarily address all SDGs, but, due to the multidisciplinary approach of this case-study, it was possible to prove that many can be achieved, contributing to sustainability in local communities.

As seen in the previous table, regarding gender equality (SDG 5) or peace, justice and strong institutions (SDG 16), for example, as relevant as these SDGs are at an international level for human development, especially in developing countries, for the scope of this project, they are not necessarily addressed in the same way as SDG 14—Life Below Water. The same applies to Decent Work and Economic Growth, Reduced Inequalities, Responsible Consumption and Production and Partnerships for the Goals (SDGs 8, 10, 12 and 17).

However, some goals, such as Sustainable Cities and Communities, Climate Action and Life on Land (SDGs 11, 13 and 15) which are very important to some municipalities' policy agendas, especially in developed countries, were covered averagely with this project. Despite SDGs being global objectives, one of the political priorities in most of the developed countries is to ensure that the SDGs are being covered at the local level. In this way, the lives of the citizens and the community are directly impacted, and local organizations start to become committed to these common goals.

4. Conclusions

In recent years, ocean literacy has gained more recognition among all society sectors, namely industries, policymakers, researchers and common citizens. Not only can ocean literacy lead to economic growth, but it can also contribute to the ocean and marine environment preservation. Therefore, ocean literacy projects like Ambassadors for Biodiversity are extremely important as citizens can improve their knowledge regarding the ocean and marine resources management. Nevertheless, this kind of project must be based on a broader strategy, with well-defined goals and objectives. The Sustainable Development Goals are key to designing and conducting a project like the one presented here, contributing to fulfilling the targets defined by them at a local level. Thus, it is also essential to evaluate projects, namely identifying their affinity to the SDGs.

As is shown in the results and discussion section, the SDG 14—Life Below Water—is the one that has the most targets addressed by the EmBio research project. As an ocean literacy project that aims for the protection and conservation of marine and natural ecosystems, this result is not unexpected. Besides this, the project addresses four targets in both the SDG 13 and 15, which are goals that have a direct connection with the project. Additionally, considering the project has a strong element of collaboration and partnership with several institutions and organizations, also four targets of the SDG 17 are addressed by the project.

EmBio research project had the main goal to achieve the protection and preservation of the natural features of the two municipalities through the knowledge, awareness and accountability of the values and vulnerabilities of local communities. That is why certain types of actions were carried out, seeking to reach the whole community and the several formal and informal groups that integrate it. With the motto “know to preserve”, the educational component of the overall project, with a hands-on approach and valuing direct application on the ground, was the effective way to achieve the desired outcomes. The feedback received from the local population and the different specific stakeholders of this project was also important to testify to the effective involvement and appropriation of the project.

To conclude, since the implementation of the SDGs in 2015, a lot of actions and projects have been developed in order to contribute to the 2030 Agenda, that encompasses all dimensions of sustainable development. However, there has been almost no recognition regarding these projects and few people know about what is happening in this matter. For that reason, this paper contributes to understanding how ocean literacy, and specifically the EmBio research project, fits into the international agenda for sustainable development and the SDGs and their targets at the local level. However, more studies like this should be developed to understand the importance and how the SDGs are being interpreted by the international community and how they are being accomplished.

Author Contributions: Conceptualization, J.C.F., L.V., R.M. and F.F.; Data curation, R.M. and C.M.D.; Formal analysis, J.C.F., R.M. and F.Z.S.; Funding acquisition, J.C.F.; Investigation, J.C.F., R.M., F.Z.S. and C.M.D.; Methodology, J.C.F., L.V., R.M. and F.F.; Supervision, J.C.F. and F.Z.S.; Validation, J.C.F., L.V., R.M. and C.M.D.; Visualization, J.C.F., F.Z.S. and C.M.D.; Writing—original draft, J.C.F., R.M. and C.M.D.; Writing—review & editing, J.C.F., L.V., R.M. and F.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research is funded by Fundação para a Ciência e a Tecnologia, with granted number of UIDB/04292/2020 and by PO SEUR-Operational Programme for Sustainability and Efficient Use of Resources—granted number EMBIO-POSEUR-03-2215-FC-000020 (European Commission Structural and Investment Funds/Portugal2020 Strategy). The research team thanks the Municipality of Torres Vedras and the Municipality of Lourinhã for their excellent collaboration, research support and funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A



Figure A1. Itinerant Exhibition “Biodiversity–Knowing to Preserve the Coastline of Torres Vedras and Lourinhã” in a school.



Figure A2. Itinerant Exhibition “Biodiversity–Knowing to Preserve the Coastline of Torres Vedras and Lourinhã” in the regional shopping center.



Figure A3. (a) Guide of educational activities and (b) contents book.



Figure A4. Theoretical classes of the training session for teachers and educators in an auditorium (a) and class room (b).



Figure A5. Field trip as part of training session for teachers and educators.



Figure A6. Awareness and action campaigns in Torres Vedras (a) and Lourinhã (b).

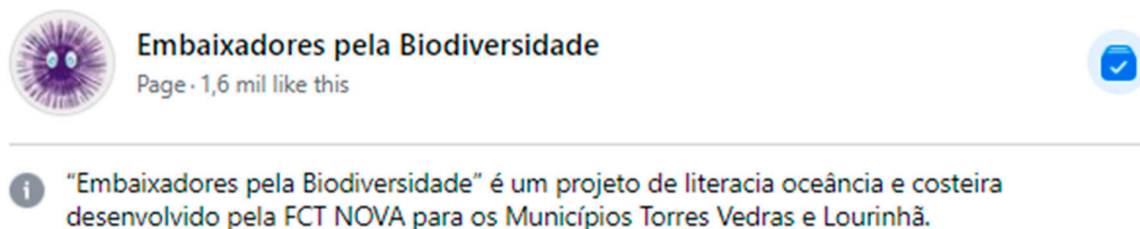


Figure A7. Social media platforms (Facebook) with 1600 followers.

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