Υβριδικό Πανεπιστήμιο ΑΣΤΕΡΟΥΣΙΩΝ 2022

Θαλάσσιος Εγγραμματισμός και Αποθέματα Βιόσφαιρας

12 -14 ΣΕΠΤΕΜΒΙΟΥ 2022
ΚΡΗΤΗ

Θαλάσσιος (εγ)γραμματισμός και σχετικές δράσεις στη Μεσόγειο
Γιολάντα Κουλούρη, Κύρια Ερευνήτρια ΕΛΚΕΘΕ

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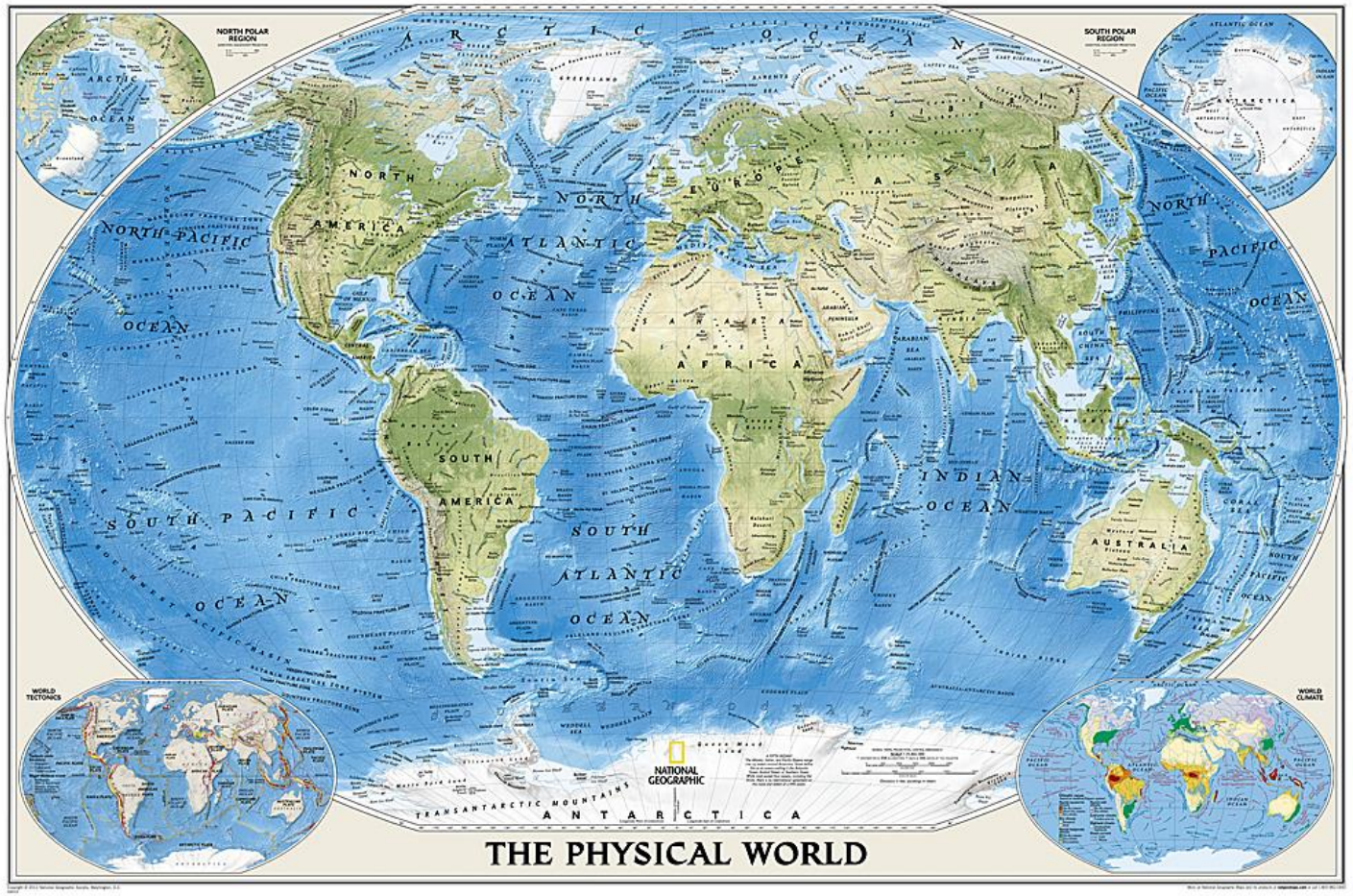
ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ UNIVERSITY OF CRETE

ΣΥΝΔΕΣΜΟΣ ΠΡΟΣΤΑΣΙΑΣ ΑΣΤΕΡΟΥΣΙΩΝ

Αναπτυξιακή Ηρακλείου

REGION OF CRETE ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ

MIO-ECSDE MEdIES The Mediterranean Education Initiative for Environment & Sustainability



"Πόσο άστοχο είναι να αποκαλούμε αυτόν τον πλανήτη Γη, ενώ είναι εντελώς ξεκάθαρο ότι είναι Ωκεανός"

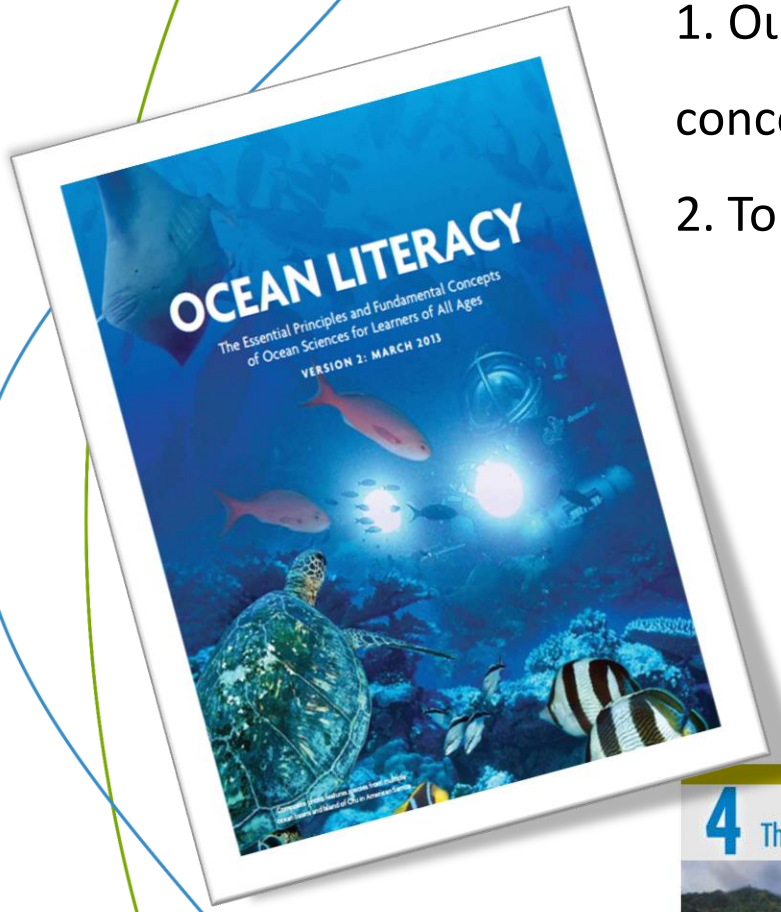
Arthur Clarke, 1917-2008
(Βρετανός συγγραφέας)

Θαλάσσια εκπαίδευση-Θαλάσσιος (Εγ)γραμματισμός

- Η έννοια ενός τύπου εκπαίδευσης για τον υδάτινο κόσμο και η αναγκαιότητα της είχαν αναγνωριστεί από νωρίς (δεκαετία του ’70 περίοδος οριοθέτησης και εγκαθίδρυσης της Περιβαλλοντικής Εκπαίδευσης).
- Μία νέα προσέγγισή ενός τύπου εκπαίδευσης για το υδάτινο περιβάλλον αναδύθηκε τη χρονιά που δημοσιεύτηκαν στις ΗΠΑ τα National Science Education Standards (1996).

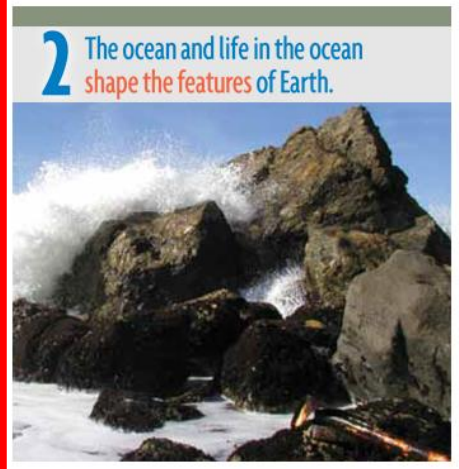
COSEE
Sea Grant
NOAA
NSF
NATIONAL GEOGRAPHIC
NMEA
ASSOCIATION OF ZOOS & AQUARIUMS
COLLEGE OF EXPLORATION

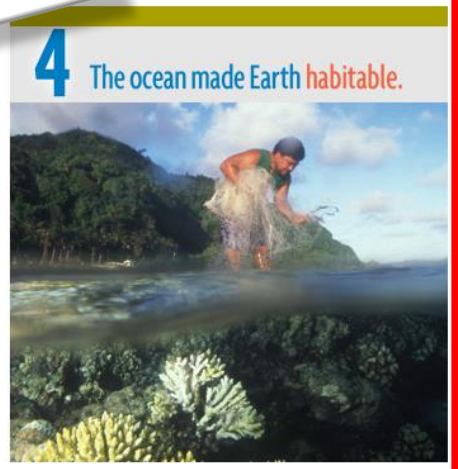
Ocean Literacy Framework (Θεωρητικό πλαίσιο του θαλάσσιου (εγ)γραμματισμού):

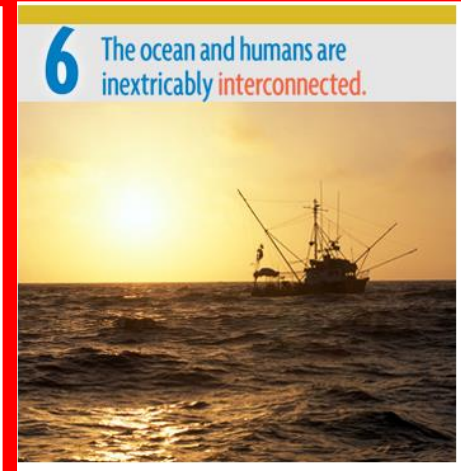


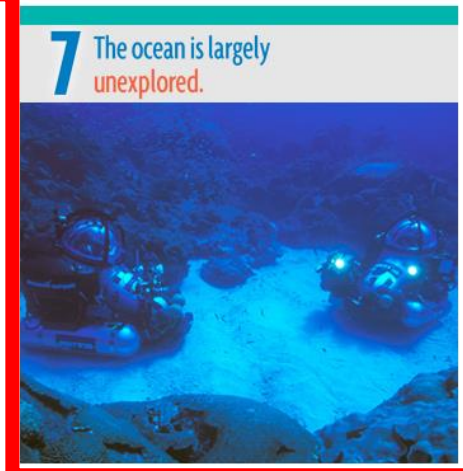
1. Οι 7 βασικές αρχές (essential principles) και 45 θεμελιώδεις έννοιες (fundamental concepts) των θαλάσσιων επιστημών

2. Το πλαίσιο Εφαρμογής (Scope & Sequence) του θαλάσσιου (εγ)γραμματισμού



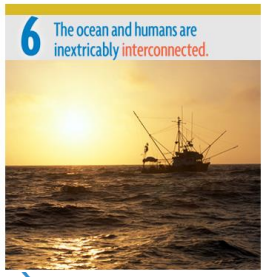






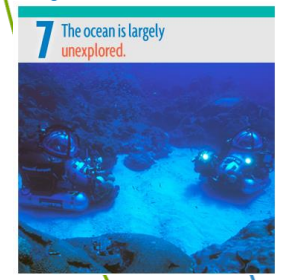
1.8 Although the ocean is large, it is finite and resources are limited.

5.3 Most of the major groups that exist on Earth are found exclusively in the ocean and the diversity of major groups of organisms is much greater in the ocean than on land.



6.2 The ocean provides foods, medicines, and mineral and energy resources. It supports jobs and national economies, serves as a highway for transportation of goods and people, and plays a role in national security.

6.7 Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.



7.3 Over the last 50 years, use of ocean resources has increased significantly, the future sustainability of ocean resources depends on our understanding of those resources and their potential.

Towards achievement of the Sustainable Development Goal 14 “Life below water” and United Nations Decade of Ocean Science for Sustainable Development

United Nations Educational, Scientific and Cultural Organization · Sustainable Development Goals

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

<u>EuroGOOS, UN Decade Action Programme:</u>
The “Scientists for Ocean Literacy” aims to inspire scientists to work closer with public and educators, embrace the diversity of disciplines linked to our ocean and inclusiveness in knowledge and innovation.

The Science We Need for the Mediterranean Sea We Want **<u>(SciNMeet) Programme (IOC)</u>** will address major Mediterranean challenges and gaps in scientific knowledge with the aim to better understand and manage anthropogenic impacts, and marine hazards on the marine environment to contribute to maintenance of ecosystems' functioning and the sustainability of relevant economic operations.

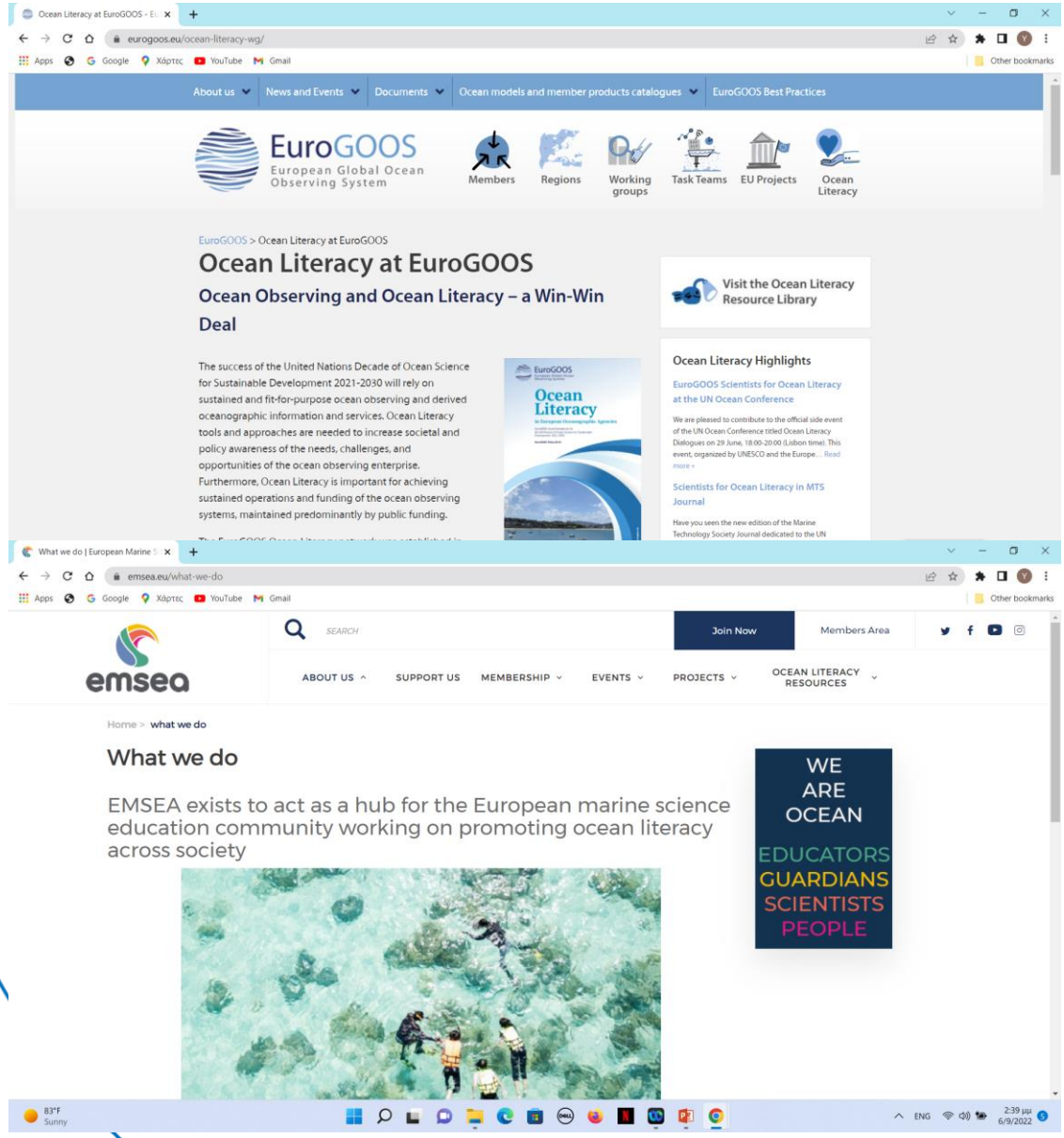
The European Ocean Coalition connects diverse organisations, projects and people that contribute to ocean literacy and the sustainable management of the ocean. Supported by the European Commission, this bottom-up inclusive initiative comprises of:

1. EU4Ocean Platform

2. Youth4Ocean Forum

3. Network of European Blue Schools

Ocean Literacy initiatives at European and Mediterranean level



Mediterranean Sea Literacy (MSL)

A guide, based on the OL framework and adapted to the specificities of the Mediterranean Sea region

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.23400

Mediterranean Sea Literacy: When Ocean Literacy becomes region-specific

Melita MOKOS[1], Maria TH. CHEIMONOPOULOU[2], Panayota KOULOURI[3], Monica PREVIATI[4], Giulia REALDON[5], Francesca SANTORO[6], Athanasios MOGIAS[7], Theodora BOUBONARI[7], Manel GAZO[8], Alessio SATTA[9], Christos IOAKEIMIDIS[10], Alba TOJEIRO[8], Carla A. CHICOTE[8], Martha PAPATHANASSIOU[10] and Theodoros KEVREKIDIS[7]

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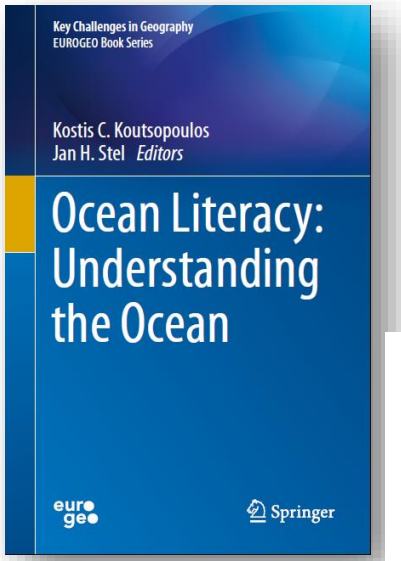


Mokos *et al.*, 2020. *Mediterranean Marine Science*, 21 (3), 592–598.

emsea

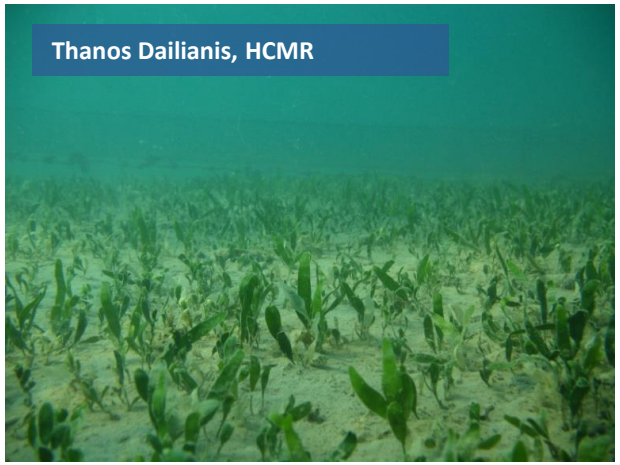
MIO-ECSDE

Applications

The Importance of Ocean Literacy in the Mediterranean Region—Steps Towards Blue Sustainability 197
Melita Mokos, Maria Cheimonopoulou, Panayota Koulouri, Monica Previati, Giulia Realdon, Francesca Santoro, Athanasios Mogias, Theodora Boubonari, Alessio Satta, and Christos Ioakeimidis

Mediterranean Sea Literacy (MSL)

ML1-G: *The Mediterranean Sea is finite and its resources are limited….along with the presence of approximately 250 million people living along its coasts, makes the Mediterranean vulnerable to pollution and over-exploitation of natural resources.*



ML5-B: *The Mediterranean Sea is characterized by extremely high species diversity and endemism, due …. In general, a west-east impoverishment of species diversity, abundance, and biomass is observed …*

ML6-B: *The Mediterranean Sea provides food, medicines, minerals, and energy resources. The Mediterranean diet is acknowledged as a healthy combination of land and seafood in this region…*

Mediterranean Sea Literacy (MSL)

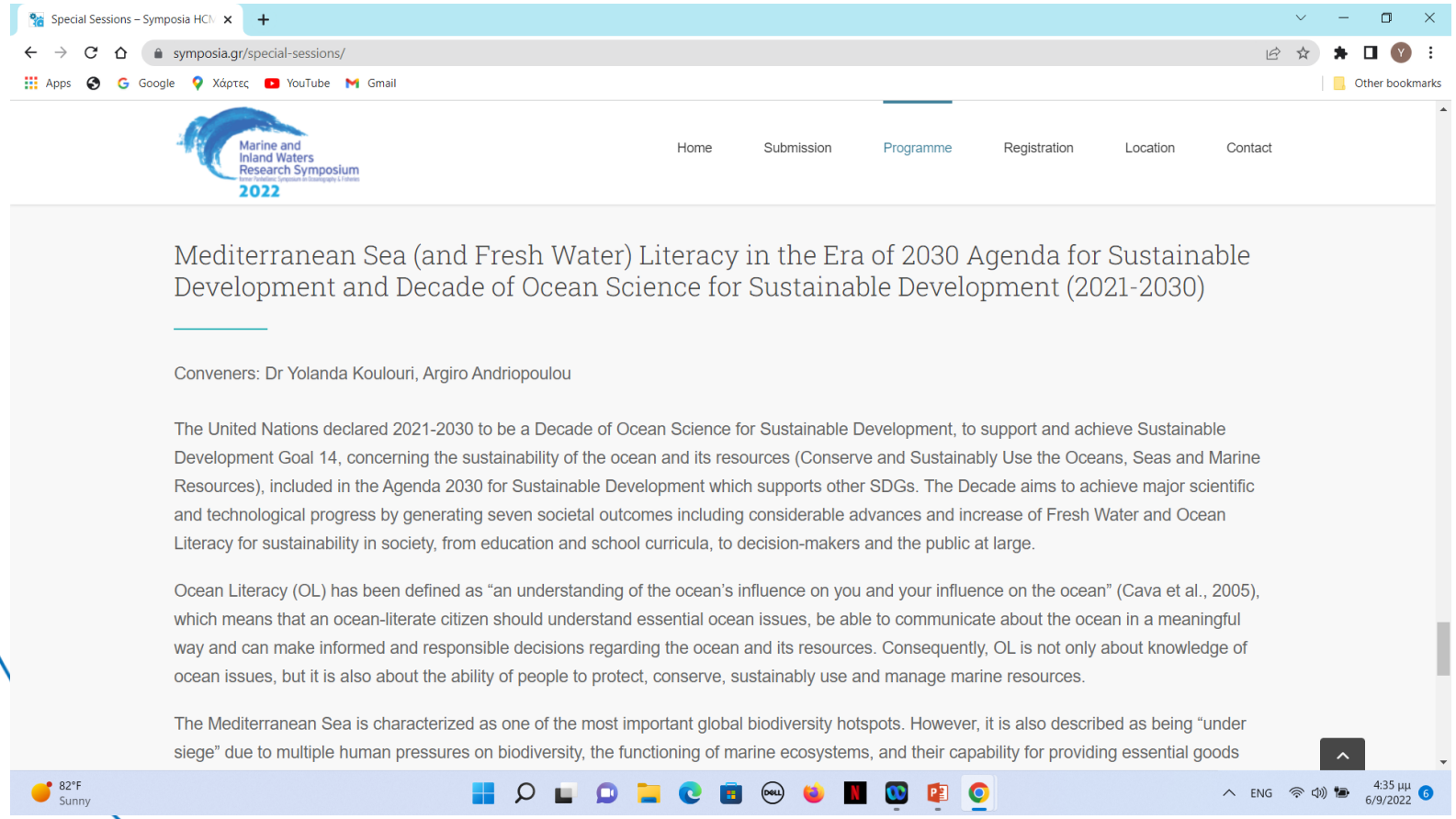
ML6-D: *The Mediterranean Sea is affected ….Major human impacts are made by marine pollution … (marine litter, eutrophication, etc.), overfishing, over-exploitation of other marine biological resources …*

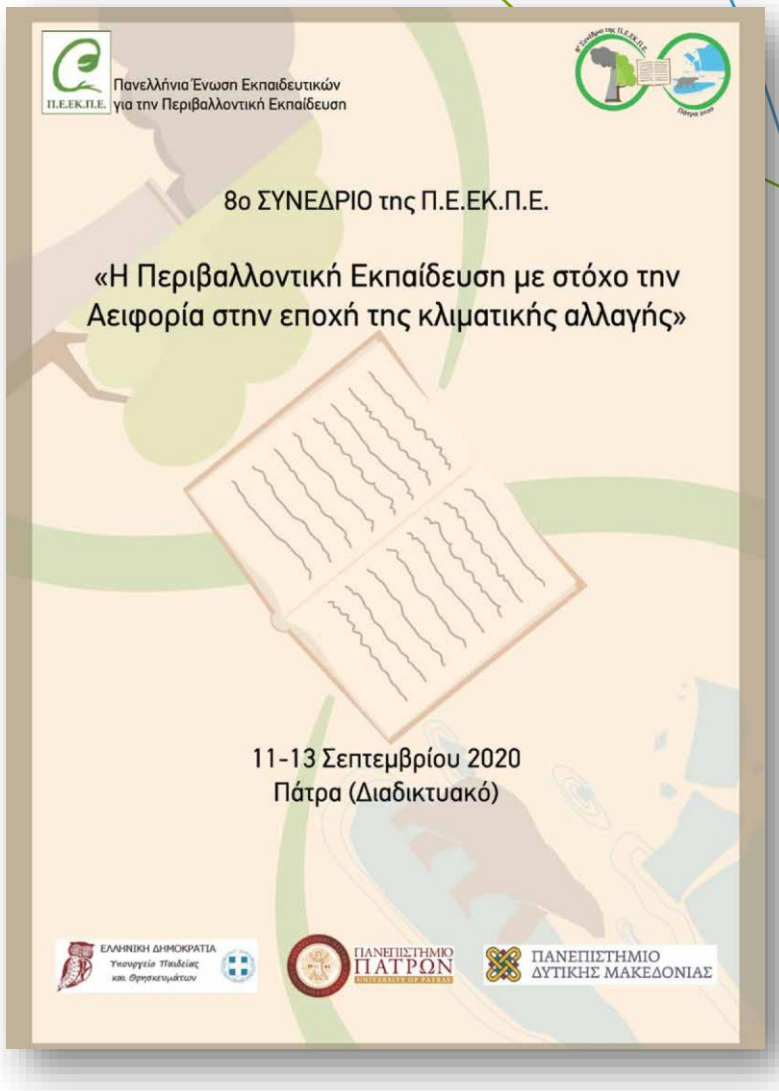
ML7-B:... *Only by knowing the Mediterranean Sea in depth, it is possible to protect it and sustain its resources for the future.*

ML7-C: *While resources in the Mediterranean Sea have been significantly decreasing during the last 50 years, fully protected areas currently cover only 0.04% of its total area. Mediterranean resources are limited and must be protected …*

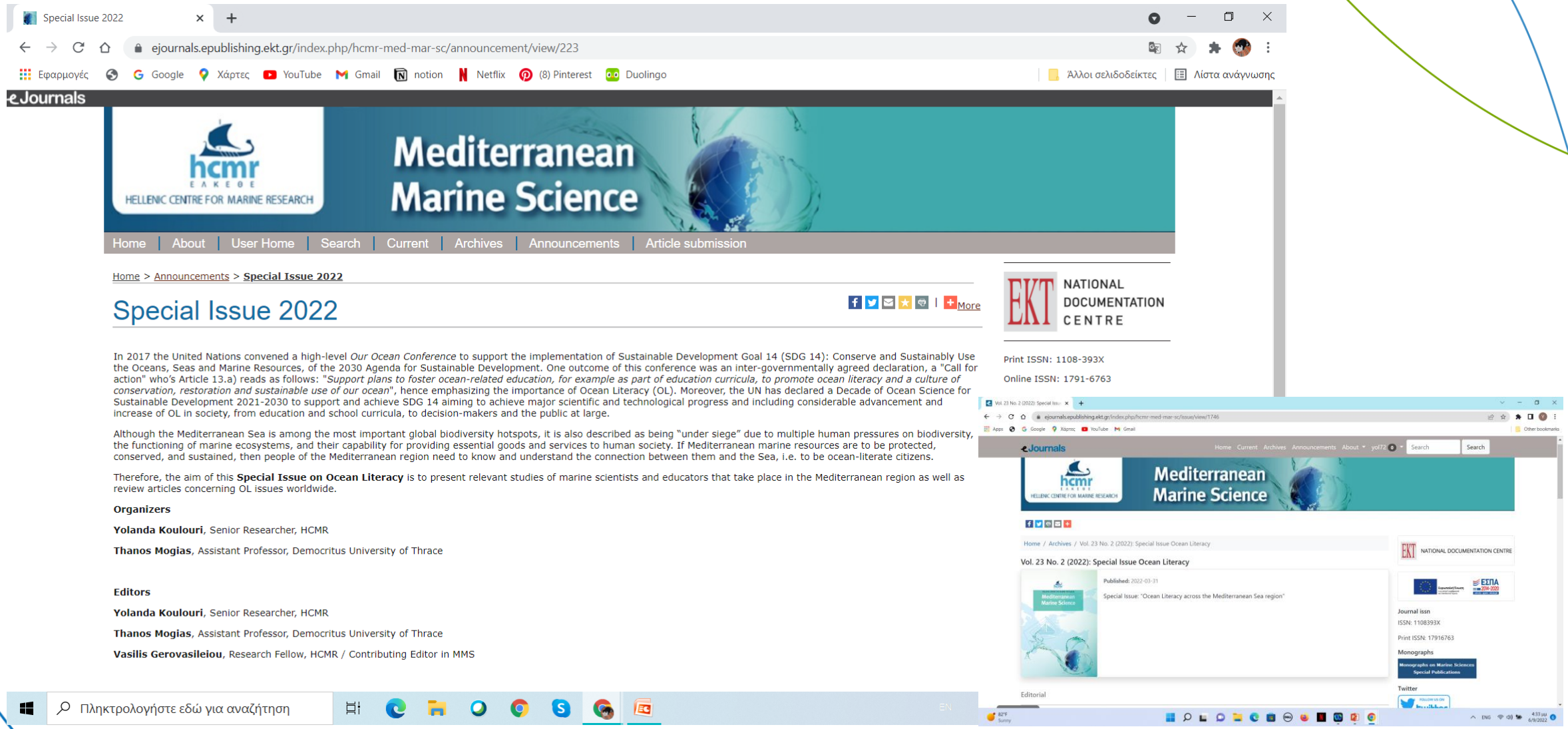
Organization of special sessions to several Pan-Hellenic conferences with focus on the OL framework:

- Environmental Education Conference (September 2021)
- Marine and Inland Waters Research Symposium September (2022)





Special Issue on Ocean Literacy of Mediterranean Sea region at Mediterranean Marine Science Journal



frontiers in Marine Science

ORIGINAL RESEARCH
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doi: 10.3389/fmars.2019.00396

Evaluating Ocean Literacy of Elementary School Students: Preliminary Results of a Cross-Cultural Study in the Mediterranean Region

Athanasios Mogias[1], Theodora Boubonari[1], Giulia Realdon[2], Monica Previati[3], Melita Mokos[4], Panayota Koulouri[5] and Maria Th. Cheimonopoulou[6]*

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A good understanding of the role and function of the ocean seems to be of paramount importance in recent years, constituting the basic tool for the promotion of healthy and sustainable marine environment, and a target area of the 2030 Agenda for Sustainable Development. In this study, the content knowledge of elementary school students (grades 3–6) in regards to ocean sciences issues was examined. A structured questionnaire was administered to 1004 students participating in a cross-cultural study from three Mediterranean countries (Italy, Croatia, and Greece). The results of the study indicated a rather moderate level of knowledge in the total sample, while slight differences were recorded among the three countries revealing common knowledge gains and misconceptions. Rasch analysis was applied to further evaluate the validity of the results, while the influence of certain demographics on students' knowledge level was also investigated. This study concludes with a discussion of the implications on national curriculum development in elementary education level, in order to promote ocean literacy and to ensure protection and conservation of the Mediterranean Sea.

Keywords: ocean literacy, marine science education, elementary school students, content knowledge, cross-cultural study, Mediterranean region

INTRODUCTION

The ocean is the main physical characteristic that defines our planet making the Earth habitable. It covers over 70% of the Earth's surface, produces more than 50% of the oxygen in the atmosphere, regulates weather and climate, supports a great diversity of life and provides food available for people all over our planet (Cava et al., 2005). Despite its role as a part of the Earth's system and its value for human society, the ocean has shown severe signs of change as a result of human activities. Decades of intensive exploitation of marine resources, pollution, coastal urbanization and climate change have led to degradation and even destruction of marine ecosystems, resulting

Ocean Literacy issues (based on OL framework)

Elementary school students (grades 3-6)

3 Mediterranean countries

FIGURE 1 | Sampling locations of the three Mediterranean countries participating in the study.

Mogias *et al.*, 2019. *Frontiers in Marine Science*, 6, 396.

Research Article

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
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DOI: http://doi.org/10.12681/mms.26797

Contribution to the Special Issue: "Ocean Literacy across the Mediterranean Sea region"

Ocean Literacy across the Mediterranean Sea basin: Evaluating Middle School Students' Knowledge, Attitudes, and Behaviour towards Ocean Sciences Issues

Panayota KOULOURI[1], Athanasios MOGIAS[2], Melita MOKOS[3], Maria CHEIMONOPOULOU[4], Giulia REALDON[5], Theodora BOUBONARI[2], Monica PREVIATI[6], Alba TOJEIRO FORMOSO[7], Ahmet Erkan KIDEYS[8], Mohamed Aly HASSAAN[9], Patrizia PATTI[10], Kostas KORFIATIS[11], Sandra FABRIS[12] and Xavier JUAN[13]

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Disclaimer: The views and opinions of Maria CHEIMONOPOULOU
in this article are her own and do not necessarily reflect those of her institution

Abstract

The Mediterranean Sea is characterized by rich biodiversity, and its region hosts people living in several countries with a rich variety of cultures, but – at the same time – it is "under siege", due to anthropogenic pressures. To address these pressures, many actions are needed aiming, among others, at establishing Ocean Literacy (OL) across the Mediterranean countries and preparing the future generation of Mediterranean Sea-literate citizens. Towards this aim, the present cross-national study investigated OL issues in relation to content knowledge, possible common misconceptions, attitudes, and the self-reported behaviour of 2,533 middle school students from eight Mediterranean countries (Croatia, Cyprus, Egypt, Greece, Italy, Malta, Spain and Turkey), as well as certain background elements (e.g., gender, grade level, environmental education experience, sources of relevant information). The results of this study revealed that middle school students of all studied countries possess a moderate level of ocean sciences content knowledge, while they showed satisfactory pro-environmental attitudes and behaviour. These findings along with further research are expected to function as a baseline for the design, implementation, and launch of specifically targeted programmes, educational activities, teaching resources, curricula and school textbooks, which will be achieved through close collaboration between schools, universities, research institutes, and Ministries of Education, thus contributing to the future protection and sustainable development of the Mediterranean Sea region.

Keywords: Ocean Literacy; cross-national study; content knowledge; environmental attitudes; environmental behaviour; middle school students; environmental education; Mediterranean region.

- **Ocean Literacy issues (based on OL framework)**
- **Middle school students**
- **8 Mediterranean countries**

Koulouri *et al.*, 2022. *Mediterranean Marine Science*, 23 (2), 266–269.

Research Article

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Contribution to the Special Issue: "Ocean Literacy across the Mediterranean Sea region"

Implementation of a new research tool for evaluating Mediterranean Sea Literacy (MSL) of high school students: A pilot study

Maria Th. CHEIMONOPOULOU[1], Panayota KOULOURI[2], Monica PREVIATI[3], Giulia REALDON[4], Melita MOKOS[5] and Athanasios MOGIAS[6]

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Abstract

The Mediterranean Sea is recognized as a key component in the development, economy, and culture of European, North African, and Middle East countries. With respect to heterogeneity across the region in different sectors, Ocean Literacy, though still in its infancy, is nevertheless a requisite for a better understanding of the two-way interaction between the Sea and its people. In the present study, marine issues in relation to the content knowledge of 154 high school students from the Mediterranean region were investigated by using a structured questionnaire based on the recently published Mediterranean Sea Literacy guide. Data analysis involved descriptive statistics to portray frequencies and knowledge scores of the participants, and inferential statistics to assess the effects of grade level on students' knowledge. The study which focused for the first time on the unique features of the Mediterranean marine ecosystems, found the level of content knowledge of the participants to be low to moderate. It is therefore of the utmost importance for the organizations and networks working on marine issues in the Mediterranean Sea to develop synergies and coordinate research programmes to broaden engagement with human societies in the region.

Keywords: Ocean Literacy; Mediterranean Sea Literacy; content knowledge; high school students; environmental education; Mediterranean region.

Introduction

The global framework of the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) has been launched recently to offer support for ocean science issues and societal challenges, underpinning at the same time the global Agenda 2030 (Ryabinin *et al*., 2019). In this context, the Mediterranean Sea is recognized as a key component in the development, economy, and culture of European, North African, and Middle East countries as well as an agent for the "transformative change" needed to achieve a sustainable future in this region (Cappelletto *et al*., 2021).

Ocean Literacy (OL), defined as the understanding of the ocean's influence on human beings and their influence on the ocean (Cava *et al*., 2005), is essential not only for bringing knowledge of marine science to society but also for inspiring marine scientists to provide acceptable and workable solutions for sustainable development and bridging the gaps among the relevant stakeholders, users and actors in different economic and cultural sectors (Cappelletto *et al*., 2021; Kelly *et al*., 2021). With respect to the heterogeneity among European, Asian and African countries all over the Mediterranean Sea region in different sectors (e.g., state of development, accessibility to education), research on OL is still in its infancy, existing

- **Mediterranean Sea Literacy issues**
- **89 high school students (16-17 years old)**
- **Italy - Greece**

a) **"difficult words":** semi-enclosed sea, precipitation, rivers run-off, submarine canyons, lacustrine formation, abiotic variables, types of winds, endemism, phanerogams, gastropods, gorgonians, benthic beds, mangrove swamps, intertidal and sublittoral reefs, calcareous algae, rhodoliths, non-indigenous species, nursery areas, citizen science

b) Mean **knowledge** score of **43%** (~13 correct answers out of 30 questions)

Cheimonopoulou *et al*., 2022. *Mediterranean Marine Science*, 23 (2), 302–309.

CAN MARINE SCIENCES STUDENTS SUPPORT THE OCEAN LITERACY FRAMEWORK? A PILOT STUDY FROM GREECE

HydroMediT 2021

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Abstract

The present pilot study aims at evaluating knowledge, attitudes, and behaviour (3-scale questionnaire) concerning ocean issues in relation to university students (106) in Greece. Marine Sciences students were found to have better knowledge, pro-environmental attitudes and behaviour in relation to the Primary Education ones. Low to moderate knowledge scores reveal the need for integration of relevant concepts, and further education research on Ocean Literacy (OL) issues to ensure the sustainability of the ocean.

Introduction

Sustainable Development Goal 14 (sustainability of the ocean and its resources) can be achieved, by increasing societal awareness of Ocean Literacy (OL) (Eparkhina et al, 2021). The OL framework, consisting of 7 essential principles and 45 fundamental concepts, is now accepted worldwide for use in education settings: this is an invaluable support for citizens to obtain sound knowledge of ocean issues, enabling them to communicate about ocean issues and make informed and responsible decisions (Cava et al., 2005).

Methodology

- Pilot study: university students of Marine Sciences (n=37 of 1st year and n=34 of 3rd, 4th) & Primary Education (n=35) Departments.
- A 3-scale questionnaire (knowledge, attitudes, and behaviour): Ocean Literacy framework (NMEA, 2010; NOAA, 2013; Mogias et al., 2015; 2019; Fauville et al, 2018).
- The normality (Kolmogorov-Smirnov and Shapiro-Wilk tests) and reliability (Cronbach α index) for all scales were checked.

Results & Discussion

- Results of the pilot study showed an interesting pattern in the correct answers, regarding the most difficult and the easiest questions, in line with other findings from the existing literature (e.g., Mogias et al., 2015; 2019).
- The majority of all students regarding
  1. Knowledge: seem to be unaware of ocean issues (e.g. connectedness of the ocean basins, the origin of atmospheric oxygen)
  2. Attitudes: believe that fragile marine ecosystems will be lost if humans do not change their behaviour towards the ocean.
  3. Behaviour: collect their garbage when they spend time on the beach and they recycle plastic.
- The slight increase of Ocean Literacy in all scales of the Marine Sciences students and the low knowledge scores of Primary Education students, point up the need to integrate relevant concepts (e.g., development of OL tools; Brennan et al., 2019) and investigate in-depth OL issues in formal education.

Fig. 1. Mean knowledge, attitudes, and behaviour values of the total sample of participants

Fig. 2. Mean knowledge, attitudes, and behaviour values of the Marine Sciences students on the basis of the year of enrollment

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- Ocean Literacy issues (based on framework)
- University students
  - ✓ Pre-service teachers (future teachers)
  - ✓ Future oceanographers

Koulouri *et al.*, 2021. *9th EuroGOOS International Conference, 3th-5th May 2021, virtual* .

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Article

A Pilot Survey Investigating *Naturoid* Reefs as a Tool for Sustainable Marine Ecotourism

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Abstract: Recreational SCUBA diving is currently a nature-based USD multibillion tourism industry across the globe. However, degradation of many recreational diving destinations all over the world due to "soft" ecotourists necessitates the adoption of innovative management measures. Hellenic Centre for Marine Research (HCMR) developed an innovative technology for the creation of artificial underwater ecotourism attractions ("oases") to divert visitors away from sensitive marine natural areas of high ecological and aesthetic value. This innovative technology includes specially constructed artificial reefs in an attempt to simulate the functional and morphological characteristics and the aesthetics of the natural rocky reefs. In this study, a pilot survey was conducted in three diving centres of Crete Island, one of the most important tourist destinations in the Mediterranean Sea, involving the participation of 144 SCUBA divers from all over the world. The survey aimed at investigating SCUBA divers' profiles and perceptions concerning recreational diving activities and artificial reefs technology. Findings of this study indicate that large naval shipwrecks combined with innovative man-fabricated constructions simulating natural rocky reefs meet the preferences of the majority of the participants of the survey and they can be used as an alternative tool for relevant marine ecotourism sustainable applications.

Keywords: artificial reefs technology; underwater artificial habitats; recreational diving parks; blue growth; environmental awareness

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1. Introduction

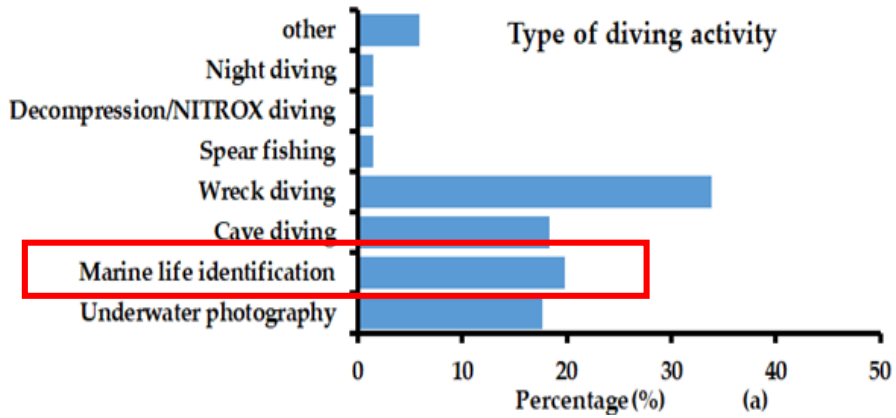
The Mediterranean Sea is one of the top tourist destinations in the world. According to the World Tourism Organization, more than 400 million tourists visited the Mediterranean in 2019 [1]. Coastal and maritime tourism, including recreational diving, are essential economic activities for many Mediterranean countries. Recreational diving, as an ecotourism product, contributes to: (a) the local economy of many tourist destinations; (b) the local differentiation and upgrade of the tourist product; (c) the extension of the tourist season depending on the destination; and (d) the entry into new markets, e.g., tourists seeking alternative types of leisure with a high level of recreational activity [2,3].

Today, this tourist "market" is dominated by people in a high-income group, who dive consciously and repeatedly into various international diving destinations belonging mostly to the group of "soft" ecotourists [4–6]. However, many recreational diving destinations all over the world have been degraded mainly due to unconscious (e.g., due to lack of knowledge) or accidental contacts with sensitive marine organisms and this cumulatively results in their injury or even their extinction [7–9]. An increasing body of literature has demonstrated that diving activities, mainly on frequently visited sites, can affect marine life detrimentally, particularly sensitive benthic organisms such as corals, sponges, bryozoans, and gorgonians [10–12]. As tourism activities in coastal areas continue to increase, SCUBA

Table 1. Importance of the listed reasons for the participants' diving activities.

Reasons	Mean ± SD
For family recreation	3.51 ± 1.29
To learn more about the marine environment	4.11 ± 0.79
To look at fish and other marine life	4.49 ± 0.63
To experience adventure and excitement	4.32 ± 0.94
To identify marine organisms	4.03 ± 0.94
To experience underwater tranquillity	4.29 ± 0.92
To be with friends	4.33 ± 1.08
For exercise	4.11 ± 1.24
To develop diving skills and abilities	4.45 ± 0.92

- **Marine Ecotourism**
- **Divers**
- **Artificial reefs**



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Greek Pre-Service Teachers' Knowledge, Attitudes, and Environmental Behavior Toward Marine Pollution

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Greek Pre-Service Teachers' Knowledge of Ocean Sciences Issues and Attitudes Toward Ocean Stewardship

Athanasios Mogias, Theodora Boubonari, Angelos Markos & Theodoros Kevrekidis

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INTERNATIONAL RESEARCH IN GEOGRAPHICAL AND ENVIRONMENTAL EDUCATION
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Examining the presence of ocean literacy principles in Greek primary school textbooks

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ABSTRACT
This study aims to add to the mapping of the presence of ocean sciences issues in national curricula and textbooks worldwide, investigating the inclusion of ocean literacy principles and their fundamental concepts in Greek primary science textbooks according to the Ocean Literacy Framework. Content analysis was implemented in both textual and pictorial material. The textbook analysis revealed that although all Ocean Literacy Principles are presented to some extent in the textbooks under study, most of their supporting fundamental concepts are absent for most of the principles. Only principles 1 and 6 are well represented, while principles 4 and 7 show the weakest appearance. The alignment of the principles and concepts in the textbooks with the Scope and Sequence of the Ocean Literacy Framework showed an apparent inconsistency, revealing that they are partially represented and superficially introduced. The implications of this study add to this mapping and aim to help curriculum designers and marine educators worldwide to cooperate for the inclusion of ocean literacy topics into the curricula which will potentially lead to students' improved knowledge about the marine environment and the enhancement of their ocean literacy and responsible environmental behavior concerning ocean conservation.

KEYWORDS
Content analysis; ocean conservation; ocean literacy; primary education; science textbooks

Introduction

Research consistently affirms the vital role of the ocean in maintaining the unity of our world, and, in addition, its ecological, social, and economic value (Costanza, 1999). To ensure sustainable use of ocean resources there is a need for responsible policies, regulations and management strategies (Mora et al., 2009), as well as individual responsible behavior by ocean-literate citizens who have some level of knowledge on ocean sciences topics, understand how attitudes and values impinge upon a topic and are empowered to take action around the topic (Strang, DeCharon, & Schoedinger, 2007). Ocean literacy has been defined as "an understanding of the

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Research Article

Contribution to the Special Issue: "Ocean Literacy across the Mediterranean Sea region"

Tracing the occurrence of ocean sciences issues in Greek secondary education textbooks

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Abstract

This study aims to investigate the presence of ocean sciences issues in Greek secondary education (grades 7-12) science textbooks, in respect of the Ocean Literacy Framework. Content analysis was undertaken concerning both textual and pictorial materials of the Biology, Chemistry, Physics, and Geography – Geology courses. Results revealed that the textbooks under study contain limited and fragmented information with regard to the seven essential principles of the Framework, while a comparison with the Ocean Literacy Scope & Sequence evidences inconsistencies. The suggestions arising from this study could help curriculum designers, textbook authors, marine educators, and marine scientists to cooperate on a wider scale towards the inclusion of ocean literacy topics into national curricula worldwide.

Keywords: Ocean Literacy; Science textbooks; Content analysis; Secondary education.

Introduction

Over the last decades, ocean literacy (OL) has been widely introduced as a powerful approach towards the design, development, and implementation of new agendas and regulations for the degradation of the marine environment. Many international and national initiatives have called for a more ocean-literate public, i.e., ocean-literate citizens who understand the importance of the ocean, can communicate about the ocean in a meaningful way, and are able to make informed and responsible decisions regarding the ocean and its resources (Schoedinger *et al.*, 2010; National Oceanic and Atmospheric Administration–NOAA, 2013). For example, the EurOCEAN Rome Declaration (EurOCEAN, 2014, p.1) promotes a wider awareness and understanding of the importance of the seas and oceans in the everyday lives of European citizens. Moreover, the Galway Statement for Atlantic Cooperation, signed by Canada, the United States, and the European Union, supports the sustainable development of the Atlantic Ocean by promoting OL (EU-CANADA-US Research Alliance, 2013). Towards this direction, the United Nations have recently declared a Decade of Ocean Science for Sustainable Development from 2021-2030, along with the Agenda 2030, comprising seventeen Sustainable Development Goals among which is Goal 14, "Life below Water", which concerns the sustainable development of oceans, and highlights the increase in students' need for a sustainability-centred education (UNESCO, 2017). In the same context, UNESCO launched the "Ocean Literacy for All" initiative, which aims to increase worldwide awareness regarding ocean conservation (Santoro *et al.*, 2017). Additionally, several international projects such as "ResponSEAble" and "SeaChange", underline the importance of connecting Europeans with the ocean through education.

The term "ocean literacy" has been defined as "an understanding of the ocean's influence on you, and your influence on the ocean" (Cava *et al.*, 2005). The development of the Ocean Literacy Framework (OLF) was the result of an extensive process of continuous meetings in the early 2000s. It consists of a guide that identifies the essential principles of OL underpinned by a series of fundamental concepts, which all students should understand by the end of high school (NOAA, 2013) (Table 1), and a more detailed Scope and Sequence for Grades K-12 (National Marine Educators Association–NMEA, 2010), which provides guidance as to what students need to comprehend at different grade bands from kindergarten to the end of high school. This theoretical framework, developed to help implement an ocean-dedicated curriculum in the USA, is now largely accepted worldwide.

Ocean Literacy can take place in both non-formal (e.g., museums, aquariums) and formal educational settings.

Results of Ocean Literacy research

- Οι μαθητές εμφανίζουν ελλιπείς γνώσεις σε βασικά ζητήματα Επιστημών της Θάλασσας αναδεικνύοντας τόσο τις έννοιες που δεν κατανοούν ή αγνοούν όσο και εκείνες που φαίνεται να γνωρίζουν σε κάποιον βαθμό.

- Η συμμετοχή σε ΠΠΕ και σε δράσεις ΜΚΟ φαίνεται να επηρεάζουν το επίπεδο του Θαλάσσιου Γραμματισμού των μαθητών.

- Οι περιορισμένες γνώσεις των μαθητών θα μπορούσαν να αποδοθούν στο γεγονός ότι θέματα του Θαλάσσιου Γραμματισμού δεν αποτελούν βασικό κομμάτι των Αναλυτικών Προγραμμάτων Σπουδών.

- Τα ενθαρρυντικά αποτελέσματα που προκύπτουν από τον βαθμό των φιλικών προς το θαλάσσιο περιβάλλον στάσεων και συμπεριφορών, τους καθιστούν εν δυνάμει δεκτικούς σε θέματα θαλάσσιου γραμματισμού, δημιουργώντας πολλές προοπτικές προς την κατεύθυνση της αειφόρου διαχείρισής του.

HCMR contribution to Ocean Literacy

- HCMR communicates the marine environmental issues with visitors at HCMR facilities and CretAquarium (20,000 students and 250,000 visitors per year) in Crete. The CretAquarium, located in Crete is a great tool to be used for disseminating OL to schools and the public at large.

- Erasmus+ projects (e.g. BlueS_Med, MED EDUC), Horizon projects (e.g. CONNECT, PERSEUS), Interreg projects (e.g. Meltemi, MoNa)

Recommendations-Future plans

a) Support European Blue Schools network;

b) Collaboration of relevant initiatives and networks (e.g. EuroGOOS, EMSEA, MIO-ECSDE);

c) Exploration of communication, social values, motivations, trust and transparency (apart from knowledge, attitudes and behavior);

d) Development and implementation of programmes/workshops for pre-service and in-service teachers and marine educators (e.g. Education Centres for the Environment and Sustainability; aquaria stuff)

e) Integration of sea issues into the national curricula, revision of school textbooks towards a sea-friendly content;

f) Communication between EU and non-EU Mediterranean countries citizens;

g) Translation of the MSL guide into the different languages of Mediterranean countries;

h) Development of the Scope and Sequence of the Mediterranean Sea Literacy.

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