

# How ocean literate are students attending schools of Arts?

## A case study from a Greek Junior High school

Panayota Koulouri (1), Athanasios Mogias (2), Giulia Realdon (3), Maria Cheimonopoulou (4), Melita Mokos (5), Theodora Boubonari (2), Monica Previati (6)

- (1) Institute of Marine Biology, Biotechnology & Aquaculture, Hellenic Centre for Marine Research, Greece  
 (2) Department of Elementary Education, Democritus University of Thrace, Greece  
 (3) UNICA Mearth Group, University of Camerino, Italy  
 (4) Hydrobiological Station of Pella, Hellenic Ministry of Rural Development and Food, Greece  
 (5) Department of Ecology, Agronomy and Aquaculture, University of Zadar, Croatia  
 (6) UBICA srl (Underwater Bio-Cartography), Italy

**ABSTRACT:** To achieve the Sustainable Development Goal (SDG) 14 focusing on the ocean, people need to understand the role and function of the ocean and be aware of issues concerning protection and sustainable use of its resources. The Ocean Literacy Framework consisting of 7 essential principles and 45 fundamental concepts is now accepted worldwide for use in both formal (schools, universities) and non-formal (e.g. research institutes, aquaria) education settings to empower citizens to use knowledge of the ocean and awareness of its issues and therefore to communicate about the marine environment in a meaningful way and make informed and responsible decisions. The present pilot study aims to this direction by evaluating ocean sciences content knowledge of students attending a junior high school of Arts in Greece. A structured questionnaire was administered to 162 students, while the influence of certain demographics on students' knowledge level was also investigated. The results of the study revealed moderate knowledge, which is in line with the limited relevant literature regarding both knowledge gains and misconceptions, and the need for integration of relevant concepts in education to ensure sustainability of the ocean.

**Keywords:** Ocean Literacy, SDG 14, marine science education, Mediterranean region, junior high school students

### METHODOLOGY

- Sample of 162 students (36% grade 7, 35.4% grade 8, 28.6% grade 9)
- Females 66% of the participants
- 85.7% of students participated in environmental education projects
- 88.3% of students received relevant information mostly from the internet
- A structured questionnaire was developed according to previous research (see Mogias et al., 2019):
  1. Demographics section (e.g. gender, parental education level)
  2. Content knowledge scale section (16 multiple choice questions)
  3. Short beliefs scale section (4 statements)

Belief statements	mean	±sd
s1 The sea influences my life even if I live far away from it	3.92	1.04
s2 We need to study more the sea so we can protect it more successfully	4.09	1.01
s3 Whatever I throw in the sink influences the sea	3.40	0.97
s4 The sea is a source of wealth and offers many jobs	3.76	1.03

Content knowledge	f	rf	OLPs
q1 If I had a boat, I could theoretically travel in every part of the ocean	18	11.4	1
q2 If I walk in the mountains and sea a rock containing a fish fossil, it means that the sea was once at a higher level than it is today	18	11.4	2
q3 The first living organisms on earth lived in the sea	114	70.4	4
q4 The marine environment is home to different animal species depending on sea depth	85	52.8	4
q5 Most of the rainwater falling on land originates from the tropical ocean	32	20.1	3
q6 The Mediterranean Sea is home to organisms of many different species	113	71.1	5
q7 The least explored environment is the deep sea	72	45.3	7
q8 The Aegean Sea is connected to all seas on the Earth	36	22.5	1
q9 The main source of the oxygen that living beings breathe, is the ocean	20	12.7	4
q10 The largest animal on Earth lives in the sea	124	77.5	5
q11 The shape of the beach is mainly influenced by the sea waves	80	50.6	2
q12 The climate of my home town would experience warmer summers and colder winters if there were no sea nearby	65	41.1	3
q13 Most of the world goods are transported by ships	111	70.7	6
q14 Most of the water on earth is in the ocean	107	66.5	1
q15 The ocean resource which is most at risk of being exhausted is fish	83	52.2	6
q16 Scientists think that world climate change will cause sea-level rise	94	58.4	1

f: frequency, rf: relative frequency, OLP's: Ocean Literacy Principles

### RESULTS & DISCUSSION

- Students possessed moderate content knowledge level of ocean sciences
  1. 45.9% mean relative frequency of correct answers, mean knowledge score 7.12 (±2.146)
  2. Positive beliefs (mean value: 3.79) toward ocean stewardship
- Background factors revealed no significant differences (e.g. gender, parental education, participation in environmental education projects)
- Interesting pattern in answers:
  1. Most difficult and easiest questions were in line with other findings from the existing literature (Mogias et al., 2019; Realdon et al., 2019; Mokos et al., 2020)
  2. Connectedness of the ocean basins (q1 and q8), origin of the atmospheric oxygen (q9), and global water cycle (q5) were failed to be addressed by the majority of the students' sample
  3. Existence of misconceptions, indicating either lack of assimilation of new or already existing concepts
  4. First living organisms on Earth lived in the sea (q3), the ocean (Mediterranean Sea in our case) as the home of organisms of many different species (q6), the largest animal on Earth lives in the sea (q10), shipping as the major transportation mean in the world (q13), and vast amount of Earth's water is found in the ocean (q14) proved easy to answer questions

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### REFERENCES

- Mogias, A., Boubonari, T., Realdon, G., Previati, M., Mokos, M., et al. (2019). Evaluating Ocean Literacy of Elementary School Students: Preliminary Results of a Cross-Cultural Study in the Mediterranean Region. *Frontiers in Marine Science*, 396, <https://doi.org/10.3389/fmars.2019.00396>
- Mokos, M., Realdon, G., Zubak Čizmek, I. (2020). How to Increase Ocean Literacy for Future Ocean Sustainability? The Influence of Non-Formal Marine Science Education. *Sustainability*, 12, 10647.
- Realdon, G., Mogias, A., Fabris, S., Candussio, G., Invernizzi, C. et al. (2019). Assessing Ocean Literacy in a sample of Italian primary and middle school students. *Rendiconti Online della Società Geologica Italiana*, 49, 107–112.

