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What is the consciousness, literacy and behaviour of Italian Gen-Z towards the protection of the marine environment?

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Abstract

The study explores Italian Generation Z's consciousness, literacy and behaviour towards marine environmental issues aimed at detecting whether different profiles of people exist. A survey was implemented with 778 students attending upper secondary schools. Descriptive statistics, significance tests for differences among groups, and cluster analysis were applied. Gen Z expresses concern and awareness about environmental issues, but not high levels of engagement in marine pro-environmental behaviours. Only about half of the sample solved six of the twelve objective knowledge questions correctly, and some misconceptions were observed. Gender, education, and area of living differentiate answers over several phenomena. Cluster results highlight four groups of young people with different sustainability profiles, two of which showed sensitiveness and awareness about the investigated topics, while the other groups are insensitive, unaware, and illiterate. The poor knowledge of Italian Generation Z about ocean sustainability topics highlighted the need to further educate young people to become literate individuals.

Keywords: marine ecosystem values; environmental consciousness; knowledge; pro-environmental behaviour; ocean literacy; cluster analysis; socio-demographics; SDG 14.

Introduction

Younger generations are often described as being more environmentally aware than the older generations. The 2023 Deloitte Gen Z and Millennial Survey affirms that the younger generations actively participate to environmental protection and feel concerned about environmental and climate changes.

Generation Z (individuals born in or after 1997), currently represents 26% of the world's population with 2 billion people being part of this group (Earthweb, 2023). There is need to consider this generation under several perspectives: because they are at a turning point in people's lives where individuals are expected to enter the workforce or engage in a higher education, which are choices that could be relevant all through their entire life; because they are entering a phase of their lives where they can create a lasting impact with their actions and choices; they will dominate future demand in the seafood market and will be crucial to promoting a more sustainable seafood system; finally, young people's approach presently reveal future tendencies about the preservation of marine resources, which form the main actor that contributes to the fulfilment of the UN SDGs in year 2030.

Due to the above reasons, a comprehensive understanding of consciousness, literacy and behaviours of today's Gen Z towards the environmental sustainability of oceans can provide valuable insight into educational needs and young people's contribution to the future sustainability of the "life below water" in the context of the UN Sustainable Development Goal 14. This contribution is even more important in light of the UN declaration of 2021-2030 as the Decade of Ocean Science for Sustainable Development, and the EU Mission to "Restore our oceans and waters" by 2030.

Environmental consciousness has been defined as a multifaceted concept comprising concern for the environment, sensitivity towards environmental problems and awareness of the need for ecological protection (Su *et al.*, 2019).

A relationship exists between people's consciousness and environmental knowledge. Indeed, knowledge is among the most considered personal trait in studies dealing with factors influencing people's environmental opinions and behaviour (Liu *et al.*, 2020). Knowledge comprises a subjective dimension, that refers to self-beliefs, based on experience, expertise, and other factors, and an objective dimension, that refers to accurately stored and actual information depending on ability or expertise (Carlson *et al.*, 2009).

In addition, knowledge is one dimension of the Ocean Literacy (OL) framework that has expanded over time to include other dimensions (Brennan *et al.* 2019; McKinley *et al.*, 2023), such as awareness of ocean issues and related challenges, attitude in cultivating a set of values and a deep concern for the ocean, behaviour towards ocean enhancement and safeguarding, and activism in efforts to address issues related to the ocean. OL was defined as the ability to understand essential principles and basic concepts about the ocean, communicating about the ocean in an effective and constructive manner, and finally, making informed and responsible decisions about the ocean and its resources (Cava *et al.*, 2005). The OL framework developed by the European Marine Science Educators Association (MacNeil *et al.*, 2021; Mokos *et al.*, 2020; Payne *et al.*, 2022) is based on seven principles and forty-four fundamental concepts. Recent reviews (Cavas *et al.*, 2023; Costa & Caldeira, 2018; Paredes-Coral *et al.*, 2021; Salazar-Sepúlveda *et al.*, 2023; Stoll-Kleemann, 2019) highlighted the relevance of OL in the scientific literature, especially regarding young people as detailed in the literature section.

In addition to people's knowledge and literacy, the behaviour adopted by individuals is of fundamental importance. A pro-environmental behaviour has been defined as a behaviour that harms the environment in the slightest possible way or is beneficial to the environment (Steg & Vlek, 2009); it has been considered as a two-factor structure construct, comprising low- and high-effort behaviours depending on the ease or effort that individuals must make to behave in a sustainable manner (Ramkissoon, *et al.*, 2013; Wyles & Ghilardi-Lopes, 2023).

To the best of our knowledge, little scientific evidence (Koulouri *et al.*, 2022; Mallick *et al.*, 2023) has jointly analysed consciousness, literacy, and behaviours of young people towards marine environmental issues. However, no study has added the sampling of opinions about the values of marine ecosystems and their potential to support economic uses, or has specifically carried out a segmentation analysis of Generation Z to identify those who are more/less environmentally conscious and literate about marine environmental topics.

This study aims to explore whether different segments and profiles of Italian Generation Z emerged based on their approach towards the sustainability of marine environment by focusing on dimensions of consciousness, literacy and behaviour, and whether socio-demographic characteristics are significant in differentiating people's profiles. In detail, three research questions are set as follows:

RQ 1. What are the consciousness, literacy and behaviour of young people regarding marine environmental sustainability?

RQ 2. Can Gen Z be categorized into distinct groups based on their consciousness, literacy and behaviour?

RQ 3. Do Gen Z segments differ with respect to sociodemographic characteristics regarding gender, living area, and educational background?

The study is part of a larger research focused on Italian Gen Z approach towards the marine environmental sustainability, by dealing also with their preferences in seafood consumption choices (Forleo & Bredice, 2023).

Literature background

Gen Z under sustainability lens

Several sustainable perspectives concerning the younger generation have been explored in the literature.

Some studies have investigated the role of Gen Z in achieving Sustainable Development Goals (Yamane & Kaneko, 2021), their preferences in hospitality and tourism context as well as in their fashion choices (D'Arco *et al.*, 2023; Karaman & Aykin, 2021; Tran *et al.*, 2022); other studies have investigated the sustainable food consumption of young people (Forleo & Bredice, 2023; Kamenidou *et al.*, 2019).

The environmental consciousness of young people was addressed in several studies, such as those highlighting the factors influencing the formation of consciousness (Krasilnikova & Kuznecova, 2021) and providing a segmentation study among university students (Mera & García-Gallego, 2023), and those studying how consciousness influences purchased behaviour of Gen Z (Nguyen *et al.*, 2020).

Pro-environmental behaviour as a topic has aroused a growing interest in the last decade, as stated by some recent reviews addressing the younger generation cohorts (Bhattarai *et al.*, 2024; Carducci *et al.*, 2021; Firmanshah *et al.*, 2023; Lisboa *et al.*, 2024; Saulick *et al.*, 2024; Upendra *et al.*, 2024). According to Grilli & Curtis (2021) who reviewed the literature on pro-environmental behaviours, the most frequently studied behaviours relate to the fields of energy, waste disposal and recycling, and the majority of studies were conducted in Europe and North America by targeting families, while a substantial minority of studies focused on other behavioural domains and students. A recent study by Saulick *et al.* (2024) investigated the pro-environmental behaviour among students and highlighted the need to promote this behaviour, since they are the leaders of tomorrow and their actions can play an important role in environmental sustainability; the Authors also supported the need for further studies into the pro-environmental behaviour of young people.

Ocean literacy among younger generations

To effectively promote marine sustainability goals among young people, it is essential to highlight the gaps in ocean literacy (Ezgeta-Balić & Balić, 2024).

Several studies addressed the topic of OL focusing on students at the primary and secondary education levels. Mogias *et al.* (2019) delved into the ocean literacy of primary school students in three Mediterranean countries (Italy, Croatia, and Greece) which showed moderate marine knowledge and misconceptions. Pazoto *et al.* (2023) investigated the effectiveness of an OL project on the attitudes of Brazilian students aged 8 to 15 and showed the

relevance of integrating OL principles within the school curriculum. Koulouri *et al.* (2022) focused on the ocean literacy of students at primary and secondary levels across the Mediterranean Sea basin. The study by Guest *et al.* (2015) assessed the level of valuation, knowledge, interaction, and interest in the ocean of school students aged 12 to 18 years in Canada; their result showed a significant positive correlation between knowledge and value assessment, indicating that ocean-literate students might place a higher value on the marine environment; in addition, students who had greater interaction with the ocean also demonstrated higher levels of knowledge, and students with higher levels of knowledge had better chances of being interested in ocean-related jobs and careers. A study about US students during their pre-college years (Plankis & Marrero, 2010), highlighted three important aspects: interest but low levels of ocean knowledge; low awareness of the urgency of ocean issues; and students' stated interest in changing their behaviour to protect the ocean. Fauville *et al.* (2019) interviewed an international 16–18-year-old audience in 24 countries, addressing the level of knowledge of all seven principles and most of the 45 concepts of the Ocean Literacy framework. Finally, Lin *et al.* (2020) reported that female students attending middle school in Taiwan who were in higher grades and attended a coastal school scored higher on ocean literacy.

Materials and Methods

Participants and Questionnaire

Students aged 18-20 years and in their final year of secondary school in central Italy were involved in the survey between January and April 2022. The sampling method was based on a three-stage sampling strategy: In the first stage, four cities were selected from two regions located in central Italy (two cities in Abruzzo and two in Molise regions), while differentiated based on their size (medium and small) and location (coastal and inland); in a second stage, all secondary schools in each city -a total of eleven schools-, were considered and students in their final year were invited to take part in the survey; finally, students were met at schools and involved in the study.

As a population of interest, the study only involved students in their fifth final year of school and not in previous years for two reasons: because they were close to entering the job market or continuing with university studies; furthermore, these students were over 18 years of age. Ten schools out of eleven agreed to participate, and a total of 792 students in the final class -of about 1300 enrolled students- were involved. A pilot test was conducted with a sample of 30 respondents and 4 teachers of different schools to check for any discrepancy in the comprehension of the questions.

Students were informed about the study aims and topics, as well as about the anonymity of the survey and the respect of the privacy information according to the EU Reg. 2016/679 on General Data Protection Regulation. On receiving their consent, students were allowed to fill out an anonymous questionnaire that was administered face-to-face using an online platform.

The questionnaire was structured in two main sections inspired by Brennan *et al.* (2019) study about the six OL dimensions –sensitiveness, awareness, concern, behaviour and activism, knowledge and communication-, and in a final socio-demographic section.

Ocean literacy among Gen Z: consciousness, knowledge and behaviour about ocean and marine environments

Students' environmental consciousness about marine environmental issues was investigated by adapting the approach proposed by Su *et al.* (2019) -sensitiveness, concern, and awareness- of the marine environment. In particular, sensitiveness refers to the environmental status of the marine ecosystem; concern refers to people's involvement in the existence of potential conflicts between marine resources conservation goals and economic activities; finally, based on the European Commission (2017), awareness refers to whether students envisaged problems of seafood scarcity and limitation to tourism fruition by the year 2030 due to a degradation of marine ecosystems.

Students were asked to respond to statements regarding their subjective knowledge about ocean resources and marine sustainability and make a comparison with an average person and with friends. Their objective knowledge regarding marine topics were structured in three sections: the first section dealt with two questions related to ocean resources; a second section dealt with people's knowledge about the surface of the Planet covered by the oceans and the Mediterranean Sea, and about the length of the Italian coast; and finally, a third section investigated people's knowledge about the seven principles of ocean literacy. The choice to focus the investigation on the seven ocean literacy principles, rather than on the specific concepts, and to follow the international framework was necessitated by the need to grasp a general knowledge of young people and follow a broad standard framework. Furthermore, the students' knowledge about the meaning of Marine Protected Area (MPA) was investigated. Respondents were also asked about the main media sources from which they obtained information on marine environmental problems.

Finally, people's Pro-Environmental Behaviours (PEBs) was detected by considering three activities with different levels of involvement.

Opinions related to the values of marine ecosystem services and the blue economy development

Opinions about ecosystem service values and related scenarios touched two spheres. A first sphere dealt with the values of marine ecosystems that students considered relevant by year 2030. Two perspectives were considered, i.e. the most important values and the values most menaced by economic activities. The selected items of values were based on the categories of marine ecosys-

tem services defined by the Common International Classification of Ecosystem Services-CICES (Buonocore *et al.*, 2021; Haines-Young & Potschin, 2018). In addition, people were asked about the most important environmental functions of marine ecosystems and about the entities having the greatest responsibility in protecting the values of marine ecosystems. People's opinions on the most important functions of Marine Protected Areas were also sampled. A second sphere dealt with opinions about the future economic scenario related to the ocean, such as the sectors of the blue economy (European Commission, 2019) that respondents envisaged will be relevant by the year 2030. The year 2030 was considered as the reference time horizon in students' opinions regarding the values of the marine ecosystem and the sectors of the blue economy, believing that by that date the students would have completed their studies, reached adulthood, and be fully in the job market. Furthermore, the United Nations declared 2021-2030 as a Decade of Ocean Science for Sustainable Development, and at EU level, year 2030 is the target of the Mission set in 2021 to 'Restore our ocean and waters by 2030".

Socio-demographic variables

A final section of the questionnaire sampled some individual characteristics, such as gender, the school sector of education based on the broad fields of the International Standard Classification of Education (ISCED), the type of school and its curriculum, the living area, and city size.

Data Analysis

Descriptive statistics (frequencies and percentage distributions) were used to provide an overall summary of the investigated phenomena, and the most interesting results are reported in tables.

The level of significant differences between the values of some variables based on socio-demographic characteristics was examined. The non-parametric Mann–Whitney U test was used to compare two groups, and the Kruskal–Wallis test was used for several groups of variables. All statistical tests were performed considering significance at the level of $\alpha = 0.05$ and $\alpha = 0.01$.

A cluster analysis was performed based on variables ranging from respondents' knowledge, awareness, sensitiveness, and pro-environmental behaviour. Cluster analysis (Kaufman & Rousseeuw, 2005) is a multivariate statistical technique frequently used in research aimed at individuating homogeneous segments of individuals (Sánchez-Bravo *et al.*, 2020). A cluster analysis with the Ward method was applied, using the statistical software Stata13. The Gower distance was used as a measure to assess the pairwise differences among statistical units. Per each cluster solution, the Duda-Hart and the Calinski–Harabasz pseudo-F indexes were used as stopping rules for detecting the number of clusters, with larger values of the indexes indicating more distinct clustering. The profile of each cluster was explored in depth based on the segmentation variables and sociodemographic characteristics. Figure 1 reports the dendrogram that visualizes the result of the hierarchical clustering analysis.

Results

This section reports results of the study which firstly gives a global picture of the sample, then summarizes the investigated phenomena based on the descriptive statistics and providing evidence about the significant differences in the distribution of phenomena based on the test analysis, and finally, reporting the results of the segmentation analysis.

Table 1 presents the main sociodemographic characteristics of the final sample composed of 778 individuals, after having excluded 14 students that did not complete

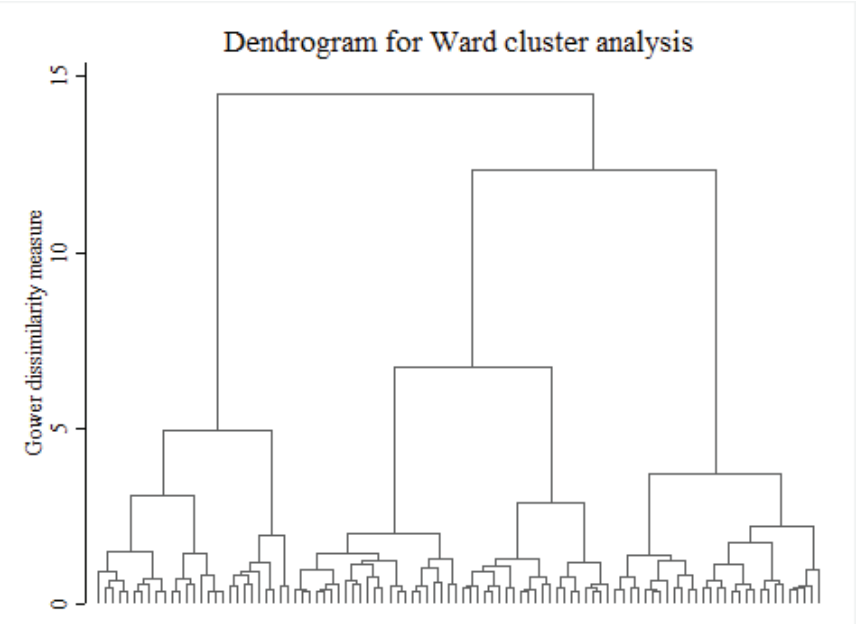

Fig. 1: Cluster Dendrogram.

Table 1. Characteristics of the sample (N=778).

GENDER	Female 56.4%	Male 43.6%	
ISCED 3 CLASSES	Humanities and Social Sci. 40.5%	Science and Engineering 28.3%	Health and Services 32.2%
SCHOOL TYPE	Lyceum 51.1%	Technical 22.0%	Vocational 26.9%
EDUCATIONAL CURRICULA	Human sciences 26.5%		
	Socio-economic sciences 31.8%		
	Environmental/Marine sciences 11.8%		
	Scientific sciences 20.8%		
	Health sciences 9.1%		
LIVING AREA	Inland 65.3%	Coastal 34. 7%	
CITY SIZE	Small-sized (<5000 inhab.) 30.5%	Medium-sized (<250000 inhab.) 69.5%	

the questionnaire. As regards the gender distribution of the sample, females prevailed over males. Our students mainly live in big-sized cities and in a context of inland areas. The distribution by types of school shows they are mainly attending a lyceum (51.1%), then a vocational (26.9%) and a technical school (22.0%). Finally, the distribution of their curriculum of study may be classified into humanities and social sciences (40.5%), in health and service sciences (32.2%) and in science and engineering (28.3%).

Descriptive statistics

Consciousness and knowledge about ocean and marine related topics

Table 2 reports in separate sections the distribution of answers about people consciousness, knowledge about marine environmental topics, and pro-environmental behaviours.

Most respondents declare consciousness for the environmental status of marine ecosystems (Table 2.a): 73.9% of young people agrees with the statement measuring their concern for the sustainability of marine and coastal environments; and 65.2% of participants affirm to be sensitive about matching economic activities with the preservation and restoration goals of these environments. although a non-negligible percentage of individuals (20.1%) are irresolute on the topic. Gen Z's awareness of the impacts of future environmental scenarios on fishing and tourism activities appears widespread in over half of the sample: in fact, 58.3% of respondents are of the opinion that by 2030, there will be a problem of scarcity of seafood from the ocean, and 62.0% are of the opinion that there will be impacts on tourism development. However, some misconceptions about the appropriate method of handling impacts and irresolute answers have emerged: 10.7% of students are of the opinion that the problem of seafood scarcity in one area can be solved by changing fishing area, and 9.3% are of the opinion that in case of environmental issues impacting on tourism, they could still go on vacation elsewhere. Finally, about one fifth of students are irresolute on both questions (respectively, 22.0% are aware about seafood scarcity and 18.5% about tourism fruition).

About 48.3% of individuals reported that they have a general knowledge of the ocean and its resources (Table 2.b). As regards the subjective knowledge about marine sustainability issues, students recognize that it is not very high. Few of them agree to being considered an expert compared to their friends (4.8% of answers); definitely higher are the percentages of students self-assessing their knowledge about marine environmental issues compared to an average person (24.8% of respondents), and the percentage (29.8%) of students that are irresolute; neither agreeing nor disagreeing.

Answers to the objective knowledge items reveal a high percentage of wrong and irresolute answers especially the extension of the oceans and the length of the Italian coast, as detailed in Table 2.c reporting the distribution of answers per section and that of correct answers. As regards the knowledge of the OL, they mainly agree about the support oceans give to the diversity of life and ecosystems, while they mainly disagree about the existence of only one ocean on the Earth. Concerning the three questions about the size of oceans and of the Mediterranean Sea, and about the length of the Italian coast, only 16.3% gave a correct answer to all three questions, 34.3% gave correct answers to at least two questions, and 10.2% of the sample gave wrong answers to the three items, the remaining percentage of the sample properly responded to one or two items. Regarding the knowledge of the principles of ocean literacy, many students are not familiar with them, only 2.6% gave a correct answer to all the principles, while 25.4% gave either zero or only one correct answer, and the remaining respondents gave between 2 and 5 right answers. Young people showed that they are more knowledgeable about topics related to the importance of the ocean in supporting the biodiversity of ecosystems (70.8%), the fact that the ocean is still largely unexplored (53.6%), the influence of the ocean on climate and weather (51.7%), and the shaping of life in the ocean for future Earth life (41.6%). As regards the two main sources of

Table 2. Distribution of answers to the consciousness and knowledge statements (%).

2.a ENVIRONMENTAL CONSCIOUSNESS

	Totally disagree	Partially disagree	Nor agree or disagree	Partially agree	Totally agree
I am concerned about the environmental status of marine and coastal ecosystems (Concern)	3.3	7.6	15.2	39.7	34.2
For me, the conservation or restoration of the marine / coastal environment is conflictual with economic activities (Sensitiveness)	7.1	7.7	20.1	40.1	25.1

	I do not know	Yes, seafood is limited and rapidly declining around the world	Yes, but seafood from one area can be replaced with those from another fishing area	No, the fish species recover over the course of twenty years	No, it will happen after 2030
Do you think that by 2030 there will be a problem of seafood scarcity due to the status of quality of the marine environment? (Awareness of Seafood scarcity)	22.0	58.3	10.7	4.9	4.1

	I do not know	Yes, the status of marine-coastal environments is deteriorating around the world	Yes, but you can go on holiday to another seaside-coastal destination	No, the quality of the sea recovers over the course of twenty years	No, it will happen after 2030
Do you think that by 2030 there will be a problem for marine tourism fruition due to the status of quality of the marine environment? (Awareness of Tourism use)	18.5	62.0	9.3	4.2	6.0

2.b SUBJECTIVE KNOWLEDGE (SubjKnow)

	Totally disagree	Partially disagree	Nor agree or disagree	Partially agree	Totally agree
I have knowledge about the ocean and its resources (Resources)	8.1	24.2	19.4	39.4	8.9
I know a lot about marine sustainability compared to my friends (Friends)	58.1	23.0	14.0	4.2	0.6
I know a lot about marine sustainability compared to an average person (Others)	14.7	30.7	29.8	21.7	3.1

2.c. OBJECTIVE KNOWLEDGE SECTIONS

First section (ObjKnow_1)

	Marine mammals	Plankton (Correct answer)	Clams	Fish
Most living material (biomass) in the ocean is found in ?	16.6	54.4	10.9	18.1

	About half are found exclusively in the ocean	Almost all of them are found exclusively in the ocean (Correct answer)	Most are found both on land and in the ocean	Most are found exclusively in tropical rainforests
There are more than 30 large groups of organisms (vertebrates, arthropods, molluscs, etc.) on Earth. Where are most of these groups located?	42.9	8.6	44.7	3.7

Continued

Table 2 continued

Second section (ObjKnow_2)

Does the ...	I don't know	Wrong* answer	Correct* answer
planet's surface is half covered by oceans? (Planet)	12.2	55.0	32.8
Mediterranean Sea represent 20% of the surface occupied by the ocean? (Med Sea)	39.3	18.4	42.3
Italy has just over 8000 km of coastline? (IT coast)	57.1	10.9	32.0

*YES/NO responses have been reclassified as wrong/correct answers according to the statements

Third section (ObjKnow_3)

Does the …	Totally disagree	Partially disagree	Nor agree or disagree	Partially agree	Totally agree
Earth has one big ocean with many features?	23.8	18.8	25.7	21.6	10.2
ocean and life in the ocean shape the features of Earth?	1.8	4.6	12.6	39.3	41.6
ocean is a major influence on weather and climate?	1.5	3.0	8.6	35.2	51.7
ocean made the Earth habitable?	2.7	4.9	18.1	35.2	39.1
ocean supports a great diversity of life and ecosystem?	1.5	2.1	5.0	20.6	70.8
ocean and humans are inextricably interconnected?	3.0	4.8	19.5	36.8	36.0
ocean is largely unexplored?	2.6	3.3	12.2	28.3	53.6

Distribution of correct answers to the objective knowledge sections (%)

	Number of correct answers												
	0	1	2	3	4	5	6	7	8	9	10	11	12
ObjKnow_1_true	42.6	51.9	5.5										
ObjKnow_2_true	10.2	39.2	34.3	16.3									
ObjKnow_3_true	14.5	10.9	15.4	16.7	15.6	14.9	9.4	2.6					
ObjKnow_all_true	2.8	5.1	9.0	9.6	14.3	10.5	15.3	13.0	9.4	7.1	3.0	0.8	0.1

2.d PRO-ENVIRONMENTAL BEHAVIOURS (PEBs)

Do you practise the following behaviours?	Never	Sometimes	Often
Participation in marine citizen science activities (Citizen science)	81.1	16.5	2.4
Participation as volunteer in marine protection campaigns (Volunteering)	79.3	16.6	4.1
Attendance to events, conferences meetings about marine topics (Events)	64.4	29.8	5.8

information on the topics addressed in the study (data are available on request), responses underline the relevance of digital media, confirming the profile of Generation Z as a digital generation: 82.4% of students declare that Internet and the social media are their main sources of information. Finally, looking at the summary distribution of right answers over each objective knowledge section, 42.6% of respondents gave incorrect answers to the first section about people's knowledge of marine organisms and living materials of the ocean, while 51.9 % gave one out of two correct answers.

The study analysed the pro-environmental behaviours of Italian Generation Z (Table 2.d). In this regard, results show that only a few of them actively participated in sea-related initiatives such as citizen science activities, volunteer work, or other events: in fact, 81.1% reported that they have never participated in citizen science activities, 79.3% have never volunteered, and 64.4% have never participated in any type of events on the subject of environmental sustainability of the oceans.

Finally, some questions in the survey focused on Marine Protected Areas and their purposes (data are available on request). Most students (86.3%) declared being familiar with the concept of Marine Protected Areas and their three main responsibilities in conserving biodiversity and providing refuges for species threatened or overexploited by fishing (87.4%), in helping to protect critical habitats by providing areas where fish can reproduce and grow to adult size (77.0%), and in increasing the resilience of ecosystems to climate change (44.2%). Most respondents are of the opinion that the main entities that should protect the value of marine ecosystems are bodies governing the marine protected areas (65.1%) and national and international institutions (62.4%); few students are of the opinion that businesses, research and educational institutions can also play a role in protecting the values of marine ecosystems (12.2% and 17.4%, respectively).

Table 3. Opinions about marine ecosystem values and blue economy development in the next 10 years (%).

The 3 most important and threatened values of the marine ecosystem	Important	Threatened
Recreational value	59.0	31.9
Ecological value for regulation or supporting services	60.8	77.0
Aesthetic value	46.4	64.9
Historical-cultural value	40.5	39.1
Educational and scientific value	37.7	37.0
Economic value for provisioning services	55.7	50.1

The 3 most important environmental functions of marine ecosystem	
Maintain biological land/sea balances to support life on the planet	73.8
Conserve and protect part of the genetic heritage of different biological populations and biodiversity	53.6
Prevent and mitigate the consequences of extreme weather events	36.1
Maintain fresh water reserves available over time	31.4
Regulate climate trends	28.4
Absorb and process potentially harmful substances (e.g., nutrients, heavy metals)	28.4
Limit erosion (e.g. thanks to the presence of tree cover along the coast line)	27.5
Produce and make available large quantities of oxygen	13.1
Fix carbon dioxide into long-term resistant forms	7.7

The 3 most important sectors of the blue economy	
Tourism	60.7
Energy	45.1
Fishery	43.2
Mariculture	34.8
Marine non-living resources extraction	30.2
Maritime transport	26.3
Biotechnology	25.2
Maritime defence, security and surveillance	14.9
Shipbuilding and repair	13.9
Port activities	5.7

Opinions related to the values of marine ecosystem services and the blue economy development

Some questions in the survey highlighted students' opinions on the values of the marine ecosystem and the development of the blue economy by the end of the decade (Table 3).

Among the values of marine ecosystems that interviewees recognize as most important, the economic value is assessed by 55.7%, while the ecological value was considered even more important by 60.8% of the sample; the recreational value is placed in an intermediate position between the two previous values and is considered important by 59.0% of young people.

The interviewees pay greater attention to the ecological function rather than the economic one in relation to the threats they foresee in the scenario of the decade: 77.0% of the sample believes that the marine ecological value could be threatened in the future, while the economic value is considered at risk by 50.1% of respondents; midway, 64.9% of the sample believes that the aesthetic value will be at risk by 2030.

Deepening the opinions about the most important environmental functions of marine ecosystems, at first, the interviewees include the contribution to the maintenance of biological balances between land and sea (73.8% of students), followed by the role played in the conservation and protection of biodiversity (53.6%), and the contribution of marine ecosystems for preventing and mitigating the consequences of extreme meteorological events (36.1%).

Regarding the three most important sectors of the blue economy, most respondents put tourism first (60.7%), followed by ocean and marine energy (45.1%) and by fisheries (43.2%); only a few of them take into consideration other emerging sectors of the blue economy, such as blue biotechnology, and even fewer of them consider the port and maritime defence sectors.

In a country surrounded by the sea, students do not consider the job opportunities offered by the blue economy: in fact, few of them (only 4.3%) declare an interest to pursue studies in disciplines associated with the economic sectors based on the ocean and its resources.

Test analysis

As reported in the previous section, a test analysis was conducted to determine the statistical *significance* of the differences between the values of the variables based on socio-demographic characteristics. Depending on the type of socio-demographic characteristic, the Mann–Whitney U test was used for making a comparison in case of only two groups (e.g., male or female), while the Kruskal–Wallis test was used in the case of more groups (e.g., the three types of school). In both tests, the null hypothesis assumes that there is no significant difference between the two/more than two groups. Table 4 reports the results of the test analysis highlighting the variables that revealed significant differences by demographics, i.e. gender, educational curriculum, school type, and living area.

Regarding the gender of the respondents, the null hypothesis can be rejected for the awareness about tourism future scenarios and females seem to be more conscious of the problems that the development of the tourism industry will suffer due to the deterioration of the marine environment in the future. At the same time, females show more concern about the conflict between economic activities and the conservation and restoration of the marine and coastal environment; in addition, women tend to participate in marine-related events. Gender also makes a difference in the knowledge about marine environmental topics: the distribution of answers shows that the males have a higher subjective knowledge than females and give more correct answers to the objective knowledge items.

Regarding the educational curricula, differences in subjective and objective knowledge of the coastal marine environment emerged. The educational curriculum makes a significant difference in the awareness about tourism's future development and the concern about the environmental status of the sea and the coast; in addition, the educational curriculum influences students' participation in volunteering or citizen science activities. Among the set of phenomena whose distribution is differentiated by school type, it emerges that students attending vocational schools had the highest scores in subjective knowledge. At the same time, vocational school students are the most active in citizen science and volunteering activities. Differences in the distribution of answers also affect the level of objective knowledge: in this regard, vocational education is no longer relevant, while students attending lyceum and technical school show higher knowledge of the principles of Ocean Literacy.

Finally, some differences in responses emerged according to the students' living area, whether coastal or inner area. Unexpectedly, those who live inland recorded a higher score on objective knowledge related to the OL principles. A difference in the distribution of answers according to the respondents' living area was also recorded in the concern of young people, with those living in inland areas showing more concern about the effects of economic activities on ocean and marine environments. Students living on the coast, on the other hand, had the

Table 4. Results of the test analysis.

Variables	Gender[a]	Educational curricula	School type[b]	Living area[c]
Concern	* (F)	**	** (L)	** (I)
Sensitiveness			* (L)	
Resources		**		
Friends	** (M)	**	* (V)	** (C)
Others	** (M)	**	** (V)	* (C)
Awareness of Tourism use	** (F)	**		* (I)
Awareness of Seafood scarcity				* (I)
ObjKnow_1_true	** (M)	**	** (L)	
ObjKnow_2_true	** (M)	**	** (T/L)	
ObjKnow_3_true		**	** (L)	** (I)
ObjKnow_all_true	** (M)	**	**(T/L)	* (I)
MPA_knowledge		**		
Citizen science		*	* (V)	
Volunteering		**	** (V)	** (C)
Events	* (F)			
PEBs_often		**		** (C)

Legend
* significance at α = 0.05 level, ** significance at α = 0.01
a Gender: M=Male, F=Female
b School type: L=Lyceum, V=Vocational, T=Technical
c Living area: C=Coastal, I=Inland

highest scores on the assessment of subjective knowledge about ocean-related topics. Moreover, it is those who live on the coast that participate more actively in activities such as volunteer work.

Cluster analysis

In order to respond to the second research question, a cluster analysis based on the described methodology was applied. Four clusters were detected in the sample. Table 5 reports the mean score of the variables included in the analysis, and Table 6 adds some socio-demographic statistics to investigate differences in individual characteristics among groups (RQ.3).

The first cluster consists of 14.9% of individuals, and together with the second cluster, are the smallest within the sample. Students in the first cluster showed less sensitivity to the environmental status of the marine environments, and less concern about the existence of conflicts between ocean conservation goals and the economic uses of marine resources. However, they are conscious of being inadequately informed about the ocean and related sustainability topics. Considering the importance of marine values and their threats, these students assign to the ecological value a level of importance as well as a level of risk that is slightly higher than the total sample; inversely, the recreational and educational values are less perceived for their importance and threats; finally, students in the group consider the cultural value more important but not at risk. As regards the gender distribution and the educational curricula of students, the group is different from the whole sample. The group is equally distributed by gender and the three main fields of education are health, scientific, and environmental sciences, while students following school curricula in socio-economic sciences are very few.

The second cluster records 16.2% of the students in the sample. In contrast to the previous cluster profile, individuals in the group show a high sensitiveness to the environmental status of the marine ecosystem, and concern about the existence of conflicts with marine uses. In addition, this cluster profile is quite similar to that of the

Table 5. Results of the cluster analysis: average score of variables by cluster.

	Gen Z's profiles				Total sample
	Insensitive, unconcerned and illiterate	**Conscious but illiterate and passive**	**Proactive and informed**	**Conscious and literate**	
N	116	126	243	293	781
%	14.9	16.2	31.2	37.7	100.0
Concern[a]	2.06	4.19	3.55	4.22	3.68
Sensitiveness[a]	3.29	4.04	4.01	4.09	3.94
Resources[a]	2.84	3.13	3.24	3.25	3.17
Friends[a]	1.46	1.62	1.86	1.60	1.66
Others[a]	2.40	2.63	2.86	2.66	2.68
SubjKnow_mean[b]	2.23	2.46	2.65	2.51	2.50
ObjKnow_1_true[c]	0.64	0.58	0.59	0.68	0.63
ObjKnow_2_true[c]	1.64	1.44	1.48	1.67	1.57
ObjKnow_3_true[c]	2.63	2.79	2.91	3.39	3.03
ObjKnow_all_true[c]	4.91	4.82	4.98	5.73	5.23
ObjKnow_1_mean[b]	2.02	2.23	2.27	2.19	2.20
ObjKnow_2_mean[b]	1.81	1.72	1.82	1.75	1.78
ObjKnow_3_mean[b]	3.79	4.00	3.92	4.18	4.01
ObjKnow_all_mean[b]	3.00	3.14	3.12	3.24	3.15
Citizen science[d]	1.22	1.15	1.29	1.18	1.21
Volunteering[d]	1.22	1.18	1.39	1.17	1.25
Events[d]	1.41	1.35	1.46	1.41	1.41
PEBs_mean[b]	1.28	1.23	1.38	1.25	1.29
PEBs_often[e]	1.09	1.06	1.19	1.10	0.12

Legend:

[a] scores from 1= "Totally disagree" to 5= "Totally agree"

[b] mean value of the scores assigned to the questions in the section

[c] number of correct answers to the questions in the section

[d] scores from 1= "Never" to 3= "Often"

[e] number of answers "Often" to the pro-environmental behaviours in the section

Table 6. Socio-demographic characteristics of individuals within the clusters (%).

	Gen Z's profiles				Total sample
	Insensitive, unconcerned and illiterate	**Conscious but illiterate and passive**	**Proactive and informed**	**Conscious and literate**	
Gender (M)	48.28	50.79	44.03	38.23	43.57
School type					
Educational curricula					
Human sciences	0	0	29.22	0	9.13
Socio-economic sciences	5.17	41.27	13.99	0	11.83
Environmental/Marine sciences	30.17	58.73	56.79	0	31.75
Scientific sciences	30.17	0	0	58.3	26.48
Health sciences	34.48	0	0	41.6	20.82
Living area (Inland)	60.34	60.32	35.39	94.20	65.30

first group in terms of subjective and objective knowledge items, whose levels tend to be quite low. This group and the previous one share another common trait which is the lowest level of involvement in pro-environmental behaviours. As for the prospective value of marine environments, this group assigns the highest level of importance and risk to the ecological value compared to other clusters. Both the aesthetic and the economic values are less perceived in terms of importance, while the economic use is not considered to be at much risk, as it is also for the cultural value. Compared with other clusters and the whole sample, the educational profile of the group is highly characterised by students following the environmental and socio-economic curricula. Compared with the gender distribution in the total sample (43.6% of males), the group counts more males (50.8%).

The third cluster includes 31.2% of individuals. Together with the fourth group, this cluster records the highest percentage of individuals – almost 90%- and in the near future, there will be a problem of fish scarcity to satisfy human nutrition. They mainly agree to be concerned about the quality status of the marine environment, as well as being sensitive about conflicts between marine conservation goals and economic activities. More than half of the group members are concerned about the environmental status of marine ecosystems and request to be informed about the concept of marine sustainability. Indeed, subjective knowledge and pro-environmental behaviour are both aspects that positively characterize this cluster compared to the other groups; the scores reported on objective knowledge items are quite good, but not excellent. Two topics of values emerged in the cluster's profile. Compared with other groups, these students assign importance firstly to the recreational value and secondly to the ecological value. As regards the value mostly at risk in the future, students in the group are more concerned about the ecological and the aesthetic values than students in other groups. Females (56.0%) are more than males; the prevailing educational profile is in the field of environmental sciences, but the peculiarity of the cluster is that it includes everyone with a humanistic education. A further peculiarity is in the context of living, with only 35.4% living in inner areas compared to the total sample (65.3%).

The fourth cluster is the biggest one with 37.7% of students. It is the most sensitive group and the most concerned. Consciousness and ocean literacy characterize the group. Compared to other clusters and the entire sample, in this group we observed a greater level of awareness regarding the scarcity of fish products and possible limitations in the tourism section. The group has the highest level of objective knowledge among clusters; a high score is also achieved on the subjective knowledge items. As for the importance of values, opinions in this group are quite balanced for the importance assigned to the economic, recreational, and ecological values. The distribution of answers about the future threats to marine values is quite peculiar among groups: students' prevailing opinion in the cluster is that both recreational and economic uses will be menaced. In contrast, these students are less concerned than their colleagues about the threats to ecological and aesthetic services. As for the socio-demographic characteristics, the cluster is strongly characterised by gender, educational profile and living context. Indeed, it is the most feminine group (61.8% of females compared to 56.4% in the total sample). There are two educational curricula of people in the group: the scientific (58.3% compared to 26.5% in the sample) and the health sciences curricula (41.6% compared to 20.8% in the sample). Finally, 94.2% of students, the highest percentage among clusters, live in inner areas (65.3% in the total sample).

Discussions

At a global glance, results of the analysis confirm what has been reported in other studies, which show that Gen Z expresses great concern and awareness for environmental issues, but not so high levels of involvement and adoption of sustainability-focused behaviours was recorded (D'Arco, 2023). These results are also consistent with those reported in a recent study about Italians (Forleo & Romagnoli, 2023) that highlighted the high level of awareness and concern about marine plastic pollution, its impacts, and solutions, among Italians across all generations.

The level of active participation in sea-related initiatives such as citizen science activities, volunteer work, or other events is quite low among students in the sample. This result is consistent with that reported in the studies by Wen & Lu (2013) as well as Chen & Tsai (2016) which assessed a moderate self-reported level of marine knowledge, but a gap between widespread environmental concerns and low engagement in environmental actions among primary schools and university students in Taiwan. In the study by Koulouri *et al.* (2022), Mediterranean junior high school students have not systematically participated in organized community activities.

The study reveals that about half of the sample (48.7%) gave correct answers to six out of the twelve objective knowledge questions. This percentages are quite consistent with those reported by Cheimonopoulou *et al.* (2022) that focused on 154 high school students (16-17 years old) in Italy and Greece, showing that overall, 40.1% of students gave correct answers; as well as with findings from Mogias *et al.* (2019) that reported a 57.4% of correct answers in the Italian sample; and finally, results of the study by Koulouri *et al.* (2022) revealed that middle-aged school students (10 to 16 years old) of eight Mediterranean countries had a moderate level of ocean literacy, with a percentage of 54.9% of correct answers in the Italian sample. In addition, this study revealed some misconceptions among Italian students, regarding some OL concepts and the method of tackling seafood scarcity from oceans and tourism use. This result is consistent with those by Realdon *et al.* (2019) who investigated ocean-related knowledge and opinions in a sample of 351 primary and secondary school students in North-Eastern Italy. Misconceptions were also found in studies among primary school students (Mogias *et al.*, 2019) and middle-aged school students (Koulouri *et al.*, 2022).

Almost all the interviewed students not only declared to know about marine protected areas but are aware of their importance in ensuring biodiversity conservation and providing refuges for species threatened or overexploited by fishing, as well as in helping to protect critical habitats and improving the resilience of ecosystems. Similarly, Tonin (2018) explored the opinions regarding the creation of MPAs in Italy and showed that the respondents were aware of the roles MPAs played in the safeguarding of marine biodiversity and their importance for future generations.

A topic that resulted from this study refers to the key role played by social media in enlightening Italian Generation Z about environmental issues. This is consistent with results obtained by Koulouri *et al.* (2022) for the Mediterranean countries. Another result highlights the relevance of socio-demographics in characterizing students' opinions and knowledge, whose scores are significantly correlated with demographic variables, namely, gender, type of school attended, and area of residence.

Gender causes differences in consciousness, concern, and knowledge related to marine environmental issues. Females in this study show greater consciousness about the impact of the marine environment on tourism development, and more concern about the conflict between economic activities and conservation efforts; they also exhibit higher participation in marine-related events. On the other hand, the males possess greater knowledge in both subjective and objective spheres. A gender effect in the greater knowledge of ocean sustainability of males was first reported by Guest *et al.* (2015). Mogias *et al.* (2019) also observed gender differences in the level of environmental knowledge with a lower level being recorded among females; a similar result was obtained by Koulouri *et al.* (2022) among Italian female students.

The living context also impacts Italian Gen Z's perceptions and knowledge. Results from some studies showed that people living in coastal areas were more informed about the oceans, but their awareness of ocean issues was very low (Fauville *et al.*, 2019; Potts *et al.*, 2016). Lin *et al.* (2020) investigated Taiwanese students and showed that coastal school-goers had higher ocean literacy scores. Our study got more articulated results concerning the previous one based on the type of knowledge: on the one hand, coastal residents demonstrate greater subjective knowledge of ocean-related topics and engaged more actively in activities such as volunteering; on the other hand, those who live inland showed greater objective knowledge of the principles of ocean education and a greater awareness of the conflict between economic activities and marine conservation goals.

Results from the segmentation analysis highlight the richness and variety of people's profiles and show the differences in ocean literacy and the socio-demographic characteristics of the groups of young Italians in the sample. These results contribute to previous literature that identified distinct groups of students based on their attitudes and behaviours, values, and beliefs related to the sustainability of food consumption, tourism, and marine environments (Cavagnaro *et al.*, 2018; Forleo & Bredice, 2023; Forleo *et al.*, 2019).

The study has some limitations. The sample was relatively homogeneous in terms of age (18-20 years) and did not include the entire spectrum of individuals belonging to the Italian Generation Z. Furthermore, it could be interesting to carry out a more in-depth examination of specific concepts and other dimensions of ocean literacy. Finally, to obtain a broader perspective, there is need to standardize and replicate the study across multiple regions and different contexts, and to carry out transnational research involving countries sharing the same marine basin, such as the Mediterranean Sea.

Conclusions

Study findings give insights into the ocean literacy of today's young people that reveal future tendencies about the fulfilment of marine sustainability goals and the preservation of ocean provisioning values and services.

Regarding the segmentation of the sample, results pointed to the differences in the profile of sustainability of four Gen Z groups, two groups showing profiles of sensitiveness and awareness about the investigated topics, and two groups comprising insensitive, unaware and illiterate individuals.

When it comes to the knowledge of ocean literacy principles, many students are not familiar with them, indicating a need for educational efforts in this area. Only a small percentage of respondents provided correct answers for all the Ocean Literacy principles. On the other hand, young people displayed greater knowledge about the importance of the ocean ecosystem, its unexplored nature, its influence on climate and weather, and its impact on future life on Earth.

Furthermore, in all clusters, there is a lack of commitment to the adoption of marine pro-environmental behaviours, underlining the need for actions that bring young people closer to nature and make them active actors in the protection of marine environments. Interestingly, the study reveals that, despite living in a country that is a peninsula surrounded by water, only a small percentage of students expressed interest in pursuing studies in disciplines associated with the blue economy. This suggests a gap in understanding the job opportunities offered by this sector and highlights the need to promote awareness in this regard.

Future research could explore ways to enhance ocean literacy among young people, to address their gaps in consciousness, knowledge, and other ocean literacy dimensions, and finally to raise awareness among the younger generation about the blue economy's job potential. Educational and awareness initiatives tailored to specific groups should be developed to foster a deeper understanding of marine sustainability and encourage active participation in preserving our marine ecosystems.

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References

Bhattarai, P.C., Shrestha, R., Ray, S., Knez, R., 2024. Determinants of adolescents' pro-sustainable behavior: a systematic literature review using PRISMA. *Discover Sustainability*, 5 (1), 112.

Brennan, C., Ashley, M., Molloy, O., 2019. A system dynamics approach to increasing ocean literacy. *Frontiers in Marine Science,* 6, 452048.

Buonocore, E., Grande, U., Franzese, P.P., Russo, G.F., 2021. Trends and evolution in the concept of marine ecosystem services: An overview. *Water*, 13 (15), 2060.

Carducci, A., Fiore, M., Azara, A., Bonaccorsi, G., Bortoletto, M., Caggiano, G. *et al.*, 2021. Pro-environmental behaviors: Determinants and obstacles among Italian university students. *International Journal of Environmental Research and Public Health*, 18 (6), 3306.

Carlson, J.P., Vincent, L.H., Hardesty, D.M., Bearden, W.O., 2009. Objective and subjective knowledge relationships: A quantitative analysis of consumer research findings. *Journal of Consumer Research*, 35 (5), 864-876.

Cava, F., Schoedinger, S., Strang, C., Tuddenham P., 2005. Science Content and Standards for Ocean Literacy: A Report on Ocean Literacy. http://www.cosee.net/files/coseeca/OLit04-05FinalReport.pdf (Accessed 13.10.2023).

Cavagnaro, E., Staffieri, S., Postma, A., 2018. Understanding millennials' tourism experience: values and meaning to travel as a key for identifying target clusters for youth (sustainable) tourism. *Journal of Tourism Futures*, 4 (1), 31-42.

Cavas, B., Acik, S., Koc, S., Kolac, M., 2023. Research Trends and Content Analysis of Ocean Literacy Studies Between 2017 and 2021. *Frontiers in Marine Science*, 10, 1200181.

Cheimonopoulou, M., Koulouri, P., Previati, M., Realdon, G., Mokos, M. *et al.*, 2022. Implementation of a new research tool for evaluating Mediterranean Sea Literacy (MSL) of high school students: A pilot study. *Mediterranean Marine Science*, 23 (2), 302-309.

Chen, C.L., Tsai, C.H., 2016. Marine environmental awareness among university students in Taiwan: a potential signal for sustainability of the oceans. *Environmental Education Research*, 22 (7), 958-977.

Costa, S., Caldeira, R., 2018. Bibliometric analysis of ocean literacy: an underrated term in the scientific literature. *Marine Policy*, 87, 149-157.

D'Arco, M., Marino, V., Resciniti, R., 2023. Exploring the pro-environmental behavioral intention of Generation Z in the tourism context: The role of injunctive social norms and personal norms. *Journal of Sustainable Tourism*, 1-22.

Deloitte, 2023. 2023 Gen Z and Millennial Survey. Available at: https://www.deloitte.com/global/en/issues/work/content/ genzmillennialsurvey.html.

Earthweb, 2023. Gen Z Statistics 2023: How many people are in Gen Z?. Available online: https://earthweb.com/gen-z-statistics/ (accessed 10.05.2023).

European Commission, Directorate-General for Research and Innovation, 2017. Food from the oceans: how can more food and biomass be obtained from the oceans in a way that does not deprive future generations of their benefits?. Publications Office of the European Union. Available online: https://data.europa.eu/doi/10.2777/66235 (Accessed 15.03.2023).

European Commission, Directorate-General for Maritime Affairs and Fisheries, 2019. The EU Blue Economy Report 2019. Publications Office of the European Union. Available online: https://op.europa.eu/en/publication-detail/-/publication/676bbd4a-7dd9-11e9-9f05-01aa75ed71a1/language-en/ (Accessed 15.03.2023).

Ezgeta-Balić, D.A.R.I.A., Balić, N., 2024. Navigating through

ocean literacy gaps: an analysis of elementary school textbooks in Croatian education. *Mediterranean Marine Science*, 25 (1), 722-734.

Fauville, G., Strang, C., Cannady, M.A., Chen, Y.F., 2019. Development of the International Ocean Literacy Survey: measuring knowledge across the world. *Environmental Education Research*, 25 (2), 238-263.

Firmanshah, M., Abdullah, N., Fariduddin, M., 2023. The relationship of school students' environmental knowledge, attitude, behavior, and awareness toward the environment: a systematic review. *International Journal of Academic Research in Progressive Education and Development*, 12 (1).

Forleo, M.B., Bredice, M., 2023. The Sustainability of Seafood Products in the Opinions of Italian Consumers of Generation Z. *Foods*, 12 (22), 4047.

Forleo, M.B., Romagnoli, L., 2023. Fishing for litter for the reduction of marine plastic debris: What benefits and costs do Italians perceive? *Marine Pollution Bulletin*, 192, 115018.

Forleo, M.B., Romagnoli, L., Palmieri, N., 2019. Environmental values and willingness to pay for a protected area: A segmentation of Italian university students. *International Journal of Sustainable Development & World Ecology*, 26 (1), 45-56.

Grilli, G., Curtis, J., 2021. Encouraging pro-environmental behaviours: A review of methods and approaches. *Renewable and Sustainable Energy Reviews*, 135, 110039.

Guest, H., Lotze, H.K., Wallace, D., 2015. Youth and the sea: Ocean literacy in Nova Scotia, Canada. *Marine Policy*, 58, 98-107.

Haines-Young, R.H., Potschin, M.B., 2018. *Common International Classification of Ecosystem Services (CICES)*. V5.1 and Guidance on the Application of the Revised Structure. Fabis Consulting Ltd. Barton, UK, 2018.

Kamenidou, I.C., Mamalis, S.A., Pavlidis, S., Bara, E.Z.G., 2019. Segmenting the generation Z cohort university students based on sustainable food consumption behavior: A preliminary study. *Sustainability*, 11 (3), 837.

Karaman, D., Aykin, Ö., 2021. Determining holiday preferences of consumers within generations. *Journal of Tourism Intelligence and Smartness*, 4 (2), 186-200.

Kaufman, L., Rousseeuw, P.J., 2009. *Finding groups in data: an introduction to cluster analysis*. John Wiley & Sons.

Koulouri, P., Mogias, A., Mokos, M., Cheimonopoulou, M., Realdon, G. *et al.*, 2022. Ocean Literacy across the Mediterranean Sea basin: Evaluating Middle School Students' Knowledge, Attitudes, and Behaviour towards Ocean Sciences Issues. *Mediterranean Marine Science*, 23 (2), 289-301.

Krasilnikova, E.V., Kuznecova, S.N., 2021. On the formation of environmental consciousness among students of an agricultural university. In *IOP Conference Series: Earth and Environmental Science,* Vol. 723, No. 4, p. 042006. IOP Publishing.

Lin, Y.L., Wu, L.Y., Tsai, L.T., Chang, C.C., 2020. The beginning of marine sustainability: preliminary results of measuring students' marine knowledge and ocean literacy. *Sustainability*, 12 (17), 7115.

Lisboa, P.V., Gómez-Román, C., Guntín, L., Monteiro, A.P., 2024. Pro-environmental behavior, personality and emotional intelligence in adolescents: a systematic review. *Frontiers in Psychology*, 15, 1323098.

Liu, P., Teng, M., Han, C., 2020. How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. *Science of the total environment*, 728, 138126.

MacNeil, S., Hoover, C., Ostertag, J., Yumagulova, L., Glithero, L.D., 2021. Coming to terms with ocean literacy. *Canadian Journal of Environmental Education*, 24 (1), 233-252.

Mallick, D., Tsang, E.P.K., Lee, J.C.K., Cheang, C.C., 2023. Marine Environmental Knowledge and Attitudes among University Students in Hong Kong: An Application of the Ocean Literacy Framework. *International Journal of Environmental Research and Public Health*, 20 (6), 4785.

McKinley, E., Burdon, D., Shellock, R.J., 2023. The evolution of ocean literacy: A new framework for the United Nations Ocean Decade and beyond. *Marine Pollution Bulletin*, 186, 114467.

Mera, A.C., García-Gallego, J.M., 2023. Segmentation of young university students according to their environmental consciousness. A Spain and Mexico cross-cultural analysis. *Responsibility and Sustainability*, 8 (2), 19-34.

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*, 6, 396.

Mokos, M., Cheimonopoulou, M.T., Koulouri, P., Previati, M., Realdon, *et al.*, 2020. Mediterranean Sea literacy: when ocean literacy becomes region-specific. *Mediterranean Marine Science*, 21 (3), 592-598.

Nguyen, T.L., Huynh, M.K., Ho, N.N., Le, T.G.B., Doan, N.D.H., 2022. Factors affecting of environmental consciousness on green purchase intention: An empirical study of Generation Z in vietnam. *The Journal of Asian Finance, Economics and Business*, 9 (1), 333-343.

Paredes-Coral, E., Mokos, M., Vanreusel, A., Deprez, T., 2021. Mapping global research on ocean literacy: Implications for science, policy, and the Blue Economy. *Frontiers in Marine Science*, 8, 648492.

Payne, D.L., Marrero, M.E., Schoedinger, S.E., Halversen, C., 2022. The rise and fall of the tide: Ocean Literacy in the United States. *Mediterranean Marine Science*, 23 (2), 270-276.

Pazoto, C.E., Duarte, M.R., Silva, E.P., 2023. Promoting ocean literacy among students in Brazilian schools. *Marine Pollution Bulletin*, 197, 115690.

Plankis, B.J., Marrero, M.E., 2010. Recent Ocean Literacy Research in United States Public Schools: Results and Implications. *International Electronic Journal of Environmental Education*, 1 (1), 21-51.

Potts, T., Pita, C., O'Higgins, T., Mee, L., 2016. Who cares? European attitudes towards marine and coastal environments. *Marine Policy*, 72, 59-66.

Ramkissoon, H., Weiler, B., Smith, L.D.G., 2012. Place attachment and pro-environmental behaviour in national parks: The development of a conceptual framework. *Journal of Sustainable tourism*, 20 (2), 257-276.

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 on-*

line della Società geologica italiana, 49, 107-112.

Salazar-Sepúlveda, G., Vega-Muñoz, A., Contreras-Barraza, N., Castillo, D., Torres-Alcayaga, M. *et al.*, 2023. Bibliometric Analysis on Ocean Literacy Studies for Marine Conservation. *Water*, 15 (11), 2095.

Sánchez-Bravo, P., Chambers, E., Noguera-Artiaga, L., López-Lluch, D., Chambers E. IV *et al.*, 2020. Consumers' attitude towards the sustainability of different food categories. *Foods*, 9 (11), 1608.

Saulick, P., Bekaroo, G., Bokhoree, C., Beeharry, Y.D., 2024. Investigating pro-environmental behaviour among students: towards an integrated framework based on the transtheoretical model of behaviour change. *Environment, Development and Sustainability*, 26 (3), 6751-6780.

Steg, L., Vlek, C., 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of environmental psychology*, 29 (3), 309-317.

Stoll-Kleemann, S., 2019. Feasible Options for Behavior Change Toward More Effective Ocean Literacy: A Systematic Review. *Frontiers in Marine Science*, 6, 273.

Su, C.H., Tsai, C.H. Chen, M.H., Lv, W.Q., 2019. US sustainable food market generation Z consumer segments. *Sustainability*, 11 (13), 3607.

Tonin, S., 2018. Citizens' perspectives on marine protected areas as a governance strategy to effectively preserve marine ecosystem services and biodiversity. *Ecosystem services*, 34, 189-200.

Tran, K., Nguyen, T., Tran, Y., Nguyen, A., Luu, K. *et al.*, 2022. Eco-friendly fashion among generation Z: Mixed-methods study on price value image, customer fulfillment, and pro-environmental behavior. *Plos One*, 17 (8).

Upendra, S., Kaur, J., Barde, S., 2024. Pro-environmental practice among young population: A scoping review. *Public Health Nursing*, 41 (2), 245-254.

Wen, W.C., Lu, S.Y., 2013. Marine environmental protection knowledge, attitudes, behaviors, and curricular involvement of Taiwanese primary school students in senior grades. *Environmental Education Research*, 19 (5), 600-619.

Wyles, K.J., Ghilardi-Lopes, N.P., 2023. Citizen science as a pro-environmental behaviour and a catalyst for further behaviour change. In *Handbook on Pro-Environmental Behaviour Change* (pp. 320-334). Edward Elgar Publishing.

Yamane, T., Kaneko, S., 2021. Is the younger generation a driving force toward achieving the sustainable development goals? Survey experiments. *Journal of Cleaner Production*, 292, 125932.