Journal of Coastal Conservation (2024) 28:54
https://doi.org/10.1007/s11852-024-01056-z

Public perceptions of marine protected areas: an Italian study

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Received: 15 March 2023 / Revised: 19 May 2024 / Accepted: 1 June 2024 / Published online: 6 June 2024

Abstract
Marine Protected Areas (MPAs) have been gaining increasing importance in modern conditions, characterised by environmental challenges like climate change, loss of biodiversity, pollution and overexploitation of marine resources. MPAs represent an effective tool for marine conservation and the current policies aim to increase their number to protect 30% of our ocean by 2030. To obtain the achievements derived from MPAs, public engagement is paramount and requires an understanding of people's perceptions of MPAs. Italy has a relevant coastline affected by extreme anthropic pressures linked to tourism, fisheries and other industries, with several MPAs established over the years to mitigate these pressures. Through an online questionnaire distributed in 2014 and 2021 via snowball sampling, this study investigated public perceptions of MPAs in Italy. Despite the sampling limitations, the results showed a temporal change in environmental awareness and pro-environmental behaviours. This finding could be linked to the greater availability and accessibility of information related to the marine environment, joined with the growing urgency to face environmental challenges that involve different sectors of the population. Despite the improvements reached in public education, efforts should still be undertaken to engage citizens, especially in inland areas, to disseminate the impact of daily actions on the marine environment and to increase the acceptability of and efforts in MPAs' implementation and effective management.

Keywords Awareness · Pro-environmental behaviour · Willingness to pay · Marine conservation · Ecosystem services

Introduction

Since the industrial revolution, due to the increasing world population and the development of more efficient technologies, the marine environment has been experiencing degradation and depletion of its biodiversity and resources. This degradation has been exacerbated by ecological processes, such as climate change and ocean acidification, that represent direct consequences of extreme anthropic pressure (Bindoff et al. 2019; Reid et al. 2005). Functioning marine ecosystems have been allowing human activities such as fisheries, aquaculture, coastal tourism, maritime transport, port activities, shipbuilding and marine extraction of oil and gas, which are crucial for the local and global economy, reaching an overall value of 658€ billion in 2017 (EU 2020; Scholaert et al. 2020). The restoration and protection of the ocean's health would provide many benefits and services to the human population through elements known as ecosystem services (ES). According to the Ecosystem Millennium Assessment from 2005, these services are defined as "the benefits people obtain from ecosystems" (p. 40) and represent advantages from social, economic and environmental points of view. Provisioning, regulating, cultural and supporting ES are connected to human well-being, including health, personal security, enhanced livelihood, and cultural and political empowerment (Bennett et al. 2019; Galafassi et al. 2018). They can be categorised also as values: use values are the ones that can be directly exploited by humans, such as food, raw materials and recreational activities, while non-use values are more related to the ecological benefits

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provided by the ocean such as sequestration of CO2 and mitigation of climate change (Thomassin et al. 2010). The ocean's deterioration and the loss of these services are jeopardising environmental health and human activities (Floris et al. 2020). The growing awareness related to the environmental crisis increased the interest for ES, making it essential to put a realistic economic value on these services, demonstrating the economic savings facilitated by environmental protection, to deliver to policymakers and stakeholders for better management of natural resources and social-ecological systems (Arias-Arévalo et al. 2017).

The ocean has a central role in sustainable economic development and innovative services considered in the European blue growth strategy, involving new approaches such as marine spatial planning and ecosystem-based management, both aimed at better management and use of marine resources (Scholaert et al. 2020). Ecosystem-based management particularly engages and integrates perspectives of different stakeholders, including scientists, citizens and policymakers, while promoting a participatory, bottom-up approach aimed at social learning and collaboration (Ressurreição et al. 2012). The pivotal European maritime policy is represented by the Marine Strategy Framework Directive (MSFD), structured to fulfil the commitments undertaken during the World Summit on Sustainable Development and in the Convention on Biological Diversity held in Rio de Janeiro in 1995. The MSFD aimed to reach good environmental status in maritime and coastal areas under European jurisdiction by 2020 (EU 2020). The MSFD claimed the importance of the marine environment, acknowledging the overexploitation of its resources and the urgent need to conserve, monitor and restore European maritime areas (EU 2008).

As the ocean's role in human well-being has been increasingly understood, the United Nations (UN) proclaimed in 2017 the Decade of Ocean Science for Sustainable Development from 2021 to 2030, placing the ocean as the main character to globally achieve Sustainable Development Goals (SDGs), particularly SDG14: life below water. The Ocean Decade aims to achieve a clean, healthy, resilient, productive, predicted, safe, accessible, inspiring and engaging ocean. These results can be achieved only with the engagement of many different stakeholders and segments of the population to create new ideas, solutions, partnerships and applications (IOC-UNESCO 2021).

Marine protected areas (MPAs) have been gaining increasing importance and application since they represent an effective tool for conserving marine biodiversity and managing extractive and non-extractive activities (Thomassin et al. 2010). The establishment of MPAs is also suggested by the MSFD to address the anthropic impacts and reduce stress on the marine environment (EU 2008). The primary role of MPAs is nature conservation, but they generate great socio-economic benefits, including less considered but expanding sectors such as blue biotechnology, aquaculture and shipping (Scholaert et al. 2020). The MSFD acknowledges that both socio-economic and biological factors can influence the success of MPAs in meeting their ecological goals: conservation and restoration actions can be successful only if the ecological processes are understood as much as the general public mentality. Social and economic factors determine the use of resources by individuals, users and stakeholders, as well as improving the collaboration among the different segments for better management (Rees et al. 2015).

The comprehension of the relationship between the ocean and society and the link between biological conservation and socioeconomic development is the basis of setting up harmonised socio-ecological systems, representing the main purpose of sustainability science (Arias-Arévalo et al. 2017; Micheli and Niccolini 2013). The ocean, throughout historical and cultural paths, has been providing heritage elements that can be considered the intangible goods of the marine environment: through these components, the emotional and sentimental attachment to a place is facilitated, promoting the maintenance and preservation of the inestimable traditions that characterise several coastal communities worldwide (Petronela 2016). For MPAs' proper design and implementation, in parallel with the legislative and ecological aspects, the social point of view must be considered a key element for long-term success. To reach this objective, political will and leadership, public education and communication, stable and functional financial support, effective monitoring efforts and practical enforcement capabilities are required. The emphasis given to scientific knowledge places proportionally less importance on involving the public and policymakers throughout the MPA process (IUCN-WCPA 2008). For this reason, leadership should be considered as a process of social influence where the leader can promote voluntary participation of the actors involved in ocean protection, including the general public, to achieve environmental goals (Micheli and Niccolini 2013).

Physical distance and growing urbanisation, as well as modern lifestyle and general apathy towards marine issues, often cause a global disconnectedness from the ocean and a lack of public knowledge about marine areas; therefore, managing natural resources becomes more challenging if the target groups have a scarce understanding of the urgent need to protect them (Kelly et al. 2022; Perry et al. 2014). Social acceptability is another matter related to MPAs as it represents the measure of support, both from individuals and communities, towards regulations, and management tools, taking into account also the sociodemographic factors. This acceptability can be increased by educating the public

and different stakeholders regarding the benefits provided by MPAs, which are established for a threefold positive outcome: environmental, social and economic (Thomassin et al. 2010).

Public involvement and education initiatives are clear objectives pursued by the MSFD and SDG 14. These imply the active participation of citizens in ocean protection and the implementation of pro-environmental behaviours obtained through educational programmes and awareness-raising campaigns (EU 2020). In more recent times, the governance and protection of the marine environment evolved from primarily top-down and state-directed to being more engaging and participatory of the general public and local communities (McKinley and Fletcher 2010). The involvement of competent authorities, public institutions, stakeholders from diverse backgrounds and the general public can promote MPAs' implementation and enhance management plans by incorporating different needs and visions from the beginning of the process (Floris et al. 2020). The MARGov Project represents a successful example of eco-social dialogue and local communities' empowerment, making people active agents for the sustainable governance of coastal and marine areas (Vasconcelos et al. 2013).

Kollmuss and Agyeman (2002) defined pro-environmental behaviour as "a behaviour that consciously seeks to minimise the negative impact of one's actions on the natural and built world". This behaviour is determined by several factors, both external (e.g. sociodemographic features) and internal (e.g. motivation, values, attitudes, emotions, responsibilities, and priorities). Nevertheless, a gap is still present between environmental knowledge and pro-environmental behaviours. However, the general public has been pointing out how environmental education and information would generate a greater sense of individual marine citizenship (McKinley and Fletcher 2010). This is what Ocean Literacy (OL) aims to do as its core intention: it is defined as "the understanding of the ocean's influence on us and our influence on the ocean" (IOC-UNESCO et al., 2022; Kelly et al. 2022). Humans often show detachment between anthropic action and environmental impact (Thomassin et al. 2010). They normally do not connect their daily actions and behaviours with environmental issues, further caused by a lack of knowledge regarding marine environmental problems (McKinley and Fletcher 2010). OL's mission, promoted by the Ocean Decade enacted by Agenda 2030, is to raise awareness among citizens, stakeholders, public and private sectors, authorities and policymakers regarding the importance of restoring a healthy ocean, as well as developing knowledge, technologies and skills needed to face the future environmental challenges (EU 2020).

The main barriers to spreading OL initiatives were recently framed in social inequalities, diverse worldviews, evolving science, and sustainable development. Other pivotal issues related to the diffusion and effectiveness of OL campaigns can be found in youth-centred education, western-centric programmes, single-issue focus, the gap in technology availability and the disconnection between marine science, policy and society (Kelly et al. 2022). Previous examples of OL initiatives funded by European Horizon 2020, like Sea Change and ResponSEAble, have proved to be successful in public awareness and engagement (Scholaert et al. 2020). Further projects such as MARGov have been developed to build a more comprehensive and holistic view of MPAs' management (Vasconcelos et al. 2013). Since 2020, participatory research or citizen science and wide-reaching media campaigns have also proven their impact, especially on issues like marine plastic litter (Kelly et al. 2022). OL and outreach campaigns can influence people's attitudes and behaviours, increasing public engagement in MPAs' network development and management. Educational efforts can be broader and more general, to make the audience understand the main benefits of MPAs, or can be more specific to address particular and essential issues, such as sustainable use of specific resources, research, monitoring and enforcement (IUCN-WCPA 2008).

The support for conservation initiatives is influenced by the perceptions of ecological effectiveness, social impacts, and good governance: these three elements can be considered predictors of increased local support and engagement (Bennett et al. 2019). Governance joined with citizenship is a fundamental component of successful collaborative and constructive dialogue aimed at improving MPAs' management (Vasconcelos et al. 2013). Furthermore, people's perceptions regarding ecosystem health and resilience are thought to influence and promote environmentally conscious behaviours (Thomassin et al. 2010). Previous social studies have been conducted among MPA managers and community members: the main challenges to community engagement are identified in communication, involvement, representation, resource limitations, preconceptions, and staff expertise. Proactivity, and clear communication about MPAs' role while accounting for communities' concerns and improving inclusivity represent essential elements to increasing public interest and engagement (Davis et al. 2014).

Marine citizenship represents a further form of society's engagement and individual contribution that aims to develop good practices and policies for the protection of the ocean and the responsible management of its resources. Societal participation and education are key factors in improving marine conservation and achieving good marine governance, engaging citizens as policy actors and changemakers to reduce negative human impact through sustainable-oriented daily habits and environmental behavioural change (McKinley and Fletcher 2010). Civic engagement is

further intensified by the open communication and cooperation between scientists and the general public through citizen science projects (Kelly et al. 2020).

Aim of the study

The main aim of this study was to determine the non-scientific Italian community's perceptions of MPAs in Italy. Given the recent efforts of various stakeholders, to engage the wider public in marine conservation, MPA awareness and OL, a secondary aim of this study was to make a temporal comparison of perceptions to assess any positive change. Comprehending the past and current state of social attitudes, the potential correlating factors and the growing interest in environmental issues in recent years can give a useful insight to better develop and implement engagement campaigns. Enhancing society's knowledge about MPAs and the marine environment is a key step towards a bottom-up behavioural change that will allow the conservation of fragile marine ecosystems and the sustainable use of their resources and services in the long run.

The results of this research are relevant as an assessment of Aichi Biodiversity targets, which precisely describe as outcomes to reach by 2020 the increased awareness related to biodiversity and its services, the sustainable use of natural resources, the increased protection of biodiversity hotspots and, finally, participatory planning, knowledge management and capacity building integrated for the implementation of protected areas.

Case study: Italy

From an ecological point of view, the Mediterranean Sea is considered one of the main biodiversity hotspots and one of the most threatened marine ecosystems in the world due to the great anthropic pressures and climate change (Coll et al. 2010). The Mediterranean represents one of the most important maritime spaces on a global level; in this context, Italy has always played a central role from geographical, historical, cultural and economic points of view. Since the end of World War II, Italy's location has been strategic also for national and European policymaking, as well as for the relationships with other Mediterranean states (Colombo and Palm 2018). Italy is further relevant in terms of intangible cultural heritage (the social and economic value that should be attributed to the various elements that are specific to people's culture) related to the substantial extent of the coastline.

The Italian coastal territory is very wide, extending for about 7.914 km, covering 22% of the national territory and 6% of the European coastal area. Historically and culturally marked by high urbanisation and extensive use of marine resources (fishing, trade, tourism and such), a quarter of the Italian coast is affected by anthropogenic activities. At the national level, the areas with the highest population density are concentrated on the coast of the country, where highly urbanised areas can be found; tourism and commercial activities related to the sea (fishing, transport, ports) have led over time to a process of metropolisation of cities such as Genoa and Naples (ISTAT 2020b). Nevertheless, in 2017, Italy was among the European countries with the highest number of excellent marine-coastal waters (89.9%) (ISTAT 2020b).

The Italian Ministry of Ecological Transition (Ministero della Transizione Ecologica) defines MPAs as marine and coastal environments of great interest for their natural, geomorphological, physical, and biochemical characteristics, with a focus on marine and coastal flora and fauna, as well as for their scientific, ecological, cultural, historical, educational and economic importance. Italian MPAs (Fig. 1) can be categorised as fully established MPAs, marine retrieval areas, which present the features to be a candidate as official MPAs and specially protected areas of Mediterranean importance. These latter areas were established after the Barcelona Convention of 1978 concerning the issue of pollution in the Mediterranean (MiTE 2021). Furthermore, Italy presents other sites of relevance in terms of nature and biodiversity, even though they're not considered fully established MPAs. Of these areas, it is worth mentioning the Natura2000 Network, used as the main tool for biodiversity protection within the European Union.

To date, in Italy, there are 29 fully established MPAs and two underwater parks (Baia and Gaiola), that protect an overall surface of 228.000 hectares and 700 km of coastline. Furthermore, the Sanctuary of Cetaceans, co-implemented and co-managed by the Italian and French governments, can be accounted for. The Italian NGO Worldrise with several public and private partners is promoting the project "30×30 Italia", which aims to protect effectively 30% of the national maritime areas within 2030 (Worldrise 2020). The Mediterranean Sea is facing an increase in the number of MPAs, but it still suffering some growing and alarming issues. Among these are the decrease in fishery stocks due to overfishing and illegal fishing, the continuous entrance and adaptation of invasive species and, finally, the wrong waste management and increase of the litter issue, causing eutrophication (EU 2020; IOC-UNESCO 2021). Despite the clarity of the proposed environmental well-being objectives and priorities, the management of the Italian MPAs is still too ineffective. These management difficulties stem partly from the poor engagement of stakeholders and the general public, discouraged and disappointed by the restrictive regulations,

Fig. 1 Distribution of established Italian MPAs, according to the Italian Ministry of Environment and Energy Security. Source: https://www.mase.gov.it/pagina/aree-marine-istituite

but also from the lack of operational synergy between the various national and European MPAs (Petrelli 2021). Nevertheless, there are examples of good administration and effective partnership with society and stakeholders, such as the Tavolara-Punta Coda Cavallo and the Asinara Island MPAs (Floris et al. 2020; Micheli and Niccolini 2013).

Considering all the mentioned elements – geography, history, culture and such – Italy is a nation that should perceive a strong bond with the marine environment, laying the right foundations for marine citizenship and sea-friendly behaviours starting with an understanding of and support for MPAs' implementation (McKinley and Fletcher 2010). However, while many people live on the coastline, they often neglect their strong ties and effects on the marine environment (Perry et al. 2014). Additionally, many people may be unaware of the effects and efforts related to MPAs' implementation and management and they should be better engaged (Perry et al. 2014). This dilemma warrants an investigation of people's perceptions of MPAs in Italy, also as a way to evaluate the effectiveness of MPAs' education, OL and engagement campaigns nationwide.

Methods

This study was quantitative and descriptive and deployed an online questionnaire survey to collect data. The questionnaire (Annex 1) was developed and launched first in 2014 and then again in 2021. As attitudes and support towards conservation initiatives depend on several factors, including social norms, personal values, sociodemographic factors, dependence on resources, place attachment, institutions and governance (Bennett et al. 2019), the questionnaire aimed to investigate most of these facets. The questionnaire was composed of pre-coded closed questions and attitude-rating scales by using Likert scales, further applicable for analytical purposes (Ressurreição et al. 2012). The questions included background information, such as participants' sociodemographic data like origin, age, gender, educational level, occupation and monthly income. Only two questions investigated the factual knowledge of the respondents regarding MPAs ("Do you know which is the closest MPA to your municipality?" and "Can you name three MPAs that you know?") while the remaining questions assessed respondents' self-assessed knowledge, perceptions, behaviours and support towards MPAs. These questions required either Yes/No responses, single-choice responses, or asked the participants to agree to several statements using a four-point Likert scale (where 1 = Fully disagree and 5 = Fully agree).

Data collection was performed through an online questionnaire set on the platform QuestionPro and distributed via snowball sampling – as a random sample of individuals from a given finite population that recruits more participants (Goodman 1961) – using social media pages of the academic institution the first and last authors were affiliated with. Only respondents older than 18 years old were considered in this study. To avoid possible bias related to greater knowledge and interest regarding the investigated issues, all the respondents who had a job related to the sea (marine biologists, professional divers, fishermen and such) were excluded from the final analysis. To ensure that respondents did not complete the questionnaire more than once, and to avoid duplicate responses, each participant was given a unique identification code. The number of respondents who fully completed the questionnaire from the 2014 sample was $n = 632$ (reached over six months of sampling), while the number from the 2021 sample was $n = 261$ (reached over one and half months of sampling), giving a total number of $N = 893$ participants. The growing interest in environmental issues on a global level, the start of international initiatives promoted by the UN such as the Sustainable Development Goals for Agenda 2030 and the Ocean Decade, launched in 2021, as well as Italian national campaigns like "30 × 30 Italia" were taken into account to justify the temporal comparison.

The software Windows Excel was used to manage and organise the collected data, while the software TIBCO Statistica was used to perform statistical analysis (Pearson's Chi-square χ^2 test, Mann-Whitney U test, ANOVA, and Spearman rank order correlations r_s) on the single datasets or to compare the two datasets. To make the two samples clearer for comparison, the data were always considered as a percentage for both of them.

There are important limitations to this study that need to be considered in the interpretation of the findings and the design of future similar studies. The time extent of data collection was much shorter in 2021 than in 2014 due to time constraints; this made the 2014 sample twice as large as the 2021 sample. While the 2021 sample respondents were requested to answer all the questions, the participants from 2014 had the option of leaving the answers blank if they chose to. For this reason, the data from the 2014 sample did not always reach the full percentage of answers. Finally, while this study did not necessarily aim to obtain a sample representative of the Italian population, the snowball sampling method caused variability between the two samples regarding sociodemographic aspects, including age, gender, educational level, income and origin of the respondents. Nevertheless, statistical analysis showed few significant relationships between sociodemographic parameters and perceptions, allowing a comparison between the two samples to speculate the change in people's perception of MPAs and the marine environment in a seven-year time frame.

There are several factors related to the "snowball sampling method" that introduce bias and reduce the representativeness of the samples, but there are still many fields in which this methodology is applied. For future studies related to this research topic, the administration of the questionnaire to a specific group of respondents is recommended to make the study more significant (Kirchherr and Charles 2018).

Results

Sociodemographic profiles

Table 1 includes a summary of the sociodemographic data for the single samples. This research considered a total of $N = 893$ complete questionnaires, but the two samples were always considered separately. The sociodemographic profiles in the two samples were significantly different. In both samples, the majority of respondents were females, with a greater number of females participating in 2021. The 2014 sample was older than the one from 2021. Consequentially, educational level and monthly income were higher in the 2014 sample. In both cases, participants were mainly from inland municipalities rather than coastal ones: nevertheless, the people from the 2014 sample had a higher percentage of hobbies related to the sea compared with the 2021 sample.

Figure 2 represents the region of origin of the respondents. The sample from 2014 showed a higher intensity of response from the regions of Northern and Central Italy, while the sample from 2021 showed a higher intensity of response from the regions of North-Western and Central-Eastern Italy. The area that showed greater participation corresponded to the region from where the study was launched. Even though the sample from 2014 had greater participation in terms of the number of participants, the 2021 sample showed more homogeneity, with people from all Italian regions except one.

Perceptions of marine protected areas

As far as the question "Do you know what an MPA is?" is concerned, 86% of respondents from 2014 to 78% from 2021 claimed to know what an MPA is. For both cases, however, the majority of participants did not know which was the closest MPA to their municipality: a significant difference was found through the ANOVA test, with $p < 0.001$ (54% in 2014 and 69% in 2021 could not answer correctly this question). A qualitative analysis was carried out on the questions: "Do you know the closest MPA to your municipality?" and "Can you mention the names of three MPAs that you know?". Table 2 summarises the answers obtained from the two samples: a distinction was made among the actual MPAs (fully established and recognised

Table 1 Participants' sociodemographic profile ($N = 893$)

Variable	Categories	Sample 2014 ($n = 632$)	Sample 2021 ($n = 261$)	Significance test (2014 vs. 2021)
Gender (%)	Male	41.5	34.9	12.90*** [a]
	Female	43.5	63.9	
Age (y)	Mean	42.9	31.9	U = 36,604*** [b]
	Median	42.5	24.8	
	Min-max	18–89	18–77	
	SD	13.27	14.93	
	SE	0.575	0.931	
Proximity to the coast (%)	Yes	26.3	17.6	7.62** [a]
	No	73.7	82.4	
Hobby related to the sea (%)	Yes	51.7	44.4	18.48*** [a]
	No	33.7	55.5	
Educational level (%)	No formal education	0	1.5	46.04*** [a]
	High school diploma	22.5	42.9	
	Professional education	7.3	5.4	
	Bachelor's degree	12.8	19.5	
	Master's degree	33.5	26.1	
	PhD	9.3	4.2	
Monthly income range (%)	0-500€	12.3	42.9	85.48*** [a]
	501–1000€	6.6	5.7	
	1001–1500€	21.9	16.5	
	1501–2000€	19.6	13.4	
	2001–2500€	6.8	4.6	
	2501–3000€	5.4	3.8	
	> 3000€	6.2	3.4	

$p \leq 0.01$, *** $p \leq 0.001$

[a] Pearson's χ^2 test, [b] Mann-Whitney U test

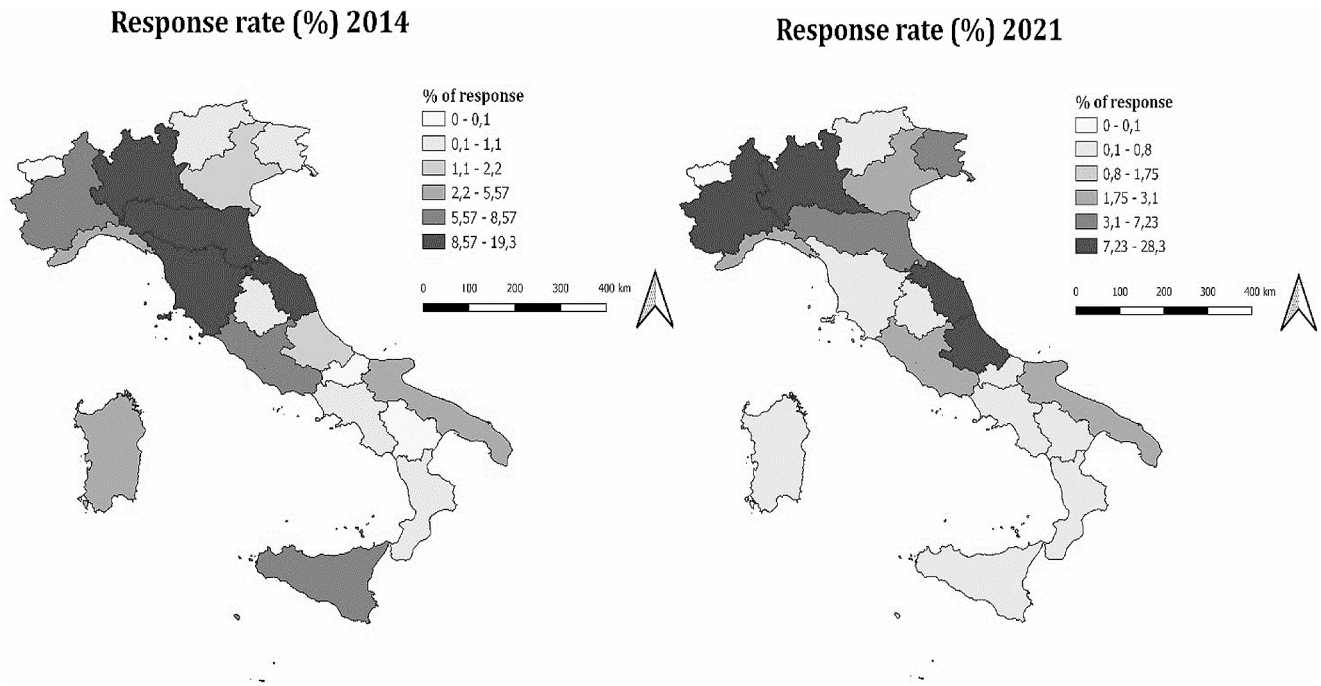

Fig. 2 Response rate of the participants in this study according to region ($N = 893$)

Table 2 Number of MPAs, protected areas and non-MPAs mentioned in the two samples. The five MPAs mostly cited in the two samples are also displayed

Sample	Number of MPAs mentioned	Number of protected areas (non-MPAs)	Number of non-MPAs mentioned	Top 5 MPAs mentioned
Sample 2014	28	21	26	Cinque Terre, Portofino, Tremiti, Asinara, Ustica
Sample 2021	29	12	12	Cinque Terre, Portofino, Tremiti, Miramare, Bergeggi

by the government), the protected areas non-MPAs (coastal areas, national parks and archipelagos that are categorised as protected areas and natural reserves but not as MPAs) and finally, the non-MPAs (sites, towns and areas of possible natural interest but not recognised to any level).

Figure 3 shows answers related to different levels of perception regarding MPAs. The statement "The ocean is important to you" aimed to investigate the personal emotional and experiential value given by the participants to the ocean: for this statement, a significant difference was found (ANOVA $p = 0.04$), where the sample from 2014 claimed to give more importance to the ocean than the sample from 2021. Nevertheless, there was a further significant difference (ANOVA $p = 0.01$) regarding the agreement on the implementation of new MPAs: the sample from 2021 showed a greater agreement. Three statements examined the personal perception related to MPAs as expensive, full of restrictions, or without any peculiar service offered compared with non-protected marine areas. The sample from 2021 perceived MPAs as more costly compared with the sample from 2014 ($p = 0.03$). The remaining questions explored the perceived importance of MPAs, both for the marine environment's health and the services provided to humans. Concerning a part of this group of statements, ANOVA and Pearson's χ^2 highlighted significant differences that are summarised in Table 3.

Figure 4 displays the respondents' contribution to and interest in marine environmental conservation through different behaviours. There were significant differences between the two samples for all the options proposed, except for "membership of environmental organisations / NGO" and "knowledge about Italian marine issues and biodiversity", where the two samples showed similar responses. The sample from 2021 showed greater attention and personal contribution to the protection of the marine environment compared with the sample from 2014. Participants were asked about their willingness to pay (WTP) a further cost to access and visit MPAs if the money was directly spent on the management and protection of the areas considered (Fig. 5). The 2021 sample showed a greater WTP compared with the 2014 sample (ANOVA $p < 0.001$). A set of questions aimed at understanding the perceived individual and collective responsibility towards the marine environment and its conservation (Fig. 6). Here, the sample from 2021 showed an

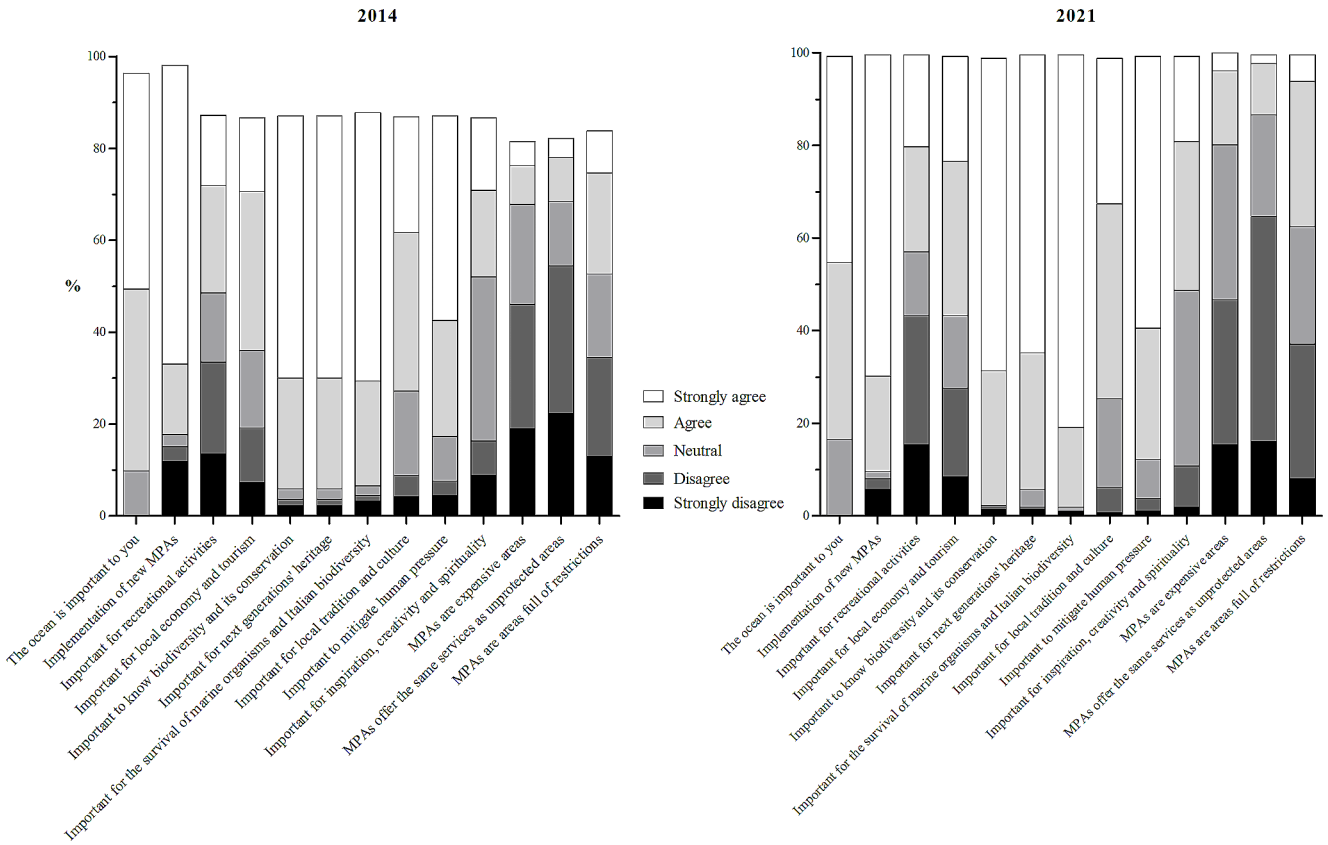

Fig. 3 Response frequencies of participants' perceptions of MPAs ($N = 893$)

Table 3 Significant differences concerning statements exploring the self-assessed knowledge regarding the importance of MPAs ($p < 0.05$)

	Sample 2014	Sample 2021	p
	Mean[a]	Mean[a]	
MPAs are important for the survival of marine organisms and Italian biodiversity	4.51	4.76	0.000022
MPAs are important to promote local tradition and culture	3.83	3.99	0.030378
MPAs are important to mitigate human pressure on marine ecosystems	4.17	4.42	0.001698
MPAs are important for inspiration, creativity and spirituality	3.29	3.57	0.000959

[a] The means are extracted from a likert scale with 1 = strongly disagree, 2 = disagree, 3 = 4 = agree, 5 = strongly agree

increased feeling of personal and collective responsibility compared with the sample from 2014. Finally, participants were asked to point out the main sources of information they used to get acquainted with the marine environment, its state of the art, and its main challenges (Fig. 7). The top three sources of information were the internet, magazines, TV and radio for 2014; and the internet, social networks, TV and radio for 2021.

Significant correlations

Spearman rank order correlations (r_s) were calculated, considering the cumulative answers obtained from both samples, to better understand the unique relationships between the variables possibly related to the significant differences found. There were few significant correlations between sociodemographic variables and perceptions. Respondents with higher incomes visited MPAs more often ($r_s = 0.19$). People living in coastal areas tended to have a hobby related to the seaside, agree with the implementation of new MPAs, and show a greater WTP for visiting MPAs ($0.16 < r_s < 0.17$). Younger generations relied more on European governance to take care of the marine environment ($r_s = 0.20$), and men, younger generations, and lower educational levels (linked to age) relied more on environmental groups ($0.15 < r_s < 0.18$).

Concerning the knowledge and importance of MPAs, including their effect and the services they provide, several significant correlations were found between variables. The perceived importance of MPAs for recreation and the local economy and tourism were positively correlated ($r_s = 0.56$). Participants who considered MPAs as expensive also perceived them as places full of restrictions ($r_s = 0.35$).

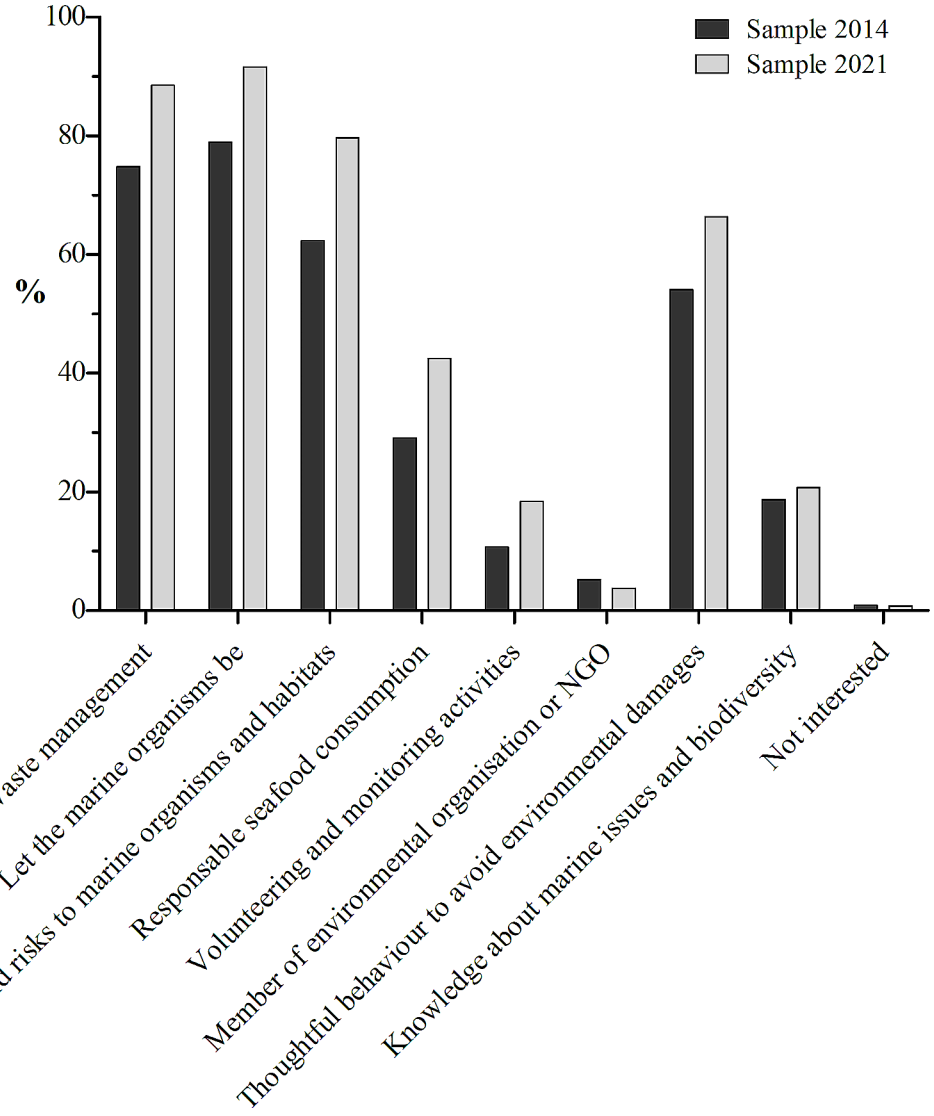

Fig. 4 Response frequencies of participants' contribution to and interest in marine environmental conservation ($N = 893$)

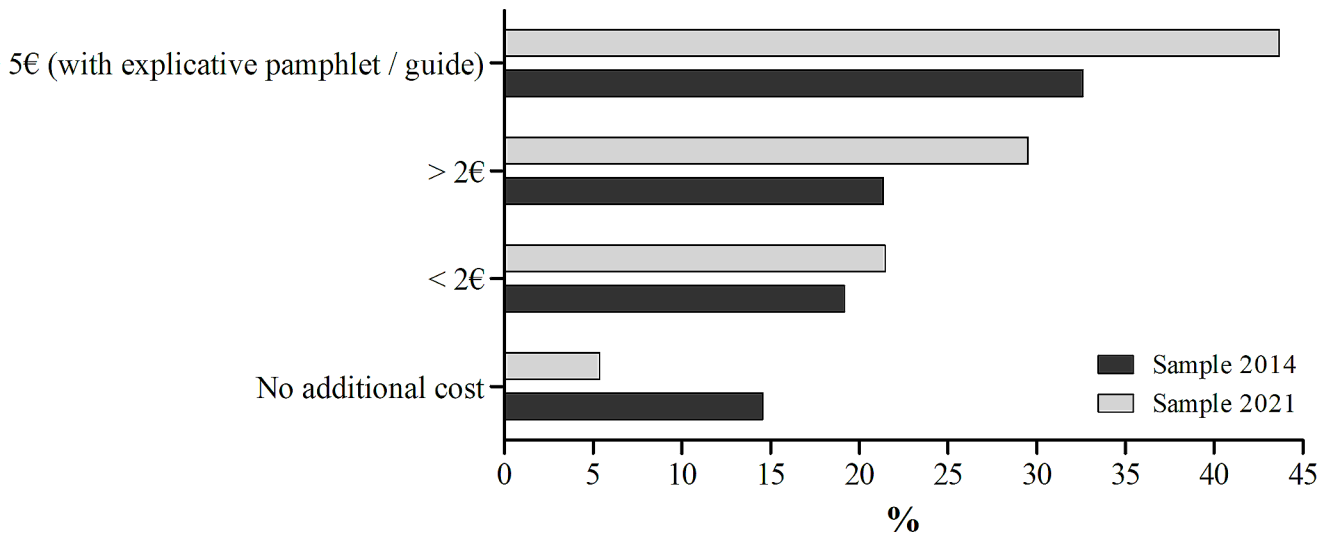

Fig. 5 Participants' willingness to pay (WTP) a further cost to access and visit MPAs if the money was directly spent on the management and protection of the areas considered ($N = 893$)

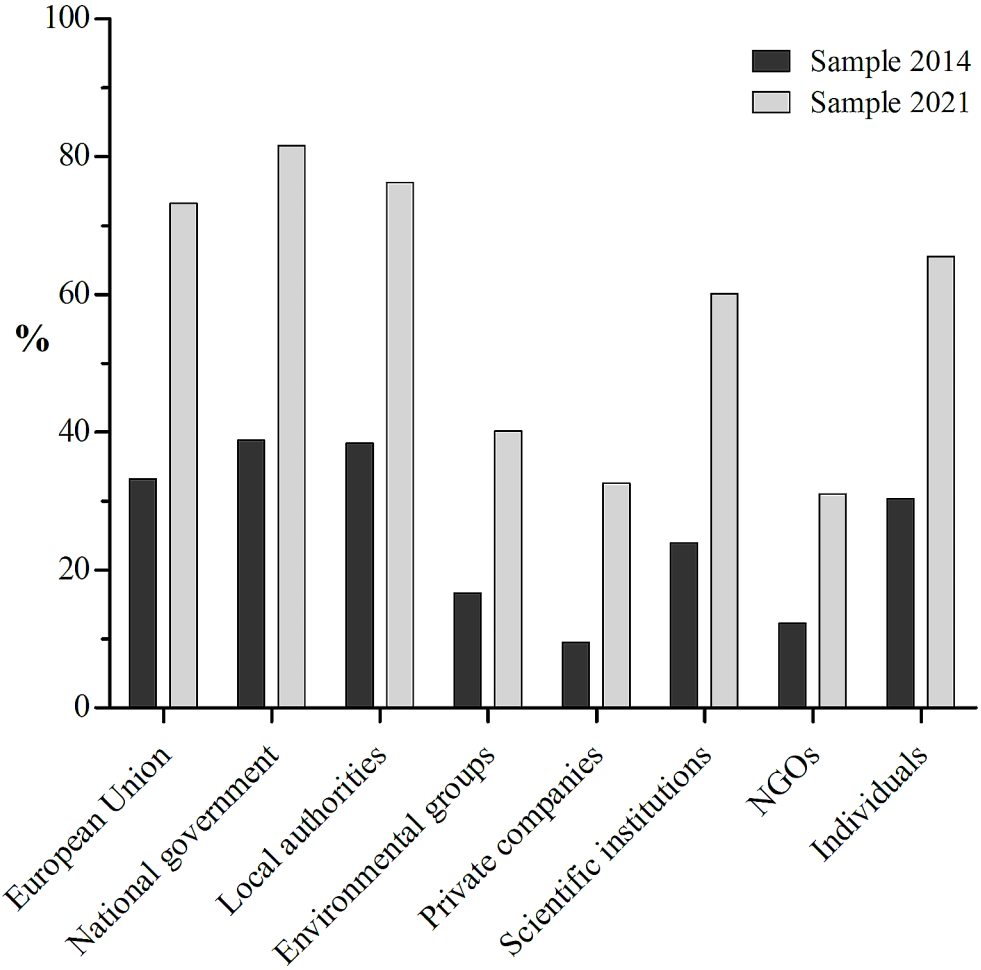

Fig. 6 Participants' perceived individual and collective responsibility towards the marine environment and its conservation ($N = 893$)

Perceptions of the ecological and societal effects of MPAs (including the importance of MPAs for marine biodiversity, the conservation of the ecosystems, the knowledge of environmental issues, cultural heritage, and wellbeing) showed strong positive correlations with one another ($0.28 < r_s < 0.86$), and with the agreement with the implementation of new MPAs ($0.20 < r_s < 0.27$).

Regarding the personal behaviours carried out to safeguard and care for the marine environment, respondents who claimed to manage their waste tended to let the marine organisms be in their environment ($r_s = 0.51$) and avoid risks towards them and their habitats ($r_s = 0.35$). These elements were linked also to positive values regarding thoughtful behaviours in the sea ($r_s = 0.28$ and 0.20) and responsible seafood consumption ($r_s = 0.17$ and 0.18). Responsible seafood consumption showed positive correlations with personal engagement in volunteering and monitoring activities and knowledge regarding the issues faced by the Italian marine ecosystem and habitats ($r_s = 0.17$ and 0.18).

Concerning the question "Who should take care of the marine environment?", all the options showed positive correlations among each other ($0.30 < r_s < 0.62$). Specifically, the entities for which the strongest positive correlations were shown, highlighted the need for coordination between national governments and local authorities ($r_s = 0.62$), as well as between national governments and the European Union ($r_s = 0.56$).

Discussion

Sociodemographic profiles

Table 1 was compared with data provided by the Italian National Institute of Statistics (ISTAT 2021). It can be claimed that the sample from 2014 is more representative of the actual Italian population from several points of view, compared with the sample from 2021. From the 2014 sample, the ratio of males and females is more indicative and in line with the actual percentages of Italians (in Italy, the female population is slightly larger than the men). The major engagement of female respondents in both samples could be explained by the greatest participation that women have been showing in social studies, as well as in participatory

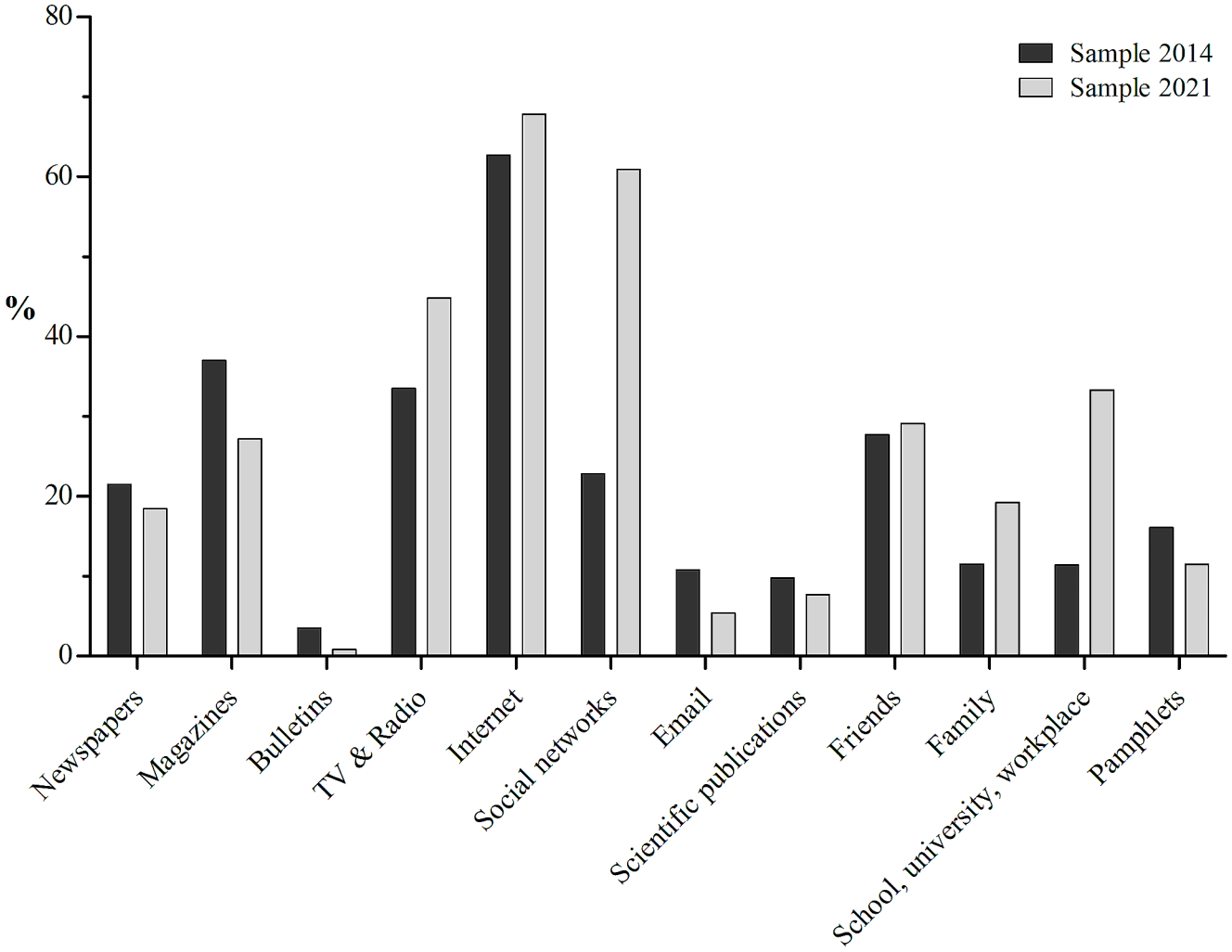

Fig. 7 Main sources of information the participants used to get acquainted with the marine environment, its state of the art, and its main challenges ($N = 893$)

citizenship and active commitment to political, social, and environmental issues (Hahn et al. 2007; IUCN 2015; Kawgan-Kagan 2020). Regarding the average age of the respondents, the 2014 sample also proves to be more in line with that of the real population in 2021 (ISTAT 2021).

As far as the proximity to the coast is concerned, again the sample of 2014 is more representative of the actual Italian population distribution: in the coastal municipalities resides 28.3% of the Italian population and the density levels are on average higher than those of non-coastal municipalities (ISTAT 2020a). Regarding the educational level of the respondents, the two samples showed dissimilarities that reflect the differences in the age of the participants. The respondents from both samples also showed a higher educational level compared with the general Italian population (ISTAT 2021). The higher age and level of education of the sample from 2014 can also be related to their higher monthly income compared with the 2021 sample, which was overall younger. Concerning the distribution of answered questionnaires displayed in Fig. 2, it was already mentioned that the region with the highest rates of answers coincided with the origin of the survey. Response rates, however, are in agreement with the Italian population density, which appears to be higher in the North-West area of the country (ISTAT 2020a).

Perceptions of marine protected areas

MPAs distribution

The two most popular Italian MPAs were the ones closer to the regions of Piemonte and Lombardia (Cinque Terre and Portofino MPAs), partly in line with the response rate shown in Fig. 2. Even though the region Puglia did not provide many answered questionnaires, the Tremiti Islands appeared to be the third most popular MPA, and this could be linked

to several elements. As criteria to better understand which factors could increase an MPA's popularity, four main elements were considered as possibly influencing its relevance: the year of the MPA's establishment, size of the MPA, availability of information through updated websites and social media accounts, and engaging activities for society such as education and citizen science programmes (Table 4). The sample from 2021 appeared to be more educated and aware of Italian MPAs, mentioning the names of more MPAs and less unrelated locations (such as Natura2000 sites, MAB sites or other places relevant for their natural importance). It frequently happens that people visit or stay within an MPA without even knowing; tourists can be attracted to a place due to the beauty of the sea landscape or due to the presence of cultural sites, unaware of actually being in an MPA (D'Anna et al. 2016).

Awareness of MPAs

Perceptions of the ecological aspects and benefits of MPAs were more positive in 2021 compared with the 2014 sample. Even if the sociodemographic profile of the 2021 sample represents younger, less educated, and poorer individuals, awareness of MPAs as important sites for biodiversity, culture, mitigation of human impact, and recreational aspects increased since 2014, suggesting that sensitivity and knowledge towards these topics have grown in a seven-year timeframe. This could be explained also due to young-centric ocean learning (Kelly et al. 2022) aimed to engage the younger generations in sustainability matters since they are going to face the greater consequences of climate change and environmental deterioration. As pointed out by McKinley and Fletcher (2010) and IOC-UNESCO et al. (2022), marine education should be implemented in schools' curricula, using kids as ambassadors to spread environmental awareness to the older components of their families. On the other hand, this could cause a generational gap and a "blame culture" process, discouraging a greater involvement of the whole community in marine management (McKinley and Fletcher 2010).

Proximity to the coast

This study partly confirms previous findings (Perry et al. 2014) related to greater support for MPAs from coastal citizens rather than inland ones. This support can be related also to place attachment: people who live closer to the coast have more opportunities to create an emotional, spiritual, and cultural bond with the marine ecosystem, increasing the interest in its protection and conservation. Most people have short-term or periodic experiences with the ocean; furthermore, the modern lifestyle causes individuals to spend more time indoors or in urbanised outdoor areas, making the emotional bond with nature and place attachment harder to create (Kelly et al. 2022). The results of this study, however, suggest that knowledge and sustainable behaviours do not necessarily change with proximity to the coast, meaning that deeper education programmes are needed equally on the national territory (Perry et al. 2014). Creating deeper emotional and physical connections with the marine ecosystem – as it happens to coastal communities – can bring individuals to behave more thoughtfully towards the ocean (Kelly et al. 2022). Personal and emotional attachment has been proven to be an essential factor in generating marine citizenship and pro-environmental behaviours (Vasconcelos et al. 2013). The coastal population has greater accessibility to the marine environment and participatory projects such as citizen science initiatives (Garcia-Soto et al. 2021). The active engagement of local communities daily, involving a good amount of people with cost-effective projects can be considered a win-win from a research and social involvement point of view (Kelly et al. 2020). At the same time, local communities should be preserved and kept in mind by the different actors involved in MPA governance: while the tourism industry can benefit from MPAs' implementation, other population segments such as fishermen, and younger and older generations can perceive a feeling of "dispossession", creating also prohibitive living costs for the locals (D'Anna et al. 2016). People with greater knowledge about MPAs show more thoughtful and respectful behaviours towards the marine ecosystem, taking more responsibility both as collective and individual actions. It can be claimed that ecosystem-based management, starting from a local context, hence in coastal areas, can trigger coordinated and effective action on a greater scale for sea protection.

Ecosystem services of MPAs

Many people still perceive MPAs as abstract for human use (for example, the samples showed neutral opinions regarding recreational services). As pointed out by Benetti and Langemeyer (2021), ES are still not explicitly considered and environmental protection is still primarily driven by an exclusionary model, separating people from nature. Understandably, MPAs are thought to be more related to environmental protection, while in reality MPAs were established to preserve ES, and consequently to benefit people from physical, psychological, spiritual and cultural points of view. When the general public is properly educated regarding what ES are and how MPAs can preserve them, people tend to agree more with MPAs and comply more with their regulations (Floris et al. 2020). The 2021 data showed an improvement in perception and understanding of MPAs' role compared with the 2014 sample, despite

Table 4 Year of institution (considering that a longer establishment can affect the popularity of the considered MPA); the extent (in hectares and coastal meters) of the considered MPA can affect the coastal and maritime users, influencing their knowledge about it; the presence of a clear and accessible website can help an MPA to become more accessible and popular; the presence of the MPA on social media platforms (including Instagram[1], Facebook[2], Youtube[3], Twitter[4]) can highly influence MPA's popularity, correlated with the fact that they represent the main sources of information; finally, proposing activities able to engage the citizens and the wider public can highly affect MPAs popularity (guided tours, citizen science programs, ecotourism, interactive and/or outdoor activities and such). The information displayed is retrieved from MiTE (2021a) and the different MPAs' websites

Marine Protected Area	Year of institution	Extent (ha - coastal m)	Official website	Social Media Account	Engaging activities for citizens
Capo Caccia – Isola Piana	2002	2.631 ha 3.614 m	Yes	Yes [1,2]	Yes: interactive mobile app, citizen science for ESV**
Capo Carbonara	1998	1.460 ha 3.421 m	Yes	Yes [1,2,3,4]	Yes: guided tours, EE, research
Capo Gallo – Isola delle Femmine	2002	2.173 ha 1.612 m	Yes	No	Yes: CS initiatives, accessible video/ photo gallery
Capo Milazzo	2018	755 ha 5.670 m	Yes	Yes [1,2,3]	Yes: Museo del Mare (MuMa), Milazzo
Capo Rizzuto	1991	14.721 ha 42.150 m	Yes	No	No
Capo Testa – Punta Falcone	2018	5.142 ha 41.700 m	Yes	No	Yes*
Cinque Terre	1997	4.554 ha 19.300	Yes	Yes	Yes: Center of Environmental Education (CEA)
Costa degli Infreschi e della Massetta	2009	2.332 ha 13.808 m	Yes	Yes [1,2,3]	Yes: Museo del Paesaggio e della Natura
Isole Egadi	1991	53.992 ha 73.992 m	Yes	Yes [1,2,3]	Yes: interactive app*, rescue center for marine turtles, CS
Isola dell'Asinara	2002	10.732 ha 79.635 m	Yes	No	No
Isola di Bergeggi	2007	203 ha 1.923 m	Yes	Yes [1,2]	Yes**: CS, excursions
Isola di Ustica	1986	15.951 ha 14.452 m	Yes	No	Yes*
Isola di Ventotene e Santo Stefano	1997	2.799 ha 9.836 m	Yes	No	No
Isole Ciclopi	1989	628 ha 6.236 m	Yes	Yes [1,2]	Yes: EE, tours and excursions
Isole Pelagie	2002	4.136 ha 46.279 m	Yes	Yes [1,3]	Yes: EE, ecotourism
Isole Tremiti	1989	1.466 ha 20.410 m	Yes	No*	No
Miramare	1986	30 ha 1.104 m	Yes	Yes [1,2,3,4]	Yes: EE, scientific communication, ecotourism
Penisola del Sinis – Isola di Mal di Ventre	1997	26.703 ha 30.080 m	Yes	No	No
Plemmirio	2004	2.429 ha 14.348 m	Yes	Yes [2]	Yes: interactive app, CS, ecotourism and excursions
Porto Cesareo	1997	16.654 ha 32.707 m	Yes	Yes [1,2,3]	Yes: interactive app*, CS, EE
Portofino	1998	346 ha 13.893 m	Yes	Yes [1,2,3,4]	Yes: EE, ecotourism, excursions, CS

Table 4 (continued)

Marine Protected Area	Year of institution	Extent (ha - coastal m)	Official website	Social Media Account	Engaging activities for citizens
Punta Campanella	1997	1.539 ha 31.433 m	Yes	Yes [1,2,3]	Yes: interactive app*, volunteer programs, Center of Environmental Education (CEA)
Regno di Nettuno	2007	11.256 ha 52.386 m	Yes	Yes [1,2,3]	Yes: EE, CS
Santa Maria di Castellabate	2009	7.095 ha 19.257 m	Yes	Yes [1,2,3]	Yes: EE, interactive contents (e.g. VR)
Secche della Meloria	2009	9.372 ha 208 m	Yes	Yes [2]	Yes: EE, CS
Secche di Tor Paterno	2000	1.387 ha 0 m	Yes	No	No
Tavolara – Punta Coda Cavallo	1997	15.357 ha 76.094	Yes	Yes [2]	Yes: EE, exhibition, interactive survey
Torre del Cerrano	2009	3.430 ha 7.103 m	Yes	Yes [1,2,3,4]	Yes: EE, museums, volunteering programs
Torre Guaceto	1991	2.227 ha 8.405 m	Yes	Yes [1,2,4]	Yes: EE, ecotourism
Parco Sommerso di Baia (NA)	2002	177 ha 3.718 m	Yes	Yes [2]	Yes: submerged archaeological museum
Parco Sommerso di Gaiola (NA)	2002	41 ha 1.985 m	Yes	Yes [2]	Yes: EE, free initiatives
Santuario dei Cetacei	1991	2.557.258 ha	Yes	Yes [1,2,3,4]	Yes: EE, CS, volunteering programs

Instagram[1], Facebook[2], Youtube[3], Twitter[4]

No* = "unofficial" profiles on IG and FB.

Yes* = only mentioned on the website, Yes** = under payment

Interactive app*: network through the same app (BlueDiscovery, promoted by Blue Thread)

the sociodemographic differences between the two samples. This improvement can be linked to an increase in general engagement and awareness of the importance of the marine environment linked to OL and citizen science initiatives. OL and awareness campaigns could be widely applied, both in coastal and inland areas, to increase the understanding of MPAs and the importance of preserving marine ecosystems: OL would be able to build a narrative about the biological and social significance of these areas, enhancing the emotional and physical engagement of the public (Perry et al. 2014). Many people have increased their attention regarding marine issues, especially topics such as plastic pollution: no other environmental issue has had so much resonance as plastics, as it is clearly and directly perceived by any coastal user, affecting the experience related to the ocean. As living in coastal areas tends to promote marine citizenship, further efforts should be made to acquaint inland citizens with the same asset, promoting practical and experiential learning possibilities (Kelly et al. 2022; McKinley and Fletcher 2010).

Comparison with previous literature

The results of this research show some points of contrast compared with previous studies. Thomassin et al. (2010) found that people who lived closer to MPAs had less social acceptability towards them as they would have been the most affected by the restrictions. Top-down management can also exacerbate the perception of MPAs as places full of limitations, promoting the interests of few compared with the possible collective benefits (D'Anna et al. 2016). In this research, people who visited MPAs more frequently and who had a hobby related to the sea were more aware of the importance of protecting the marine environment and they were keener on the implementation of new MPAs. Social acceptability and insights are fundamental aspects of a successful and functioning network of MPAs. It is also worth mentioning how the different users and stakeholders of MPAs often live in contrast within the protected site if proper and integrated management is lacking, making the conservation efforts less effective (Micheli and Niccolini 2013). The results obtained confirm other previous

considerations: Thomassin et al. (2010) highlighted how people with a "heritage view", as the importance of natural resources maintenance for future generations, show stronger agreement with MPAs. In the present study, people with this view showed considerable knowledge about the use and non-use values of MPAs, greater agreement with MPAs' implementation and increased WTP that measure also the value of preserving the environment for future generations.

The results of this study showed an increase from 2014 to 2021 in people's WTP to access MPAs, which represents a greater agreement with MPA implementation. The main reason behind this contrast could be traced back to a general lack of trust in Italian authorities and institutions. This could be linked also to lower compliance with MPAs' rules in Italy; the same can likely happen in other countries where governance is considered less reliable (e.g. developing countries). As MPAs' regulations mainly affect the daily users and involved stakeholders, their involvement in management should be promoted to increase compliance (Micheli and Niccolini 2013). WTP is an indicator that can be used for ecosystem monetary valuation: ecological benefits can be more tangible if they are related to some sort of economic value (Thomassin et al. 2010). An element that is considered in the ES valuation process is the touristic attraction to a site, which increases the value of the related components, such as real estate, and recreational and leisure activities (D'Anna et al. 2016). Most of the ES valuation focuses on marketable products, such as raw materials and fisheries, but the economic valuation must take into account also the regulating and supporting ES provided by biodiversity and habitat conservation (Floris et al. 2020). Similarly, the cultural and historical aspects and the emotional bonds of people to the marine environment – also known as "intangible cultural heritage" – should be evaluated (Petronela 2016). The deterioration of marine ES and the impact on several human activities can highly affect global socio-economic and environmental conditions, a reason why they should be accounted for in management and decision-making plans (Floris et al. 2020). A proper monetary ES valuation process is needed and can be carried out by assessing the value and use of different human activities and natural elements – such as habitats, species and related ES – in specific marine areas (Floris et al. 2020; Rees et al. 2015). At the same time, Arias-Arévalo (2017) points out that focusing on the monetary valuation of all these services could easily be a double-edged weapon, as it would highlight the instrumental and anthropocentric point of view rather than the intrinsic and relational values of these services. Ecological benefits such as biodiversity conservation can increment the local economy, promoting active participation from different stakeholders involved in MPA management, and making natural protection more effective (D'Anna et al. 2016). As pointed out by Micheli and Niccolini (2013), MPAs' lack of effectiveness is often related to the absence of proper human and economic resources: a punctual ES valuation, as well as public funding through tolls such as an additional tax to visit MPAs (as suggested in the questionnaire), would certainly improve MPAs' functioning.

Ascription of responsability

As the results show, from 2014 to 2021 there was an increase in individual and collective responsibility toward the protection of the marine ecosystem. Part of the degradation of the marine environment can be attributed to the collective daily impact of individuals' choices and lifestyles. People often claim their lack of knowledge about the link between their actions and environmental impacts, but at the same time there is an awareness that daily individual action can be decisive in shaping pro-environmental attitudes (McKinley and Fletcher 2010): this is why an ascription of individual responsibility towards the health of the ocean should be hailed as much as the call for collective responsibility and coordinated action, working with a bottom-up and top-down approach in parallel. A collective effort and a shared vision of conservation are necessary to achieve responsible and sustainable development. The limited awareness and absence of real support from local communities and entrepreneurs represent a problem to MPAs' efficacy (Micheli and Niccolini 2013). Even though McKinley and Fletcher (2010), as well as the sample from 2014 research, showed how individuals agree on taking an active role in marine conservation and governance, there was a relevant increase in the sample from 2021. Marine conservation policies are eventually the policymakers' responsibility, but there is an urgent need for more effective implementation and more transparency in the political process (McKinley and Fletcher 2010). Petrelli (2021) highlights, as one of the reasons for general dissatisfaction, the actions taken by some ministerial commissioners managing MPAs and, more generally, the sought delays in appointments to senior roles in the administration. The greater participation and cooperation among stakeholders, promoting conflict resolution and clarity among the different sectors involved, has been demonstrated to be effective in improving MPA management in recent years (D'Anna et al. 2016). As provided by the example of the MPA of Tavolara-Punta Coda Cavallo, good leadership joined with the identification and involvement of key stakeholders are crucial elements for MPAs' positive outcomes (Vasconcelos et al. 2013) – especially in areas with extreme human pressure as the Mediterranean Sea. Tavolara-Punta Coda Cavallo, Asinara Island and Torre Guaceto MPAs show a multi-actor governance framework, with the active involvement of local communities,

to achieve the socio-economic and environmental benefits provided by MPAs (Floris et al. 2020; Micheli and Niccolini 2013). Environmental education applied to essential Mediterranean industries such as the tourism sector (including scuba diving, recreational fishing, water sports and such) and fisheries (with specific restrictions and privileges) is a key element toward more ocean-friendly behaviours and long-term benefits. The 2021 sample displayed indeed an increased engagement and feeling of responsibility – both individual and collective – towards the conservation of the marine environment. Previous research (Ressurreição et al. 2012) showed how people trust scientific institutions and NGOs for marine environmental protection, while there was little trust towards EU and local government roles, still perceived as top-down mechanisms with little regard for local realities. In this research, in parallel, local, national and European governances represented the public's shared thought of the urgent need for cooperation. The importance of effective communication and education about ocean issues targeting policymakers is a key element for achieving the implementation of effective environmental policies, including the enlargement of protected areas and the monitoring of their effectiveness. Better communication between policymakers and citizens is also needed, encouraging governance to listen to people's voices and to take practical environmental action (Kelly et al. 2022). Improved communication and cooperation among the different scales of governance (local, national and international) are also required to enhance the current policies while promoting marine citizenship and a more integrated sense of responsibility (McKinley and Fletcher 2010). A sustainable administration can be reached only by achieving an effective and intensified eco-social dialogue (Vasconcelos et al. 2013).

Pro-environmental behaviours

The participants were questioned about the management of their waste in marine areas: marine litter and pollution are among the issues that get the most public attention as they leverage the visual perception that has a direct impact on people's sensitivity (e.g. marine plastic pollution). For this reason, many environmental education campaigns and conservation initiatives promoted by authorities and NGOs tend to focus on cleaning activities while raising awareness of the consequences of people's behaviours and promoting a responsible reaction (Ressurreição et al. 2012). Considering how humans can relate more to different matters when directly connected through their senses, educational and awareness campaigns could be shaped and developed to stimulate the transfer of knowledge through interactive content, aimed at displaying a clear depiction of a healthy marine ecosystem provided by its protection through MPAs: previous studies showed how positive and alternative images are more likely to make emerge transformative strategies rather than fatalist and doomed representations of the future. An arts-based and participatory approach supported by scientific and transdisciplinary knowledge could represent the key to generating new ways of seeing, feeling and interpreting environmental issues and creating new emotional-social-experiential sensibility and knowledge towards these matters (Galafassi et al. 2018). The visualisation of the ocean and life within it, demonstrating the visible impacts of human activities, can support citizen awareness and ultimately influence protection (Davis et al. 2014). Today's technologies are effective learning tools: the use of educational videos and games, even available on most smartphones, improves the understanding of the causes and impacts of marine issues (Kelly et al. 2022). This element should be further considered regarding the age gap between the two samples of this research: the younger generations (such as Millennials and Generation X) are keener on the daily use of practical and handy devices.

Citizen science programmes further promote individuals' engagement and responsibility, empowering them practically and actively towards marine protection (Kelly et al. 2020). This kind of project can be applied at a local scale and later implemented in bigger datasets, on regional, national and international levels, allowing the use of collected data for scientific research. Citizen science has proven to be effective in marine conservation, especially in collecting data and monitoring biodiversity and restoration progress in MPAs (Kelly et al. 2020). Regarding the development of successful educational tools, mere informational campaigns related to sustainability have often proved to be ineffective (Kollmuss and Agyeman 2002). Similarly, virtual experiences of nature do not induce the same sensory stimulations and responses as real experiences, affecting the creation of an emotional bond, necessary to trigger pro-environmental behaviours (Kelly et al. 2022). This matter could be addressed by promoting experiential activities in both private and public sectors and developing targeted programmes and immersive actions tailored to the different population segments.

The sample from 2021 showed a greater engagement in the topic of responsible food consumption compared with the sample from 2014. As the average age of respondents from the 2021 research corresponds to the generation of Millennials, it could be thought that this generation might be more sensitive to the food industry problems. This is opposed to previous findings, where the Millennials generation was found more sensitive and aware of environmental sustainability but was specifically lacking action towards sustainable food consumption (Schoolman et al. 2016). This element can be further explained by the usual

higher prices of sustainable food products compared with the mass products normally available in supermarkets, preventing younger individuals from purchasing sustainable seafood. Previous literature suggests that even if people are aware of the ecological benefits related to environmentally friendly products, they are reluctant to change their eating and purchasing habits (Skallerud et al. 2021). Marketing strategies (such as eco-labels) depend on the consumers' demand: hence, there is a need to promote the consumption of less endangered species, obtained through sustainable fishing techniques, according to the seasonality, the size and the origin of the final product. It can be highlighted, once again, the need for OL to increase awareness regarding the link between biodiversity loss and human consumption choices (Ressurreição et al. 2012). The food industry represents a wicked problem of our society, underlying most of the sustainability issues on the planet: the ways food is currently produced, processed, distributed, consumed and wasted daily cause inequities and injustices both from a social and ecological point of view (Glover and Sumberg 2020). Consequentially, this matter ought to be addressed also in relation to population growth while considering the "planetary boundaries". In Italy, food is a pivotal part of tradition, culture and society; hence, changing eating habits and consumer choices might be especially challenging but determining. As successful previous strategies demonstrated, targeting a specific behaviour that must be modified makes the related marketing strategy more effective and suited to shape a social change, filling the gap between knowledge and pro-environmental action (Kollmuss and Agyeman 2002).

Conclusion

This research aimed to contribute to the research gap related to the role of people's knowledge, perceptions and feelings toward MPAs, understanding and assessing the baseline of the ocean literacy of the Italian general public as an indispensable element for the support of already established MPAs and the implementation of further community-supported MPAs. Specifically, this study aimed to determine the non-scientific Italian community's perceptions of MPAs in Italy and to make a temporal comparison (between 2014 and 2021) of perceptions to assess any positive change. Even though the two samples were different, there were few significant relationships between sociodemographic parameters and perceptions, allowing a comparison between the two samples to speculate the change in people's perception of MPAs and the marine environment in a seven-year time frame. The sample from 2021 suggested an increased knowledge and sensitivity regarding the marine environment, improved knowledge about MPAs, more conscious and ocean-friendly behaviours, an increased ascription of individual and collective responsibility, increased WTP and an increased heritage view for future generations. Despite the improvement in environmental awareness achieved in the last few years, there is still much to do. As people's poor knowledge regarding MPAs can be considered a factor in their ineffectiveness, there is an urgent need to engage the public and different stakeholders, from the planning to the implementation to the monitoring phases of MPAs. The several interlinked target groups (policy-makers, citizens, scientific institutions, NGOs and other stakeholders) should play significant roles from the very beginning of MPA development. As the different population segments differ on several factors (sociodemographic aspects, economic interests, cultural background and geographic locations), OL initiatives should be tailored for each socio-ecological system, considering local and global perspectives (a "glocal" approach). MPAs' management plans should be more inclusive and interdisciplinary, in addition to a more transparent and pragmatic management of these areas by the governing bodies. Permanent and competent staff within MPAs, as well as public funding and financial resources to promote environmental education, are also crucial for a general improvement of MPAs' status and public engagement. To better shape educational programmes and OL initiatives, there is a need to identify the different target groups for a more effective outreach: the main stakeholders and MPAs' economic, recreational and cultural users should be recognised for effective management plans, pursuing ecological success and socio-economic benefits. A focus should be further made on the groups that show negative perceptions towards MPAs: this would improve the chances of decreased conflicts and higher compliance with MPA regulations. By promoting science-based events, and increasing the public's active participation and experiential learning with citizen science projects, immersive activities and interactive tools, people's interest will be intrigued and captivated by the greatness of the ocean and its resources, triggering interest, ocean-friendly attitudes and protection of the marine environment. It is worthwhile to consider the development of effective communication to the public through a comprehensible and targeted language (tailored to the different age groups, cultures, and interests), without missing the scientific accuracy and avoiding the now usual doomed-and-gloomed vision towards environmental challenges. Celebrating MPAs and communities' achievements and small victories can promote people's engagement, encouraging an emotional bond with the marine ecosystem and its inspirational aspects. Shaping a greater awareness of the physical, psychological, and emotional well-being provided by healthy and accessible marine ecosystems can

promote ocean protection initiatives and individuals' pro-environmental behaviours. Research could further investigate factual knowledge about the marine environment and pro-environmental behaviours. Another relevant topic of investigation could be the relationship between MPAs' popularity and societal engagement elements, such as the different social media platforms, and citizen science programmes.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11852-024-01056-z.

Acknowledgements Special thanks go to the IMBRSea Programme and IOC-UNESCO. The research was approved by the Research Ethics Committee of the Faculty of FEMS at the North-West University under the ethics code NWU-00976-21-A4. This paper reflects only the authors' view. The author's affiliations do not accept any liability whatsoever in this regard.

Funding Open access funding provided by North-West University.

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