# Long-Term Effects of an Informal Education Program on Tourist Environmental Perception

Mariana Machado Toffolo [1,2†], Ginevra Allegra Simoncini [1†], Chiara Marchini [1,2*],
Marta Meschini [1,2], Erik Caroselli [1,2], Silvia Franzellitti [2,3], Fiorella Prada [1,2]
and Stefano Goffredo [1,2*]

[1] Marine Science Group, Department of Biological, Geological, and Environmental Sciences, University of Bologna, Bologna, Italy,
[2] Fano Marine Center, The Inter-Institute Center for Research on Marine Biodiversity, Resources and Biotechnologies, Fano, Italy,
[3] Animal and Environmental Physiology Laboratory, Department of Biological, Geological and Environmental Sciences, University of
Bologna, Ravenna, Italy

Tourism is one of the most important economic sectors worldwide, with significant overarching impact on the environment, including negative effects caused by tourist inappropriate behavior while on vacation. By providing informal educational activities, tourism also has an educative role that leads to positive learning outcomes and beneficial environmental effects. Here we present the short- and long-term outcomes of a project for environmental education (Glocal Education) carried out in three travel destinations, aimed at promoting sustainability variables (knowledge, attitude, and awareness) in participating tourists. Since psychological components can affect learning outcomes, we also considered tourist satisfaction in participating in the project and identification with its values, as well as the intention to travel with the hosting tour operator again in the future. Tourists were asked to complete evaluation questionnaires three times: before Glocal Education activities, right after activities (i.e., while still on vacation), and after at least one year from initial project participation. Short- and long-term learning outcomes were tested, and possible relations between these variables and psychological components (satisfaction, identification, and intention) of the learning experience were verified. Overall, knowledge, attitude and awareness increased in the short term, while in the long term, knowledge and attitude decreased, and awareness remained constant. In most cases, psychological components showed positive relation with sustainability variables, which suggested their important role in structuring and carrying out environmental education activities. This study suggests that informal environmental education activities can be advantageous for tourism stakeholders in terms of customer loyalty. Such activities can contribute to enhance environment literacy, by allowing tourists to observe the environmental impact caused by human activity, and understand how their day-to-day actions, even if small, might help address some of the current concerns for environmental conservation.

Keywords: environmental education, knowledge, attitude, awareness, tourism, informal learning, cognitive dissonance

# INTRODUCTION

Tourism, currently one of the largest industries in the world, is an example of human activity with an overarching impact on the environment, contributing to global pollution, infrastructure development, and land use (Gössling, 2002; United Nations World Tourism Organization, UNWTO, 2017). Although the modernization of transportation has helped promote global connectivity and affordable air travel (Cohen, 2012), the previous trend that predicted 1.8 billion international tourist arrivals by 2030 World Tourism Organization, and International Transport Forum (2019) has been severely impacted by the coronavirus (COVID-19) pandemic, leading to a decline of more than 50% in international tourist arrivals for the year 2020 (UNWTO, 2020). Hence, predicting long-term touristic global trends is currently problematic (Gössling et al., 2020; UNWTO, 2020).

Many popular travel destinations are often locations known for their appealing natural environments, such as tropical locations, characterized by unique ecosystems and biodiversity (e.g., coral reefs and tropical forests). In addition to the aforementioned social impacts, tourists can significantly impact the environment through inappropriate behavior (Gössling, 2002; Davenport and Davenport, 2006; Pickering and Hill, 2007). For example, trampling by tourists can lead to disturbance of local vegetation and damage in coastal environments (sand dunes and intertidal areas), and also underwater, damaging coral reefs (Davenport and Davenport, 2006; Pickering and Hill, 2007; Defeo et al., 2009). Moreover, visitors can leave their debris along the beach causing problems to marine organisms through tangling and ingestion (Beeharry et al., 2017), and they contribute to sunscreen pollution that cause a cascade of impacts to the ecological structure (Koh and Fakfare, 2020; Downs et al., 2022). Tourists interested in observing nocturnal fauna are responsible for light pollution which can cause changes in orientation, disorientation, or misorientation, and attraction or repulsion from the altered light environment, which in turn may affect foraging, reproduction, migration, and communication (Longcore and Rich, 2004). Further issues include harvesting of natural components or their acquisition as souvenirs, such as local and sometimes endangered plant and animal species, seashells, coral fragments, and sand (Gössling, 2002; Pickering and Hill, 2007; Defeo et al., 2009; Kowalewski et al., 2014), and also interactions with wildlife: touching and feeding animals create disturbance for wildlife and can lead to behavioral and reproductive modifications, increased human dependency or aggression (Orams, 2002; Green and Giese, 2004).

Short-term effects derived from inappropriate and unaware tourist behavior can cumulatively develop into long-term impacts on populations and ecosystems (Green and Giese, 2004; Pickering and Hill, 2007; Kowalewski et al., 2014). Thus, it is important to address these issues, by acting on a small, local scale, to reduce overall environmental impact (Green and Giese, 2004; Defeo et al., 2009). Reducing such effects benefits the environment and the tourism stakeholders, both public and private, as natural ecosystem integrity guarantees the lasting appeal of travel destinations and continuous economic influx from tourism (Gössling, 2002).

For these reasons, The UN Conference on Sustainable Development Rio+20, in 2012, reported the need to support sustainable tourism activities and the promotion of environmental awareness, with governments, tourists, local communities, and stakeholders all having interest in promoting sustainable tourism development (Assembly, 2012; Desa, 2016). Furthermore, recent initiatives such as the UN Decade of Ocean Science (Ryabinin et al., 2019) and the EU Green Deal and Horizon Europe (Eckert and Kovalevska, 2021) provide additional support for compliance with the sustainable development goals of the Agenda 2030.

Environmental education can contribute to achieving more sustainable tourism (United Nations, 1993; 2015; Tilbury, 1995). Education shapes not only knowledge and understanding, but also emotions, awareness, and personal development, which in turn can influence behavior (Gössling, 2018). Knowledge (cognition, understanding topics, and issues), attitude (concern and active improvement and protection), and awareness (consciousness, sensitivity to issues) are among the objectives that environmental education should address (UNESCO, 1977; Pooley and O'Connor, 2000; Cheng and Wu, 2015). Even though knowledge is not the only factor that might contribute to environmentally-friendly behavior, with factors such as group behavior, previous beliefs and even income playing an important role on how much people are willing to contribute to conservation overall (Gustafson and Rice, 2016), several studies indicate that when individuals have higher levels of environmental knowledge, they are more concerned about the environment (Hines et al., 1987; Lyons and Breakwell, 1994; Huang and Shih, 2009). Moreover, Cheng and Wu (2015) found that when tourists feel attached to the destination they are visiting, they tend to feel protective towards such a destination, showing intention to actively prevent negative impacts to that given place.

Knowledge, awareness, and attitude are not the only variables contributing to environmental perception, possible behavioral changes and increased sustainable actions (Grob, 1995; Gössling, 2018). Other important variables in the path of environmental education are the so-called "empowerment variables" (hereafter, psychological variables) (Hungerford and Volk, 1990). These variables, affective attributes that contribute to empathy towards the environment (Chawla, 1998), are the cornerstone in environmental education and include: identification with the environmental cause, intention to act in favor of the environment, and personal satisfaction in being an active participant to environment protection (Hungerford and Volk, 1990; Bamberg and Möser, 2007). In creating sensitivity, combined with a sense of power and responsibility, people can choose to contribute to a mass effort in the conservation and protection of the environment (Hungerford and Volk, 1990).

Although there is a plethora of touristic targets (gastronomic, historical, cultural, wildlife, and so on), we focused our study on mass tourism resorts located in naturalistic tropical destinations. Such resorts are popular touristic destinations, raising concerns about possible social, economic, and environmental

consequences across the local area (Richins, 2009; Cowburn et al., 2018; Grilli et al., 2021). Nevertheless, these touristic destinations can be profitably employed to put environmental education into practice and, in the long-term, select the best educational model prompting novel, conservation-oriented, public attitudes toward vulnerable ecosystems.

This study aimed to assess the short-term and long-term effects of recreational activities offered to tourists. Specifically, these activities were provided within the Glocal Education project, an environmental education project carried out as a pilot study at three different tropical resort facilities located in Madagascar and the Maldives. The study considered variables related to sustainability and environmental perception (environmental knowledge, attitude, and awareness) and psychology (satisfaction, identification, intention), and the possible relation between them.

## MATERIALS AND METHODS

### Field Activities

The activities were carried out in three travel destinations as part of the environmental education project "Glocal Education". These locations were Nosy Be island (Madagascar), Dhiggiri island and Maayafushi island (Maldives) (**Figure 1**) (see Meschini et al., 2021).

Tourists were asked upon arrival to take part in the Glocal Education project. In case of positive response, they filled the first questionnaire ($T_0$) before the first scheduled project activity with the biologist onsite, in order to assess their environmental background. The Glocal Education biologists were BSc or MSc students in biological or natural sciences at the University of Bologna, selected based on their interest and experience in both environmental education and touristic facilities, and previously trained on project activities.

Tourists could then take part in any of the project weekly activities, which consisted of 1) two one-hour introductory lessons, the first focused on island geology, coral reef formation and coral biology, and the second one on the identification and general biology of local organisms (marine invertebrates, fish, marine reptiles, and mammals in the Maldives, and both terrestrial and tropical plant species in Madagascar); 2) an "around-the-island" interactive walk, with explanations on local fauna and flora; 3) participation in field excursions accompanied by the Glocal Education biologist and local guides - snorkeling excursions were organized at the Maldives facilities, and excursions through the primary forest at the facility in Madagascar.

After conclusion of the last proposed activity, eligible tourists were asked to fill the second questionnaire, here referred to as questionnaire $T_1$. Tourist eligibility required participation in at least one Glocal Education activity.
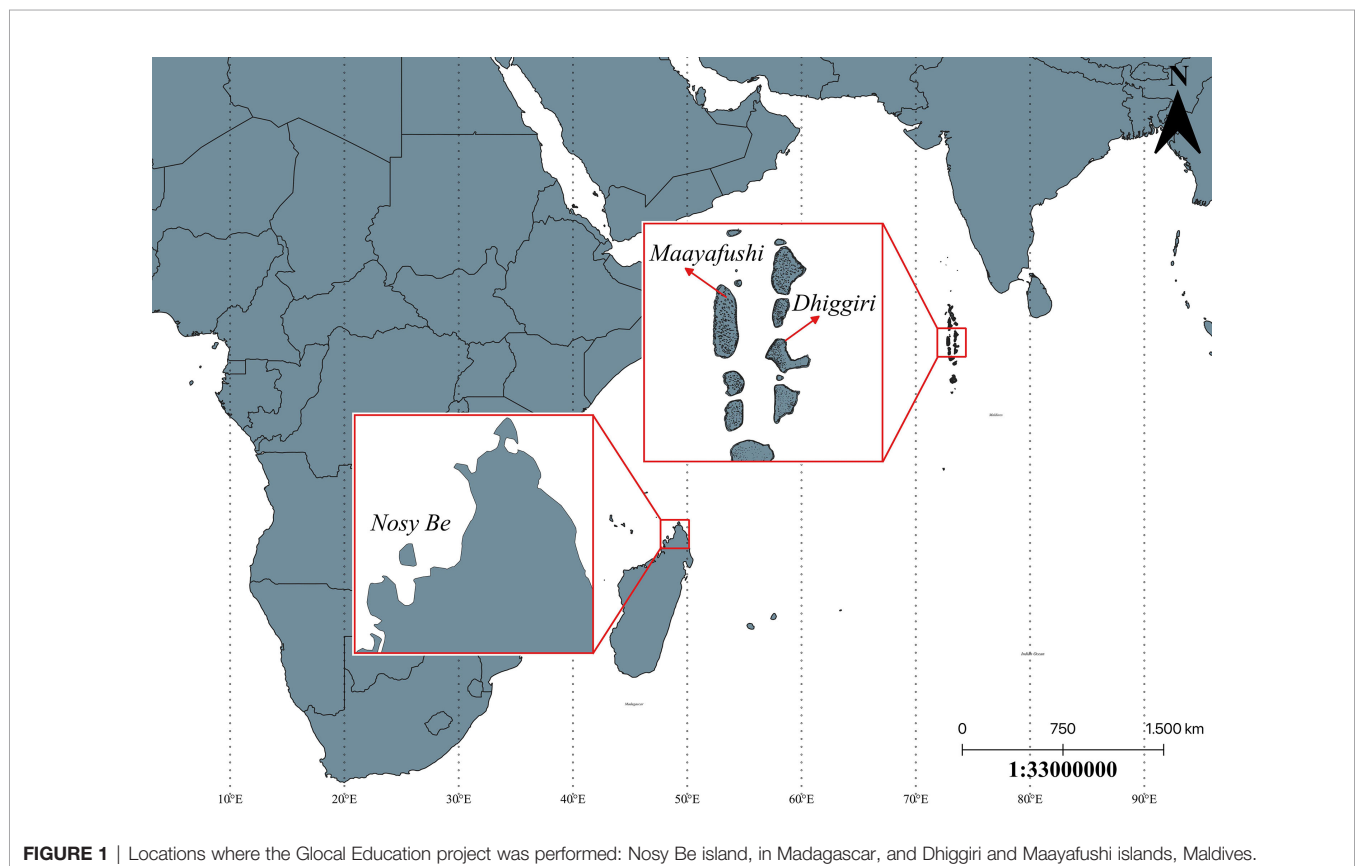


**FIGURE 1** | Locations where the Glocal Education project was performed: Nosy Be island, in Madagascar, and Dhiggiri and Maayafushi islands, Maldives.

To test for long-term effects of the Glocal Education project (GE-LT), tourists who agreed to leave their email address were re-contacted after approximately 12-16 months from initial participation, to fill out a third evaluation questionnaire ($T_2$), using the Qualtrics online survey platform (Qualtrics, Provo, UT, USA. https://www.qualtrics.com).

## Environmental Education Evaluation Questionnaire

The questionnaire, previously developed to detect short-term effects (see Meschini et al., 2021) was repeated after one year of tourist participation in the project. The evaluation questionnaire (**Supplementary Figures 1–7**) was developed by the Department of Psychology of the University of Bologna and was divided into sections as follows:

- Section A: Participant personal data. Name and email were used to pair questionnaires filled by the same participant over time, to have repeated measures for every participant, while sex, age, education and nature contact (frequency of activities carried out in nature regularly) were asked to evaluate if these factors could affect initial levels of environmental education and their variation in time.
- Section B: Knowledge variable. 10 items (number 1 to 10) regarding knowledge in basic biology and ecology topics covered during Glocal Education activities. Some items were customized accordingly to the ecosystem of each location.
- Section C: Attitude variable. 8 items (number 11 to 18) regarding the intention to carry out pro-environmental and sustainable actions, therefore a positive behavior towards the environment.
- Section D: Awareness variable. 9 items (number 19 to 27) regarding the emotional component of individual awareness towards environmental issues.
- Section E: Satisfaction variable. 4 items (number 28 to 31) regarding the personal impression of the quality of the proposed project activities.
- Section F: Identification variable. 4 items (number 32 to 35) regarding participants' sense of affinity to the project and its values.
- Section G: Intention variable. 4 items (number 36 to 38) regarding the intention to travel with the same tour operator who hosted the environmental education activities again in the future.

For sections B–G, scores were calculated according to Meschini et al., 2021. We defined sustainability variables, the variables of knowledge, attitude, and awareness which represented overall environmental perception before participation in Glocal Education activities ($T_0$), in the short term ($T_1$) and long term ($T_2$) after project participation. We defined psychological variables, related to participating in the Glocal Education project, the variables of satisfaction, identification, and intention, measured in the short term ($T_1$) and long term ($T_2$).

## Statistical Analysis

For each variable measured with the Likert scale (attitude, awareness, satisfaction, identification, intention), reverse formulated items were recalculated accordingly (Paulhus, 1991), and reliability analysis using Cronbach's alpha ($\alpha$) was conducted to test the internal consistency of items for each repeated measure of the variables at $T_0$, $T_1$, and $T_2$. When Alpha values resulted in below acceptable scores ($\alpha < 0.50$), items were removed to reach acceptable internal consistency. Reliable items for each section were used to calculate mean scores as representative of the measure of each variable, for all individuals (**Supplementary Table 1**). All scores for all variables for every participant were re-scaled from 1 to 10.

Levene's test was used to test homogeneity of variance and Kolmogorov-Smirnov's test was used to test the normality of variance, for sustainability and psychological variables; these analyses were performed using IBM SPSS Statistics v. 22.

Using PRIMER-e v.6 – Quest Research Limited and PERMANOVA+ (Anderson, 2017), a first permutational multivariate analysis of variance (PERMANOVA) was carried out with two factors ("location" with 3 levels: Nosy Be, Dhiggiri, Maayafushi; and "time" with 3 levels: $T_0$, $T_1$, $T_2$) based on Euclidean distance and 999 permutations to test the effect of the factor "location" on sustainability variables. A second PERMANOVA with five factors ("time" with 3 levels: $T_0$, $T_1$, $T_2$; "sex" with 2 levels: male, female; "age" with 2 levels: under 40, 40 and over; "education" with 2 levels: high school diploma, college degree; "nature contact" with 2 levels: naturalist, non-naturalist), based on Euclidean distance and 999 permutations, was carried out to test the effect of participants demographic factors on sustainability variables. The levels of age, education and nature contact were determined based on the sample number; we chose to group further levels into 2 for all the factors due to the fact that when we employed more levels (e. g., <30, 31-45 and 46> years for age), there were level combinations in which the sample number was equal to zero (i.e., there were no participants that fit that particular subset of levels to allow us to analyze factor interaction on PERMANOVA). Pairwise comparisons were subsequently carried out to investigate the main effects of factor time on sustainability variables.

For interpretation of all PERMANOVA analyses and pairwise comparisons, a threshold value for the average scores of sustainability variables was set to identify statistical significance that also indicated an actual difference in overall environmental education from participation in the Glocal Education project. The threshold for the difference in average scores was set at 0.5, which indicated that at least half of total participants (n = 97) answered at least one additional question correctly, corresponding to a variation of at least +1 in a variable score, in $T_1$ relatively to $T_0$ and in $T_2$ to $T_1$.

Assumptions for parametric statistics were not met, so Wilcoxon signed-rank test was carried out (IBM SPSS Statistics v. 22) to compare repeated measures of psychological variables for participants in time ($T_1$, $T_2$). To test for relations between sustainability variables and psychological variables, Spearman's

rank correlation analyses were performed using IBM SPSS Statistics v. 22. Variation for each sustainability variable in time, from $T_1$ to $T_2$, was calculated for every participant:

$$\Delta variable = \left( \frac{T_2\, average - T_1\, average}{T_1\, average} \right) \times 100$$

and tested for correlation with psychological variables as described above.

# RESULTS

From August 2016 to April 2019, 1851 tourists participated in Glocal Education – Short term study. Of these, a subset of 1192 tourists expressed availability to be re-contacted in the future and were invited to compile the long-term evaluation questionnaire between May 2018 and November 2019. 223 individual responses were received (19% response rate). Incomplete questionnaires were removed, resulting in 194 valid questionnaires for Glocal Education – Long term (GE-LT) analysis, each questionnaire having been compiled by one single participant. The present study focused on the 194 tourists who participated in GE-LT by compiling three valid sequential environmental education questionnaires ($T_0$, $T_1$, $T_2$).

## Demographic Data

Participation was slightly higher among females (n = 111, 57%) compared to males (n = 83, 43%) (**Table 1**). The overall average age was 43 years old, with the slightly underrepresented age category of under 40 (n = 84, 43%) relatively to 40 and over (n =

110, 57%) (**Table 1**). The level of education was divided quite equally between participants having up to a high school diploma (n = 100, 52%) and those with a graduate degree or higher (n = 94, 48%) (**Table 1**). Most participants carried out activities in contact with nature up to once a month (n = 124, 64%) and the minority more than once a month (n = 70, 36%) (**Table 1**).

## Sustainability Variables in Time

PERMANOVA analyses to test for the effects of factors location and time on sustainability variables showed no interaction between factors (p > 0.05; **Table 2**) while there was a significant effect for the factor time on all sustainability variables (p < 0.01; **Table 2**). For the factor location, there was no effect on variables knowledge and attitude (p > 0.05; **Table 2**), but a significant effect for variable awareness (p < 0.01; **Table 2**).

Pairwise comparisons (**Table 3**) showed that awareness scores for Maayafushi (Avg = 9.3, 95% CI = 9.2-9.4) were significantly different from Nosy Be (Avg = 8.9, 95% CI = 8.7-9.1) and Dhiggiri (Avg = 9.0, 95% CI = 8.9-9.1). However, the difference in average scores was below the threshold of 0.5, thus they were not considered meaningful in educational terms. Data from sustainability variables from all locations were aggregated for all following analyses.

Pairwise comparisons showed that all sustainability variables were significantly different (p < 0.01) for levels of factor time ($T_0$, $T_1$, $T_2$), except for the variable awareness that showed no significant difference between $T_1$ and $T_2$ (**Table 4**).

Knowledge average scores increased from $T_0$ (Avg = 7.6; 95% CI = 7.4-7.9) to $T_1$ (Avg = 8.7; 95% CI = 8.6-8.8) and decreased from $T_1$ to $T_2$ (Avg = 8; 95% CI = 7.8-8.2), with $T_2$ scores higher than $T_0$ scores (**Figure 2**). Attitude average scores increased from $T_0$ (Avg = 8.9; 95% CI = 8.8-9.0) to $T_1$ (Avg = 9.4; 95% CI = 9.3-

**TABLE 1** | Tourist participation in the Glocal Education project.

| Factors | | N | % |
|---|---|---|---|
| Sex | Male | 83 | 42,78 |
| | Female | 111 | 57,22 |
| Age | Under 40 | 84 | 43,30 |
| | 40 and over | 110 | 56,70 |
| Education | High School | 100 | 51,55 |
| | College | 94 | 48,45 |
| Nature contact | Non-Naturalist | 124 | 63,40 |
| | Naturalist | 70 | 36,60 |
| | Total | 194 | |

*Tourists were classified according to 4 factors: Age, Sex, Education level and frequency of contact with nature.*

**TABLE 2** | PERMANOVA[a,b] analyses testing the effect of factors location and time on sustainability variables (knowledge, attitude, awareness).

| Factor | Knowledge | | Attitude | | Awareness | |
|---|---|---|---|---|---|---|
| | Pseudo-F | p | Pseudo-F | p | Pseudo-F | p |
| Location | 0.352 | 0.706 | 19425 | 0.142 | 82376 | **0.002** |
| Time | 33975 | **0.001** | 97472 | **0.001** | 14158 | **0.001** |
| Location x Time | 24354 | 0.051 | 14763 | 0.198 | 0.894 | 0.460 |

*[a]Tests were run using Euclidean distances among samples and 999 permutations.*
*[b]Significative effects (p < 0.05) are indicated in bold.*

**TABLE 3** | Pairwise comparison[a] among locations for the variable awareness.

| Variable | Pairwise-comparison | t | p |
|---|---|---|---|
| Awareness | Nosy Be vs Dhiggiri | 0.67998 | 0.492 |
| | Nosy Be vs Maayafushi | 3243 | **0.001** |
| | Dhiggiri vs Maayafushi | 35976 | **0.001** |

*[a]Significative comparisons (p < 0.05) are indicated in bold.*

**TABLE 4** | Pairwise comparison[a] among times ($T_0$: before GE activities; $T_1$: short term after GE activities; $T_2$: long term after GE activities) for all sustainability variables (knowledge, attitude, awareness).

| Variable | Pairwise-comparison | t | p |
|---|---|---|---|
| Knowledge | $T_0$ vs $T_1$ | 83218 | **0.001** |
| | $T_0$ vs $T_2$ | 3022 | **0.003** |
| | $T_1$ vs $T_2$ | 51729 | **0.001** |
| Attitude | $T_0$ vs $T_1$ | 4673 | **0.001** |
| | $T_0$ vs $T_2$ | 86764 | **0.001** |
| | $T_1$ vs $T_2$ | 13584 | **0.001** |
| Awareness | $T_0$ vs $T_1$ | 46358 | **0.001** |
| | $T_0$ vs $T_2$ | 42616 | **0.001** |
| | $T_1$ vs $T_2$ | 0.4 | 0.705 |

*[a]Significative comparisons (p < 0.05) are indicated in bold.*
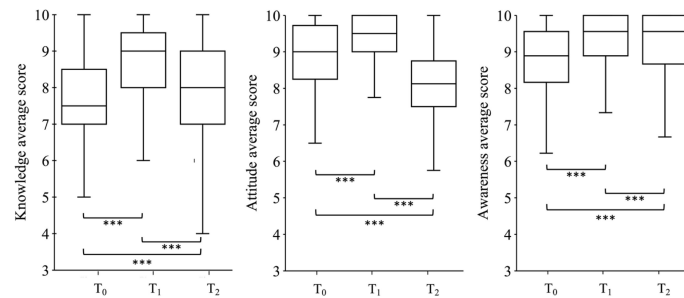
**FIGURE 2** | Average scores of sustainability variables (knowledge, attitude, awareness) in time ($T_0$, $T_1$, $T_2$). Brackets with asterisks indicate significant differences between two groups: *** ($p < 0.001$). The box indicates the 25th and 75th percentiles, the line within the box marks the median, and the cross is the average. Whisker length is equal to $1.5 \times$ interquartile range. N = 194.

9.5) and decreased from $T_1$ to $T_2$ (Avg = 8.1; 95% CI = 8-8.2), with T2 scores lower than $T_0$ scores (**Figure 2**). Awareness average scores increased from $T_0$ (Avg = 8.8; 95% CI = 8.7-8.9) to $T_1$ (Avg = 9.3; 95% CI = 9.2-9.4) and were not significantly different from $T_1$ to $T_2$ (Avg = 9.2; 95% CI = 9.1-9.3) (**Figure 2**).

The PERMANOVA analysis to test for the effects of demographic factors on sustainability variables showed no interaction between time and any of the demographic factors ($p > 0.05$; **Table 5**). The full analysis of demographic factor effects did not provide clear patterns of interpretation (see

**TABLE 5** | PERMANOVA[a,b] test for demographic factors and factor time.

| Factor | Knowledge | | Attitude | | Awareness | |
|---|---|---|---|---|---|---|
| | Pseudo-F | p | Pseudo-F | p | Pseudo-F | p |
| Time | 35766 | **0.001** | 87837 | **0.001** | 16703 | **0.001** |
| Sex | 62087 | **0.012** | 0.29328 | 0.602 | 23068 | 0.121 |
| Age | 25468 | 0.135 | 96361 | **0.004** | 58306 | **0.011** |
| Education | 15901 | **0.001** | 0.85084 | 0.337 | 0.38406 | 0.536 |
| Nature contact | 0.14363 | 0.675 | 0.13823 | 0.696 | 40326 | **0.039** |
| Time x Sex | 1369 | 0.251 | 0.32893 | 0.725 | 0.71503 | 0.468 |
| Time x Age | 0.30922 | 0.745 | 0.22683 | 0.792 | 15881 | 0.218 |
| Time x Education | 15499 | 0.221 | 17446 | 0.16 | 0.21271 | 0.8 |
| Time x Nature contact | 0.46255 | 0.636 | 0.25739 | 0.792 | 0.28467 | 0.766 |
| Sex x Age | 25371 | 0.104 | 27207 | 0.123 | 11794 | 0.277 |
| Sex x Education | 10148 | 0.313 | 0.50348 | 0.459 | 0.31044 | 0.59 |
| Sex x Nature contact | 16935 | 0.194 | 0.55182 | 0.442 | 0.6251 | 0.434 |
| Age x Education | 0.53916 | 0.502 | 17654 | 0.166 | 0.24543 | 0.643 |
| Age x Nature contact | 7.48 | **0.008** | 0.30379 | 0.581 | 107.38 | 0.93 |
| Education x Nature contact | 0.11778 | 0.733 | 0.19976 | 0.648 | 724.89 | 0.801 |
| Time x Sex x Age | 558.97 | 0.952 | 0.12892 | 0.885 | 0.16881 | 0.825 |
| Time x Sex x Education | 0.19867 | 0.815 | 0.16121 | 0.86 | 15106 | 0.229 |
| Time x Sex x Nature contact | 0.12759 | 0.887 | 0.5919 | 0.537 | 0.40413 | 0.674 |
| Time x Age x Education | 0.23891 | 0.777 | 0.77832 | 0.465 | 11687 | 0.265 |
| Time x Age x Nature contact | 0.22737 | 0.796 | 0,77011 | 0.455 | 588.55 | 0.944 |
| Time x Education x Nature contact | 11948 | 0.287 | 14537 | 0.214 | 0.36744 | 0.698 |
| Sex x Age x Education | 203.96 | 0.884 | 24399 | 0.12 | 21227 | 0.151 |
| Sex x Age x Nature contact | 942.16 | 0.743 | 27264 | 0.101 | 0.59801 | 0.42 |
| Sex x Education x Nature contact | 63028 | **0.011** | 34643 | 0.065 | 45173 | **0.031** |
| Age x Education x Nature contact | 0.13425 | 0.714 | 0.41963 | 0.519 | 89.05 | 0.77 |
| Time x Sex x Age x Education | 0.26343 | 0.779 | 0.32579 | 0.724 | 0.91012 | 0.417 |
| Time x Sex x Age x Nature contact | 0.10286 | 0.904 | 19094 | 0.148 | 0.7476 | 0.505 |
| Time x Sex x Education x Nature contact | 0.82229 | 0.444 | 0.22631 | 0.809 | 0.46871 | 0.627 |
| Time x Age x Education x Nature contact | 0.10138 | 0.902 | 587.35 | 0.932 | 0.39267 | 0.656 |
| Sex x Age x Education x Nature contact | 0.15291 | 0.665 | 386.91 | 0.857 | 40949 | **0.039** |
| Time x Sex x Age x Education x Nature contact | 0.38767 | 0.7 | 0.68597 | 0.508 | 12407 | 0.307 |

[a]Tests were run using Euclidean distances among samples and 999 permutations.
[b]Significative effects ($p < 0.05$) are indicated in bold.

**Supplementary Tables S2–S8**). Since the effects of factor time were independent of participants' demographics, data from all demographic groups were aggregated.

## Sustainability and Psychological Variable Correlation

Wilcoxon signed rank test showed that all psychological variables were significantly different between $T_1$ and $T_2$ (Satisfaction $p < 0.001$; Identification $p < 0.001$: Intention $p < 0.001$; **Supplementary Table 9**).

We then performed Spearman's correlation analyses among sustainability and psychological variables $T_1$ and $T_2$ (**Figures 3–5**, **Supplementary Table 10**, **Supplementary Figures 8, 9**), which showed that within $T_1$ and $T_2$, knowledge showed no correlation with any psychological variables ($p > 0.05$; **Figures 3**, **4**). Attitude showed positive correlation with all psychological variables ($p < 0.001$ for satisfaction; $p < 0.001$ for identification; $p < 0.001$ for intention; **Figures 3**, **4**). Awareness showed positive correlation with satisfaction and identification ($p < 0.01$; **Figures 3**, **4**).

Knowledge, attitude and awareness scores at $T_2$ showed positive correlation with satisfaction measured at $T_1$ ($p < 0.05$, $p < 0.001$ and $p < 0.01$, respectively; **Figure 5**). Attitude and awareness variables also showed positive correlation with identification at $T_1$ ($p < 0.001$ and $p < 0.05$ respectively; **Figure 5**).

The variation of knowledge scores between $T_1$ and $T_2$ positively correlated with satisfaction at $T_1$ ($p < 0.05$; **Supplementary Figure 8**) and the variation of attitude positively correlated with satisfaction, identification and intention scores at $T_2$ ($p < 0.01$, $p < 0.001$ and $p < 0.01$ respectively; **Supplementary Figure 9**).

## DISCUSSION

The Glocal Education project may contribute to investigating potential outcomes of environmental education activities as learning opportunities in tourism when mediated by an educator figure and inserted within the informal context of a leisure vacation. Previous studies show that positive learning outcomes can derive from participation in tourist activities such as wildlife safaris, whale watching experiences, citizen science projects and aquarium/zoo visits (Ballantyne and Packer, 2011; Higginbottom et al., 2011; Hughes et al., 2011; Branchini et al., 2015). The aim of this study was not to bring tourism impact to a zero, as that would not be possible, but rather create food for thought and sensitize tourists. The translation of reported outcomes into actual sustainable and environmentally friendly behavior is still a convoluted aspect to analyze and report accurately (Kennedy et al., 2009; Hadjichambis et al., 2015; Chen and Tsai, 2016). A potential follow-up study focusing on this interaction would be required to verify in what manner these variables contribute to individual change in behavior.

## Demographic Data

Sustainability variable scores (knowledge, attitude, awareness) were the same in the three travel destinations (one in Madagascar and two in the Maldives). This suggested that the same project can be carried out in different locations leading to the same result. A possible bias to this outcome could be that all localities were within tropical ecosystems, and therefore similar amongst them. To address this issue, future studies should test the Glocal Education project in a wider range of locations, such as in the Mediterranean Sea and possibly other temperate environments.
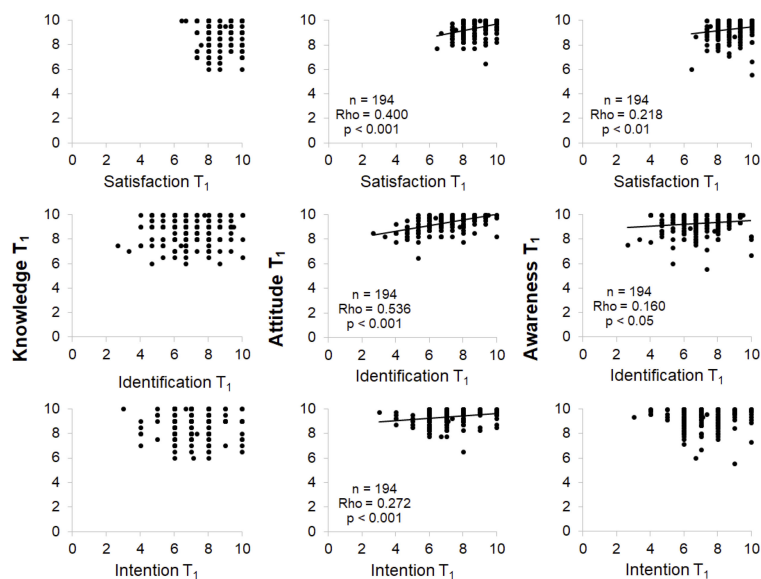
**FIGURE 3** | Correlation plots between sustainability variables (knowledge, attitude, awareness) and psychological variables (satisfaction, identification, intention) at $T_1$. Only significant ($p<0.05$) regressions are drawn. n: number of participants; Rho: Spearman's rank correlation coefficient; p: p-value.
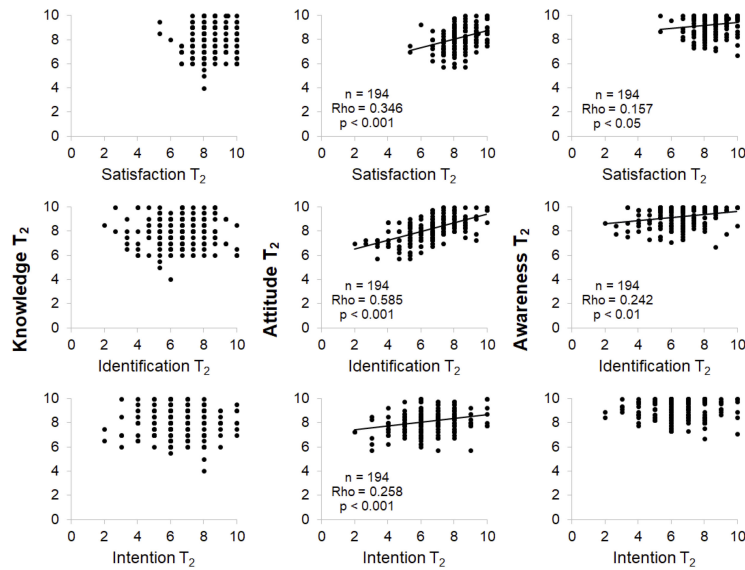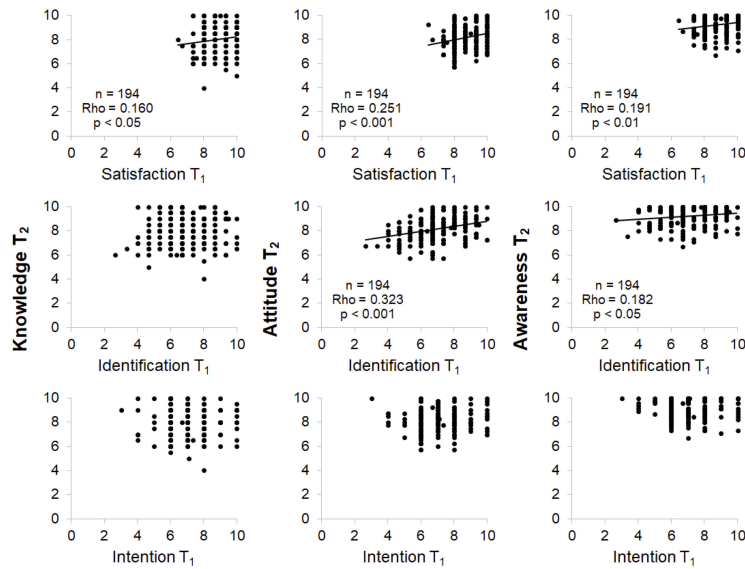
**FIGURE 4** | Correlation plots between sustainability variables (knowledge, attitude, awareness) and psychological variables (satisfaction, identification, intention) at $T_2$. Only significant ($p<0.05$) regressions are drawn. n: number of participants; Rho: Spearman's rank correlation coefficient; p: p-value.



**FIGURE 5** | Correlation plots between sustainability variables (knowledge, attitude, awareness) at $T_2$ and psychological variables (satisfaction, identification, intention) at $T_1$. Only significant ($p < 0.05$) regressions are drawn. n: number of participants; Rho: Spearman's rank correlation coefficient; p: p-value.

Subsequently, we verified that effects of project participation were equal amongst different demographic groups. Informal education experiences can vary significantly among them, and contrasting information exists regarding learning outcomes for different demographic groups: in some cases, demographics have a significative effect, and in some cases they do not (Rodari, 2009). In the case of Glocal Education, all participants expressed similar learning outcomes, regardless of previous education, gender, age, or nature contact. Although age range was somewhat broad (under 40 and over 40, with no ranges in between), these results imply that everyone can benefit equally from the learning experience provided by Glocal Education and that possible outcomes on environmental perception can be achieved equally by all participants. Further analysis focusing

on the age factor can be performed in order to ascertain whether age is a significant influencer on the learning experience proposed by the Glocal Education project.

## Sustainability Variables in Time

When evaluating learning experiences, time passed after participation is to be considered, as educational outcomes may show up at different times (Rodari, 2009; Falk et al., 2012). Short-term outcomes are the most reported as they are easier to verify, but there are also long-term outcomes that can appear much later or that can have important long-lasting effects (Rodari, 2009). Long-term outcomes are the most difficult to record as they require tracking of individuals over time. However, they are necessary to assess the influence of education over time (Rodari, 2009). In order to verify the long-lasting effects of the Glocal Education project, all sustainability and psychological variables were tested in participants after one year of taking part in Glocal Education activities.

In the short term, knowledge, attitude, and awareness increased compared to pre-participation scores. From learning about the surrounding environment and how one can behave in order to minimize impact, all while being able to see firsthand the beauty and diversity of such environment (through snorkeling or hiking, for example), tourists knew and were more aware of environmental issues. Tourists reported to be more careful to avoid direct harmful and damaging behavior towards the environment and showed a positive attitude in promoting such behaviors with others in the short term. From an environmental point of view, this positive result highlights the importance of implementing informal education projects in travel destinations. If our proposed project were to be implemented in resorts globally, the positive short-term outcomes seen for each individual would be multiplied by engaging a large number of participants simultaneously.

In the long term, knowledge scores decreased to intermediate values compared to pre-project participation and short-term outcomes. In this case, it is probable that acquired concepts about tropical reefs and exotic ecosystems, while being of interest to tourists on vacation, were forgotten in the long run, being of minor relevance in individuals' daily lives and likely not repeated often once returned home. Long term attitude scores decreased compared to both short-term outcomes and pre-project participation. On the other hand, awareness scores remain stable in time after the increase registered in the short-term indicating that positive outcomes achieved from project participation tied to the emotional components of environmental education are maintained even after one year. Long-term outcomes of the Glocal Education project indicate that having knowledge and being aware of environmental issues does not always translate into a more sustainable attitude towards the environment and sustainable actions. This result is in line with social psychology studies indicating that there is a gap between environmental perception and actual pro-environmental behavior (Hines et al., 1987; Kollmuss and Agyeman, 2002; Liu et al., 2020) and highlights how some educational outcomes, such as attitude, may be subject to

complex social/emotional factors beyond simple knowledge of environmental facts (Bamberg and Möser, 2007). Behavioral intentions (here, attitude), which in turn shape actions, can be influenced by economic constraints, social pressures and constructs, moral norms, and the opportunity to choose different actions (Hines et al., 1987; Bamberg and Möser, 2007; Steg and Vlek, 2009). The resulting pro-environmental behavior is therefore a mixture of self-interest and pro-social motives, with attitude being one of the many components (Kollmuss and Agyeman, 2002; Bamberg and Möser, 2007; Steg and Vlek, 2009). The resulting higher attitude scores right after participating in the educational activities and lower scores in the long term, can be explained by a few theories, such as: social desirability: tourists might answer in a manner that is considered socially acceptable, rather than their own actions and points of view, giving biased answers instead of true ones (White et al., 2018; Vesely and Klöckner, 2020; Vilar et al., 2020); cognitive dissonance: this social-psychological theory is based on the knowledge that people tend to act consistently with personal beliefs to avoid discomfort (Festinger, 1962; Thøgersen, 2004) and the psychological distancing perspective: whenever people feel positive (in this case, seeing in person and learning about the biodiversity of a tropical paradise), they tend to "draw plans" on how to achieve a certain goal (in this case, the conservation of ecosystems) (Labroo and Patrick, 2009). The Glocal Education project participation occurred while the tourist was enthusiastic, immersed in a compelling natural environment, and in the presence of the educator figure. Such factors could have influenced individuals to answer the questionnaire according to what they think is the most appropriate answer, as opposed to what they would actually do in that particular situation (Thøgersen, 2004). Furthermore, after one year or more from the vacation, individual initial enthusiasm may have worn off. This reasoning can also be applied to the difference recorded in psychological variables, with higher scores registered in the short term also attributed to direct emotional involvement with the Glocal Education project on location. Additionally, information received over a short period of time tends to be stored in more "shallow" levels, allowing the receiver to forget more easily (Craik and Lockhart, 1972). In the case study of Glocal Education, tourists were fully immersed in an exotic location, which coupled with participation in Glocal Education activities led to an overall boost in reported environmentally friendly behavior intention on vacation. However, once returned home, individuals tended to revert to behaviors and habits determined by other external factors such as routine or social constructs, which led to knowledge and attitude declining in long term even when high awareness scores were maintained (Festinger, 1962; Kollmuss and Agyeman, 2002). Furthermore, because of the lack of reinforcement of the positive outcomes acquired on vacation *via* subsequent similar learning experiences, immediate effects dissipated in the long term, as has been observed in the case of free-choice education activities (Ballantyne and Packer, 2011). For this reason, if activities like those proposed by the Glocal Education project were to be consistently implemented in a greater number of touristic resorts worldwide, tourists would

benefit from further reinforcement of previous learning experiences and educational achievements in future vacations.

## Sustainability and Psychological Variable Correlation

As indicated in the correlation analysis, there was no significant relationship between knowledge and psychological variables. Attitude and awareness showed a positive relationship with both satisfaction and identification in all tested cases (6 out of 6; **Supplementary Table 10**). The more participants were satisfied in having taken part in the Glocal Education project, and the more they identified with project values, the higher was their awareness and attitude scores. This goes in line with previous findings (Meschini et al., 2021), indicating that psychological components of educational activities can contribute to greater learning outcomes. In most cases (2 out of 3; **Supplementary Table 10**) attitude also correlated with the intention to travel with the same tour operator again. From an economic perspective, individuals with higher attitude scores expressed higher intention to travel with the same tour operator again, a strong indication of customer loyalty towards the host who provided the educational program. For these reasons, we propose the implementation of the Glocal Education project to be carried out by the main stakeholder organizations that represent commercial, touristic, and service businesses, travel agents, and tour operators, in mass tourist resorts, since we believe that it could be beneficial from an environmental, social, and economic perspective.

In the case of Glocal Education, these positive correlations found with the psychological components of participating in activities demonstrate the importance of valuing social and emotional aspects of environmental education projects in tourism. Furthermore, participants with higher psychological scores in the long term showed a higher value in attitude after one year. To reinforce positive attitudes to behave sustainably, satisfaction and identification of individuals are therefore important features to consider (Thøgersen, 2004). Since the study analyzed a reduced sample size (194 out of 1851 who initially participated in the project), the observed results could be corroborated by further studies with a larger sample size, achieved through higher engagement of participants on the follow up analysis. Higher tourist engagement can be achieved not only through the development of a user-friendly app, rendering the activities easier and more interactive, but also with the employment of "vacation coupons", discount coupons to be raffled among project participants. GE activities could also be adapted to other contexts such as zoos, parks, etc. according to the target audience (children, schools, other touristic facilities), to render the project accessible and efficient in different scenarios.

## Tourism Impacts

The tourism industry is a complex and interconnected system, where socioeconomic and environmental interactions and impacts take place over distances (Liu et al., 2020). Hence, a useful tool to analyze the industry as a whole would be through telecoupling, an integrated framework suited to understand the

interconnected world and help map possible pathways towards the United Nations' Sustainable Development Goals (United Nations, 2015) and other global challenges. Nonetheless, our study had a more limited scope, focusing on educational activities within touristic facilities. Such activities, applied over a larger range of touristic facilities and involving a larger number of participants to mitigate volunteer bias, could in the future present useful to the tourism industry, at which point they could be added to the telecoupling framework. As this is a pilot study, further analyses are required.

It is un-neglectable that global tourism is leaving its ecological and social footprint, and that global actions should be undertaken to promote awareness, educate people, and achieve a meaningful behavioral change towards more environmentally parsimonious ways of life. The rationale behind the Glocal Education project is to provide individuals with an enhanced perception of the environment and related issues to enhance their intention of positive behaviors while on vacation. The ultimate goal is to improve a localized action that, together with other initiatives, may help contribute to mitigating the global problem of mass tourism impacts on biodiversity and natural landscapes. The present study reported the first outcomes for the Glocal Education project on a limited number of tourist resorts. Thus, the reported data do not allow to discuss or make societal impact projections on a broad spatial scale. In this context, the informal educational activities described here could be applied to different locations and could have a wide outreach, involving a significant number of participants.

## CONCLUSION

Informal education activities are in line with the UN Sustainable Development Agenda, particularly Goals 8 - devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products (United Nations, 2015); and 12 - Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products (United Nations, 2015), and can aid the tourism sector in pursuing this goal on multiple fronts. There is social and educative importance focused on the direct involvement of tourists who gain knowledge, awareness, and positive attitudes while on vacation. There is a financial interest for stakeholders, such as tour operators, who can benefit from increased competitiveness by hosting environmentally friendly programs and becoming more appealing to customers. In addition, maintaining ecosystem integrity by reducing impact guarantees continuous natural appeal in the long term for tourists, and therefore a continuous economic return for the tourism sector.

Overall, the educational model we present addresses the importance of implementing informal learning projects in tourism, specifically on location within tourist resorts and other popular travel destinations. The tourism industry has the potential and the responsibility to act as a key player in

implementing such strategies, which can be immediate actions contributing to sustainability that do not require strategic policymaking. In this context, the recreational and informal educational activities as described here be applied to different locations and can have a wide outreach involving a significant number of participants. By providing individuals with an understanding of the environment and related issues, the aim is to reduce the direct environmental impact caused by tourists while on vacation.

Finally, the outcomes of our study indicate that on the fine scale of local and individual intention of action, by tailoring Glocal Education to the reality of touristic facilities, tourists may help address environmental and biodiversity issues.

## DATA AVAILABILITY STATEMENT

The dataset analyzed for this study can be found on FigShare, available at: 10.6084/m9.figshare.15143130.

## ETHICS STATEMENT

The Glocal Education project and its consent acquisition procedure have received the approval of the Bioethics Committee of the University of Bologna (Prot. 118055). For this study, participants (or parents/guardians in case of minors) gave their consent by signing a declaration inserted in the questionnaires., and their personal data (name and surname) were collected to guarantee the comparison between the initial environmental education assessment and that after participation in project activities. We have treated the data confidentially, exclusively for institutional purposes (art. 4 of Italian legislation D.R. 271/2009 - single text on privacy and the use of IT systems) and according to art. 12, 13, and 14 of EU Regulation 2016/679 - General Data Protection Regulation (GDPR). Data treatment and reporting took place in aggregate form.

## AUTHOR CONTRIBUTIONS

MMT and GS collected data during the study; MMT and GS analyzed the data; MMT, GS, MM, CM, EC, FP, SF, and SG wrote and reviewed the manuscript; CM managed the project; SG supervised the research. All authors discussed the results and participated to the scientific discussion. All authors contributed to the article and approved the submitted version.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmars.2022. 830085/full#supplementary-material

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