# "THE SCHOOL DIFFERENTLY" LEARNING ABOUT MARINE PROTECTED AREAS – A PROACTIVE EDUCATIONAL APPROACH TOWARDS IMPLEMENTATION OF MEASURES OF MARINE HABITATS CONSERVATION AND PROTECTION

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**Abstract.** On the 5th of May and the 20th of June 2017, the NRDI GeoEcoMar received the visit of students of two elementary schools from Constanța ("Ciprian Porumbescu" and "Mihail Koiciu"), which dedicated a day of "The school differently" week to awareness-raising and educational activities on marine protected areas. "The school differently" is part of a program developed within the Romanian Program of Education, in 2011. Under the supervision of biologists from NRDI GeoEcoMar, in collaboration with the PhD students from Belgium involved in the PRIDE project, a series of interactive and proactive activities were accomplished, aiming at foster a sense of community and environmental responsibility to the young generation. In total, 30 students of 5th grade, with ages between 11 and 12 years were involved. The children from "Ciprian Porumbescu" School learned how to identify species belonging to the Ponto-Caspian relicts, recognize and understand the negative impact of the invasive species on the Black Sea biodiversity. The children from Mihail Koiciu School, who visited the R/V *Mare Nigrum* (in custody of the NRDI GeoEcoMar) guided by the ship's commander and biologists from GeoEcoMar, explored the complicated but interesting domain of marine science, helped by explanations and demonstrations on research work in biology and geochemistry. The feedback received from the children, assessed by help of questionnaires specially conceived for the targeted category of age and activities carried out, is presented in the paper. Judging after children's reactions and responses to questionnaires, it makes sense to affirm that the activities achieved their scope and these methods of education and awareness are positively perceived by the children from elementary schools.

**Key words:** Black Sea marine protected areas, ecological education, field activities, questionnaires

## 1. INTRODUCTION

Environmental Education is a key component in any marine protected area management plan. Although considerable progress has been made in the field of community-based management, one of the major difficulties is to move from a passive community participation (e.g. information and consultative processes) to an active community involvement (two way communication, decision making, action for change) (Zorrilla-Pujana and Rossi, 2016; Pitoska and Lazarides, 2013). "Education can, and must, contribute to a new vision of sustainable global development" is the UNESCO's vision on future sustainable development (UNESCO, 2015).

The environmental awareness actions dedicated to marine environment and especially, to marine protected areas upsurged all over the world (Otto and Pensini, 2017; Santos *et al.*, 2017), as the signs of serious deteriorating of the oceans and seas due to pollution, overexploitation and inequitable sharing of resources, spreading of invasive species, and climate change, are increasing, as underlined in the report *A Sea of Troubles* (GESAMP, 2001). The Convention on the Protection of the Black Sea against Pollution (Bucharest Convention) is one of the legal instruments helping at implementation of good environmental practices in the Black Sea region.

The ecological education and awareness activities have become a tradition among the research institutes and NGOs

from Romania. With more than 20 years of experience in the field, the NGOs "*Mare Nostrum*" (www.marenostrum.ro) and "Oceanic Club" (www.oceanic.ro/) represent laudatory examples for the educational programs carried out with children from Constanța. The NMRDI "Grigore Antipa", Constanta and NRDI GeoEcoMar, have joined the efforts in their quality of custodians of MPAs and representative marine research institutes to raise the ecological awareness among students from schools in Constanța.

The concept "The school differently" has been developed within the Romanian National Program of Education, in 2011. The methodological guideline for the program implementation, elaborated by the Ministry of Education and Research of Romania (Borbe *et al.*, 2016), offers practical recommendations, ideas, questions and demonstrations for teachers, parents and students, encouraging the cooperation and sharing of experiences and state-of-the art methods of education. The concept addresses to elementary schools, thus to children from 6 to 15 years old. The program aims to strengthening the learning competencies and socio-emotional abilities of children by getting experience from practical meetings with grown-ups from different domains of activity, school systems and educational approaches.

## 2. MATERIAL AND METHOD

Two elementary classes from two schools in Constanța participated in the activities organized by NRDI GeoEcoMar on the 5th of May and 20th of June 2017. The schools dedicated one day of the "The school differently" week to ecological education on topics related to MPAs. In total, 30 5th grade students, with ages between 11 and 12, have been involved.

On the 5th of May, 20 students from *Ciprian Porumbescu School* visited the *Modern* beach from Constanța (located on the Romanian Black Sea coast), accompanied by the teachers and the biologists from the NRDI GeoEcoMar, as well as by three Ph.D. students from Belgium. Using proactive and interactive learning methodology that included lectures, informative materials (flyers) and the "explore by yourself" method, the specialists intended to enrich the children's knowledge with information about the MPAs and the Ponto-Caspian relicts and invasive species in the Black Sea. Each of the students received two questionnaires (at the beginning and at the end of the beach activity), comprising 14 and 10 questions, respectively.

The children from the "Mihail Koiciu" school, who visited the R/V *Mare Nigrum* on 20th of June, were introduced to the "world" of marine science, by means of lectures and demonstrations on the methodologies and instruments used in exploring the biology, geology and hydrochemistry of the sea. One questionnaire with 12 questions was given to each of them at the beginning of the activity. Suggestive images were used as helpful elements to guide the students to find the right answers.

The content of the questionnaires and the number of questions within were adapted to the young age of the participants and their level of knowledge (after consultation with the teachers). The questions asked were related to the field activities the children participated in.

## 3. RESULTS AND DISCUSSIONS

Among the activities carried out by the schools in Constanța within "The school differently" week, excelled those dedicated to ecological education on marine environment with focus on the marine protected areas (MPAs). Since 2012, as custodian of two Natura 2000 MPAs (ROSCI0073 and ROSCI094), NRDI GeoEcoMar organizes yearly a series of activities in collaboration with schools from Constanța. The scope of these activities is to show how important is for children to understand the necessity of maintaining a healthy marine environment and how they can help to attain this desiderate by learning about the role of MPAs for conservation and protection of habitats and species of community interest. The MPAs are envisioned as the key elements of a sustainable marine development. The maritime planners, scientists and ecologists rely on stakeholders' involvement to achieve the conservation goals of marine environment as foreseen in cornerstone environmental legislation (Marine Strategy Framework, Habitat Directive, Marine Spatial Planning, EU Blue Growth Strategy, etc). The ecological education of the youths from Constanța is one of the "must" actions towards accomplishing the protection and conservation of biodiversity and health of MPAs.

### 3.1. Assessing the responses of students from "Ciprian Porumbescu" School to the initial questionnaire (Q1)

On the 5th of May 2017, 20 5th grade students from the "Ciprian Porumbescu" school were invited to take part to the beach activities, guided by biologists from the NRDI GeoEcoMar. Beforehand, all children received a questionnaire (Q1) with 14 questions. The questionnaire (Table 1) helped to assess the initial level of knowledge of children concerning the Black Sea's biodiversity, the role of MPAs for protection and conservation of species and habitats, and the major problems that Black Sea (including beaches) poses in terms of pollution, exploitation of resources and ecological awareness.

The first four questions (A-D) of the Q1 refers to MPAs from the Romanian littoral and to the marine biodiversity. The responses showed that 65 % of children have never heard before of the Black Sea's MPAs, though most of the students (75 %) appreciated their existence as very important. Nevertheless, some of the surveyed participants were able to list a few, most of them mentioning the Danube Delta and some terrestrial sites. All children managed to give examples of marine organisms like fish, mollusks, crabs, dolphins and algae either seen or heard of them at school, in media or in their own lectures.

**Table 1.** Questionnaire 1 (Q1)

| | Questions |
|---|---|
| A | Have you ever heard about marine protected areas (MPAs)? |
| B | What do you think about having MPAs at the Romanian littoral? |
| C | Could you list some examples of MPAs? |
| D | Could you give some examples of plants and/or animals that you noticed on the beach or in the seawater? |
| E | What do you think that the shells and algae can be used for? |
| F | Have you ever eaten seafood? If yes, give some examples. |
| G | What do you like most to do when you go to the beach? |
| H | Do you like diving, swimming or playing in the seawater? |
| I | Do you find underwater animals or plants interesting? Have you ever been curious to discover them? |
| J | What is your impression when you see garbage on the beach? |
| K | To what extent do you think the Black Sea is polluted? |
| L | In your opinion, which are the most polluted beaches from the Romanian littoral? What causes the pollution? |
| M | How do you think you can help to reduce the pollution on the beach? |
| N | Do you think it would be useful to warn our parents, grandparents, friends to throw the garbage only in garbage bins instead of on beach or into the sea? |

The next 2 questions (E, F) approached topics referring to marine life and goods extracted from the sea for human consumption or industry purposes. The GeoEcoMar' biologists wanted to find out if children are aware of the importance of the Black Sea in this context. Most of the children (80 %) affirmed they have consumed seafood before (mussels, squids, shrimps and others) and some of them mentioned the use of shells and algae for the pharmaceutical industry and handmade crafts.

Questions G, H, and I (Q1) assessed the physical, emotional and intellectual relation of the children with the sea. The responses received indicated that most children love swimming and are eager to find out more about the animals and plants that live in there, wishing to discover animals such as fishes, mollusks, octopus, sea stars and corals.

The final questions (J-N) concerned the pollution of sea and beaches. Most of the children have been receptive to this "sensible" issue, considering that the litter on the beach is harmful for animals and humans.

All students expressed their volunteer engagement in future cleaning activities of the beaches, saying that if necessary, they would not hesitate spurring their parents and friends to collect the garbage, as appropriate. The garbage bins should be plenty on the beach in order to discourage breaking the law. They agreed that sanctions and fines are necessary for improving the aspect and cleaning the beaches. Pollution was seen as a bad thing in the acception of 95% of the pupils, 55% of them believed that the sea is moderately polluted, while 40% that it is hardly polluted. Factors such as industry, urban agglomeration and wastewater discharge were considered causes of most of the problems.

The responses of children are summarized in Figure 1. All answers that received a quantifiable positive response have been considered "affirmative", while the quantified negative ones as "negative". The undecided responses "don't know" were summed up in the third category ("Don't Know").

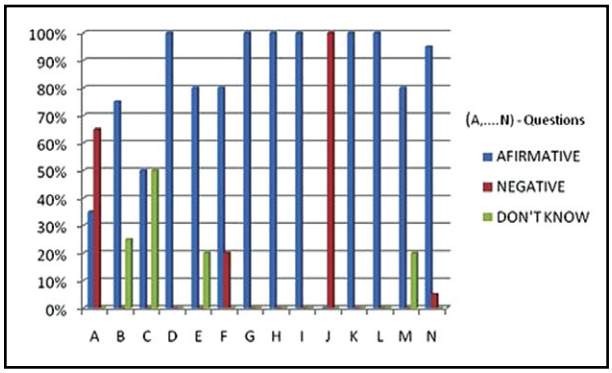


**Fig. 1.** Proportion of affirmative, negative and undecided responses on Questionnaire 1.

### 3.2. Assessment of activities carried out on the beach

Following the completion of the fist questionnaire, the activities of children from "Ciprian Porumbescu" school continued on the Modern beach (Fig. 2), situated in the northern part of Constanța. The students, supervised by two biologists from GeoEcoMar and three PhD students from Belgium involved in the PRIDE project (more details on www. pride.com, (www.pontocaspian.eu), had to look for shells, especially for the Ponto-Caspian relicts and invasive species. A series of informative materials were used for this activity, such as flyers (Fig. 3) and various shells, so that the students can understand how to identify a species belonging to Ponto-Caspian relicts, why this is important and how can children further contribute to improving knowledge about

their occurrence in the Black Sea region. The invasive species were also brought into attention of students, who learned how to recognize the main invasive species found on the beach, the negative impact caused by their introduction and their invasive character on the native Black Sea fauna.

**Fig. 2.** Practical lesson conducted on the "Modern" beach Constanța.

"Learning by doing" and "explore by yourself" were the guiding principles of the educational method adopted. Through direct dialog and interaction, the specialists from GeoEcoMar took the opportunity to record the perceptions of children on the topics presented and the motivations behind the attitude adopted by each pupil. The scientists tried to instill in all participants the conscience of their own and their fellows' actions on the marine environment, as well as a sense of implication and participation in nature protection.

The children investigated a large portion of the beach, trying to collect all the shells they identified according to the pictures and explanations given (Fig. 4). Their curiosity was raised through a series of questions about the ecology and biology of different animals living on the beach and in the sea. Children learned how to get more information on the Ponto-Caspian species, what to do in case they find a species matching the description in the flyer. The students were enthusiastic, showing a great interest for using the application created within the PRIDE project, which allows to upload themselves information on the project' site on the Ponto-Caspian species observed. They understood that in the geological past (millions of years ago) the Black Sea was linked with the Caspian Sea, the reason why the Caspian origin species could still be found in the Black Sea. This, along with its remarkable biodiversity, makes the Black Sea a very special sea, as biologists explained them. Highly appreciated by the children was a demonstration with specific methods of collecting organisms from the water using a dredge.

**Fig. 4.** Children identifying species of mollusks on the "Modern" beach, Constanța.

### 3.3. Assessing the responses of students from Ciprian Porumbescu School to the final questionnaire (Q2)

At the end of the activity, the students received a final evaluation questionnaire (Table 2). This assessed the children feedback on the activities carried out on the beach. The specialists from GeoEcoMar were interested to find out whether the students, besides the information acquired, perceived the modality of presenting it as if it were interesting and easy to understand.

After evaluating the responses, it was found that 49% and 43% of the students appreciated the knowledge acquired on the beach as very useful and moderately useful, respectively. 83% of the children rather chose a domestic animal or a plant to protect and only few of them would have a marine one

**Table 2.** Questionnaire 2 (Q2)

| | Questions |
|---|---|
| A | To what extent do you think the information obtained from this activity was useful? |
| B | What would be the plant or the animal that you would protect, if you could? |
| C | Do you think that the ecological education is important and why? |
| D | What native species of mollusks have you identified on the beach? |
| E | Why do you think these species are important? |
| F | What invasive species of mollusks have you identified on the beach? |
| G | What impact do the invasive species have upon the environment? |
| H | What other species of animals and plants have you identified on the beach? |
| I | What did you like most during this activity? |
| J | Do you think such activities should be organized more often? |

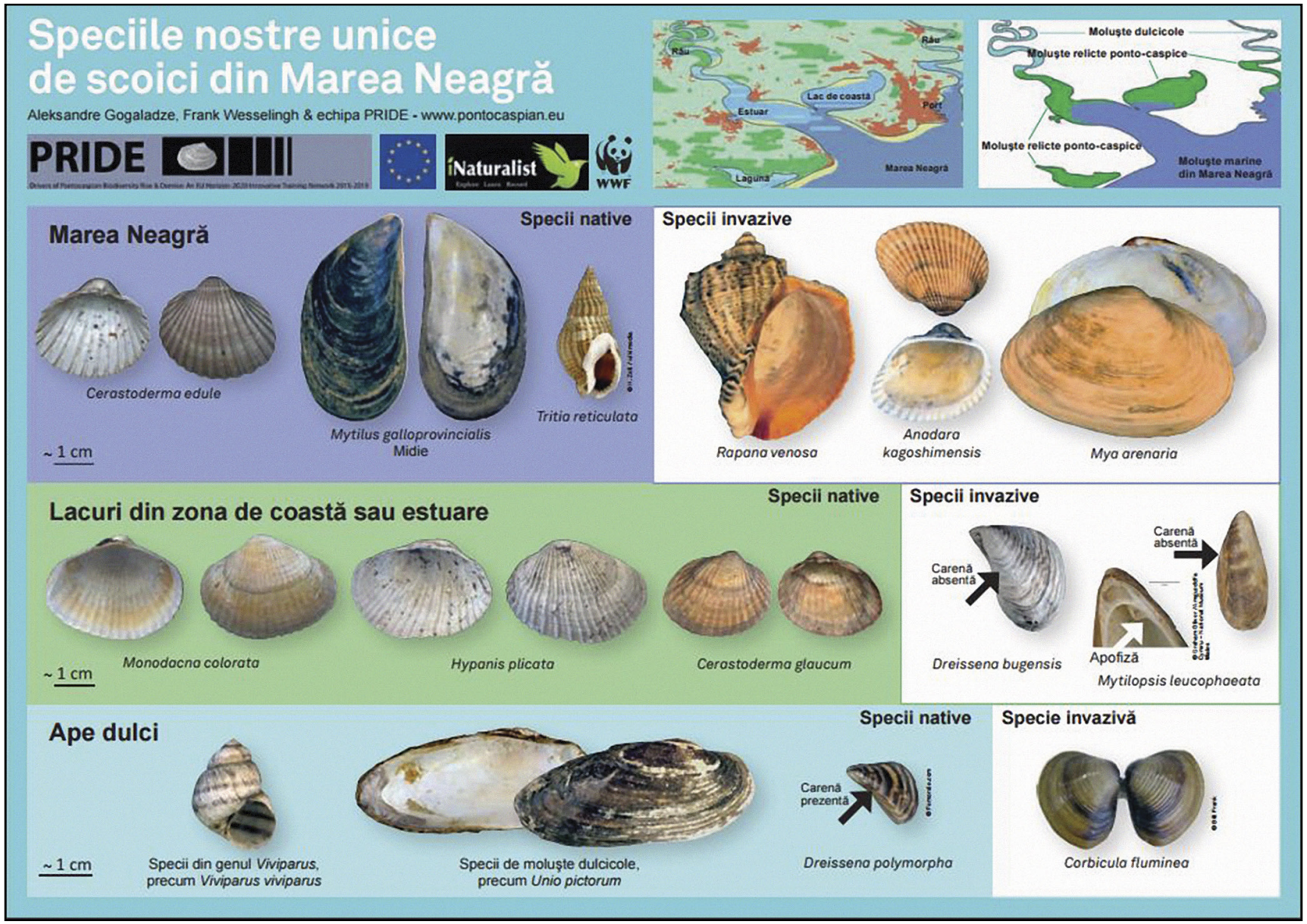


**Fig. 3.** Flyer with information about Ponto-Caspian and invasive mollusks species (www.pontocaspian.eu)

(e.g. dolphins). The ecological education is important in their opinion because it helps to understand and become aware of the influence of human actions upon the environment.

Many of the native mollusks frequently encountered on the beach (*Cerastoderma sp.*, *Tritia reticulata* and *Mytilus galloprovincialis*) were easily recognized by the children, following the explanations received from the specialists. The flyers have been useful for most of the children that have been able to identify several invasive species such as *Mya arenaria*, *Anadara kagoshimensis* and *Rapana venosa*. Comprehension of the ecological importance of the native species was acknowledged by 52 % of the students, while 61 % of them apprehended the negative impact of the invasive species. Algae, crustaceans and other shellfish species were noticed by 53 % of the participants.

Questions (I and J), that appraised the feeling of satisfaction related to the practical activities carried out on the beach, received a positive response in over 90% of the cases. The new knowledge assimilated in practice (collecting and identifying the shells), the way the information was communicated by the specialists and, not the least, the team building feeling were in top of their preferences. 91% of respondents agreed that the activities organized in this way are challenging and more interesting, therefore such events should be organized more often. The responses are represented in the Fig. 5.

### 3.4. Assessing the responses of students from "Mihail Koiciu" School to questionnaire 3 (Q3)

Before beginning the activity onboard R/V *Mare Nigrum*, the students were inquired on various aspects concerning the MPAs and the diversity of species with questionnaire Q3 (Table 3). To be more attractive and suggestive, the Q3 included pictures with examples of plants and animals from the Black Sea, as well as images with clean and dirty beaches.

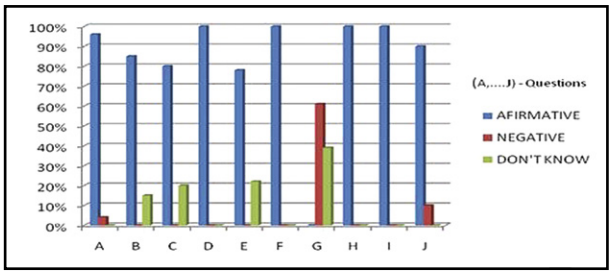


**Fig. 5.** Proportion of affirmative, negative and undecided responses on Questionnaire 2.

The results of the survey showed that about 82 % of the respondents were aware of the fact that many species of plants and animals require protection, but only one knew about the existence of MPAs in the Black Sea, and also managed to exemplify a protected area from the Romanian seaside (Submerged Eforie Nord – Eforie Sud beaches). They also recognized species of algae and animals found on the beach, about 37% of them indicated *Ulva lactuca, Ceramium virgatum, Cerastoderma glaucum* and *Rapana venosa*.

When children had to recognize in four images shown the species living in the Black Sea, only 37 % affirmed that they saw them on the Romanian seaside. Despite this, all children were able to identify two protected species from the images: the seagrass and the seahorse.

Regarding the children's knowledge on the dolphins in the Black Sea, 64 % of the respondents knew that 3 species live here, the rest, in equal percentages of 18 %, mentioned the existence of two or one species. It was also noted that the students knew about the use of shellfish for food, 36 % of them heard of the mussels, and 18 % about the *Rapana* and mussels.

The students prefer to recreate on the beaches "Trei papuci" (43 %) and in Mamaia resort (36 %), all of them saying

**Table 3.** Questionnaire 3 (Q3)

| | Questions |
|---|---|
| A | Do you know that some plants and animals from the Black Sea require protection? |
| B | Are you aware of the existence of the marine protected areas on the Romanian Black Sea coast? |
| C | Can you locate any of the MPA's from the Romanian littoral? |
| D | What plants and animals may be found on the beach? Can you identify any of them in the next figures? |
| E | Can you recognize the seahorse from the pictures bellow? |
| F | Can you indicate which of the plants in the pictures represent a seagrass? |
| G | Do you know how many dolphin species exist in the Black Sea? |
| H | Can you give some examples of edible shells and snails from the Black Sea? Is any of the species of shells in the picture good for human consumption? |
| I | How would you like our beaches to look like? |
| J | Which of the beaches on the Romanian seaside are you visiting more often? |
| K | Do you think it would be useful to warn our parents, grandparents, friends to throw garbage in bins? |
| L | Would you like to become a marine researchers? |

that the beaches should be clean, without any kind of waste, and that is useful to warn others to throw garbage in special places.

Eventually, 91 % of the students said they would like to become marine researchers or be part of a volunteer's team to help cleaning beaches and informing adults about the importance of protecting the marine environment. The responses were summarized in Figure 6.

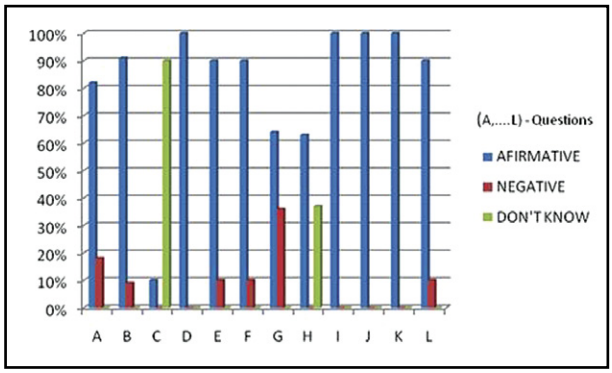


**Fig. 6.** Proportion of affirmative, negative and undecided responses on Questionnaire 3.

### 3.5. Activities carried out onboard R/V Mare Nigrum by the children from "Mihail Koiciu" School

On the 20th of June 2017, 10 5th grade students (11-12 years old) from "Mihail Koiciu" School in Constanța visited the ship "*Mare Nigrum*", while being docked. Aboard, guided by the biologists from NIRD GeoEcoMar, the activities were focused on explanations concerning the marine research work, the instruments and the methods used to explore the biodiversity and the hydrochemical parameters of the Black Sea (Fig. 7). Also, short lectures were given about the MPAs in the custody of GeoEcoMar.

**Fig. 7.** Children learning about the marine research on board of R/V Mare Nigrum.

The children were delighted to inspect the laboratories and the deck of the research vessel and above all the research instruments, hence the questions on uses of each of them did not wait to come out. Many of them declared on spot that they wish to become marine researchers when they grow up.

Our research, focused on assessment of reactions and responses of fifth grade students from two elementary schools in Constanța involved in ecological educational activities organized by specialists from the NRDI GeoEcoMar, entailed methodologies largely used at this moment in educational science and environmental projects. These include direct communication in an informal environment (outside the school) and a quantitative analysis in form of questionnaires (Zorrilla-Pujana and Rossi, 2014), which assessed the children feedback before and after each field activity. There is widespread consensus that outside of schools, empowering people to be stewards of the natural environment must begin well before adulthood (Wells and Lekies, 2006). Kudryavtsev *et al.*, 2012; Hartley *et al.*, 2015 showed that direct nature experiences and emotional connections increase interest and motivation for engaging in pro-environmental behaviors and actions to protect individual species and ecosystems. The learning performances and involvement in the field activities are driven by the feeling that they are playing an important role in achieving the objectives of protection of diversity of MPAs, as also shown by Cigliano *et al*, 2015. Over 70% of students responded they have worked better in the team. The children's positive attitude when faced the environmental problems of the Black Sea (beaches included) and their desire to help, the efforts of authorities and teachers for changing (at least in part), the educational vision by promoting state-of-the-art methods, as well as the opportunities opened by the increasing number of scientists and NGOs involved in ecological awareness, are among the good aspects noted. The weaknesses and threats are related to the lack of permanent ecological education within schools and a still "rigid" curricula, which was noticed in the children's relatively low level of knowledge about MPAs and biodiversity of the Black Sea.

## 4. CONCLUSIONS

Following the activities organized with the children from two schools in Constanța, "Ciprian Porumbescu" and "Mihail Koiciu", the researchers from NRDI GeoEcoMar received positive feedback from the majority of the participants. Students showed interest in the marine protected areas from the Romanian littoral, despite the fact that most of them did not know the concept. However, the students advocated in favor of their participation in actions of protection of the marine environment, and pleaded for the necessity of maintaining and conserving the habitats and species within marine protected areas. At the same time, the children claimed the right for clean beaches and seawater, the Black Sea being quite polluted in their opinion. They suggested starting the volunteer actions of the waste collection from the beaches or involvement in other greening initiatives, inclusive awareness of their parents or friends.

Children learned about native and invasive species, understanding the differences between the two terms, the importance of the native ones and the negative impact of the invasive species on biodiversity. They also acquired knowledge about the specific methods of investigation the biology and geochemistry of marine environment and about the research vessel R/V Mare Nigrum.

The students showed a higher receptivity for the practical field activities, looking forward to participating in such events in the future. Some students showed a medium interest to fill in the questionnaires, possibly due to a mental association with the formal lessons used to be taught in school.

The popularization of information on MPAs and promoting the protection measures among 9 to 15 years old children, or even younger, could contribute in the future to improving the state of the marine environment. Children in this age segment have proven to be more responsive and eager to change things for the better. Additional training and resources to facilitate children's participation to such activities, and in schools, efforts to align with the curricula and national standards must be considered.

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