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Assessment of the Motivation for Participation in Citizen Science Initiatives for Invasive Alien Species in Bulgaria

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Abstract. The article presents an analysis of the motivation for participating in Citizen Science (CS) initiatives for invasive alien species (IAS) of professionals involved in the management and use of biological resources and general public. The motivation of the interviewees was assessed through a questionnaire containing questions about: Level of awareness of the existing opportunities for CS initiatives related to biodiversity in Bulgaria; Experience in initiatives for monitoring or registration of plants and animals; Reasons that would motivate or disappoint the respondents to participate in the CS; The most appropriate way for respondents to participate in CS initiatives, as well as the most appropriate form of raising their awareness of IAS. The results indicate that the main reasons for the failure to participate in CS initiatives was the lack of accessible information on the problems posed by the IAS and tools and initiatives for the IAS CS in Bulgaria. Possible measures and policies for involvement of various stakeholders in the IAS SC initiatives in Bulgaria are discussed.

Key words: data analysis, biodiversity, invasive alien species, citizen science.

Introduction

Good information on introduction routes and the negative impact of invasive alien species (IAS) is crucial for their early detection and rapid removal. IASs can significantly hamper efforts to conserve and restore biodiversity and cause significant damage to nature and the economy. The EU's 2030 Biodiversity Strategy aims to achieve the management of identified invasive alien species and reduce by 50% the number of endangered species on the Red List, which currently stands at 354 (EC, 2020). Citizen science (CS) can play an important role in involving a wide range of stakeholders in various initiatives that contribute to preventing the introduction and dissemination of IAS, but in Bulgaria it is underdeveloped. Insufficient volume of related information, as well as access in an understandable form through digital exchange channels is the reason for the poor knowledge of the state of CS for IAS. Improving this trend should be sought by providing and learning about activities aimed at increasing the experience of

individual groups of participants in the monitoring of IAS. With the appropriate tools, a higher level of motivation can be achieved for their involvement in the process of registration of individuals from the flora and fauna. The level of awareness about the existing opportunities for CS initiatives for biodiversity in Bulgaria, the available experience in initiatives for registration/monitoring of plant and animal habitats, the main reasons that would motivate or disappoint the respondents to participate in CS. Together with the most appropriate way for respondents to participate in CS initiatives and the forms for raising their awareness about IAS, they are criteria whose assessment and analysis can be used to solve the problem of low interest and motivation of non-professionals in this field.

Approaches related to the assessment of motivation. It is essential here to study the importance of the relationship between assessment and motivation from the perspective of both biodiversity professionals and non-professionals. One way to do this is to combine a survey with separate data sets (Wu et al., 2014) to obtain the appropriate number of interrelated topics, with the subsequent analysis performed on the basis of an accepted standard thematic process of coding responses and inductive code generation. In order to increase motivation, it is necessary to provide activities related to the assignment of authentic and diverse evaluation tasks, providing effective feedback, as well as clarification of the set goals together with internal motivation. When the response rate is low, it is impossible to correctly interpret and use the responses of the respondents, which creates a number of problems (Hoel & Dahl, 2019). In such a case, it is necessary to assess where the motivation to participate breaks down, and where and how it makes sense to focus efforts on overcoming the problem. Regarding the behavior of those who rarely or never participate in online initiatives, in most cases the reasons can be found in their willingness to invest up to 5 minutes in the process. In terms of motivation, factors such as: willingness to participate at all; perception of autonomy and competence; significance; personal value, commitment to the participation of others; understanding the value of their own participation for the benefit of others. The approaches for assessing the motivation should also take into account the connections and in terms of knowledge of the subject related to the various activities and initiatives, which determines the effectiveness of the individual groups of participants in them. Dependence has been found according to which the internal motives for engagement with the problems of the surveyed professionals increase in a positive direction, while that of the others decreases over time (Tasgin & Tunc, 2018). Approaches such as the 'Effective Participation Scale' or the 'Internal External Motivation Scale' can be used to collect and process data from different surveys. The first is suitable for use at both the institutional and peripheral levels, allowing for an assessment of the impact of interventions to improve social participation - data allowing for comparison between participants, interventions and programs (Van Brakel et al., 2006). The scale allows data collection on participation and assessment of the impact of interventions to improve participation. In other approaches aimed at measuring motivation to participate, in particular in initiatives involving physical activity and leisure, in order to establish a comprehensive measure, a check on the internal coherence and validity of the criteria of the Motivation Scale for Physical Activity and Leisure (PALMS) is added, as well as testing individual models in confirmatory factor analysis (Roychowdhury, 2018). Despite the fact that the data from the surveys provide valuable information for both institutions and citizens, there is a worldwide trend of

decreasing participants in them and, respectively, in the degree of answers given. Negative impact on future research may be caused by attempts to persuade or pressure for mandatory participation, which is counterproductive in the long run. An alternative approach to achieving higher levels of response may be to focus on the self-motivation of respondents in the surveys (Wenemark et al., 2011). Based on the use of the 'Self-Determination Theory', which provides a theoretical framework on how to stimulate inherent motivation, a redesign approach to relevant surveys can be used, measuring the effect in terms of response rate, participant satisfaction and data quality. Such an approach will also have an effect on the accumulation of positive experience by the respondents. Regardless of the approach used to assess motivation, it should be borne in mind that even a small dropout rate can affect bias and unrepresentative information (Ekholm et al., 2009).

CS for the IAS. CS plays an important role in engaging a wide range of stakeholders and the general public on the issue of IAS, whose biological invasions are an increasing challenge to individual countries in terms of measures needed to prevent environmental problems at local and national level. level. Any collection and analysis of environmental and/or biological data, including data quality control, undertaken by members of the general public, as individuals or as organized groups of citizens, with the guidance and/or assistance of scientists to solve environmental problems and/or community issues are treated as CS (Encarnação et al., 2021). In this process, the measures and initiatives taken need to be widely available and known to the general public in order to achieve a good level of its involvement. Good road awareness and the negative impact of IAS are crucial for early detection and prevention of their spread. In this sense, CS can be very successfully involved and greatly increase the effectiveness of the actions taken to prevent the introduction of IAS. When assessing the propensity to participate in such initiatives, surveys should take into account the extent to which they are applicable and possibly whether it is necessary to adapt methods and approaches to the studied ecosystems and species, along with the profile of respondents - motivation, level of engagement, social status, gender and age. In order to avoid obtaining fragmented data collected from various citizen initiatives related to the IAS, it is necessary to use an open and accessible platform for uploading data from CS sources (Cardoso et al., 2017), which reflects validated data. in an easy-to-use web service, in line with the EU's strategic open science priority. Once the data has been validated by the competent authorities of the Member States regarding the IAS Regulation, they will contribute to the early warning of the IAS by complementing the official monitoring systems, while raising citizens' awareness. The emergence of new, potentially invasive taxa, in addition to adverse effects on the environment, may directly affect some economic activities. Early detection and action is most cost-effective in terms of the resources needed to address the problem. For this reason, from a public point of view, CS's initiatives in this direction are extremely important. Volunteers providing information are a key part of such initiatives. In order for their participation to become more widespread, it is necessary to develop methods for quantifying their efforts and, accordingly, to assess their contribution to the detection of alien species (Pocock et al., 2017). In this way, there will be a tool for the objective assessment of the use of CS as a monitoring tool in the discovery of IAS deposits. Qualitative data collected by volunteers can greatly increase the range of the sample, fill gaps in the distribution of species, and improve habitat suitability patterns compared to professionally

generated datasets used alone (Crall et al., 2015). The addition of voluntary data does not significantly change the performance of models generated by professional data sets, but changes the fitness surface generated by the models, making them more realistic. This helps CS to expand the scope of data collection and monitoring for IAS. The establishment of monitoring networks involving a wide range of professionals and non-professionals involved in the monitoring process, as well as the pooling of data, are key to the effectiveness and success of any initiatives related to improving knowledge about the dissemination of IAS.

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Approach to assessing the level of awareness regarding CS for IAS in Bulgaria. In Bulgaria, in recent years, studies on the motivation for public involvement in various environmental initiatives have been conducted by Bancheva (2015), Bancheva-Preslavska & Bezlova (2018), Bancheva-Preslavska & Dallmer (2020) and others. Very little is known about the state of CS for IAS in Bulgaria. COST action CA17122 'Increasing the understanding of alien species through citizen science', addresses multidisciplinary research in connection with the development and implementation of CS. In implementation of this COST action, the project 'State and prospects of citizen science for invasive alien species in Bulgaria' is being implemented, funded by the Research Fund at the Ministry of Education and Science. The project has developed a specialized web-platform for registering information about the IAS and its sharing (https://invazivnividove.ltu.bg/) with a survey on public attitudes to IAS-related initiatives.

The main goal of this study is to assess the motivation of the general public in Bulgaria to participate in CS initiatives for IAS.

Material and Methods

Questionnaire surveys were conducted to assess the existing CS initiatives related to IAS, the level of IAS awareness of different groups of society and their motivation to participate in CS were assessed through a questionnaire survey asking respondents to make judgments about their own level of knowledge about: the level of awareness of about existing IAS CS initiatives in Bulgaria; the experience in monitoring or registration of plants and animals; the motivation and appropriate ways to participate in CS; the most appropriate approach for IAS awareness raising.

Two groups of respondents were questioned: professionals (with educational background in biology or with professional activities related to the bio resources) and non-professionals (not connected with bio resources).

Results and Discussion

The survey included 616 respondents, including 259 of them professionally dealing with biological objects, and the rest are representatives of the general public - non-professionals. The distribution by age and sex in the two groups is identical, except that among professionals the group of 15-20 year olds is missing (Fig. 1). The share (over 93%) of the respondents who are professionally engaged in biological sites and are in the active working age 21-60 years is significant, which makes the results of the survey representative in terms of the implementation of European policies related to biodiversity conservation in Bulgaria. Fulfilling one of the specific objectives of the survey, in terms of citizen society participation in citizen science initiatives, over 82% of non-professionals surveyed are under the age of 40, with more than 50% of them being young people under the age of 20. The knowledge, motivation and activity of young people is essential for solving modern environmental problems. The relevance of the study is confirmed by the result that respectively for about 58% of professionals and 42% of non-professionals, working with biological objects is related to their hobby. The main share is of tourists, naturalists, wildlife photographers and others. About 1/3 of the surveyed professionals have noted that they fall into the group of students, respectively master, doctor or bachelor 3, 4 course. The share of non-professionals who are students or bachelors from the initial courses of study is significant, these are almost 2/3 of the respondents.

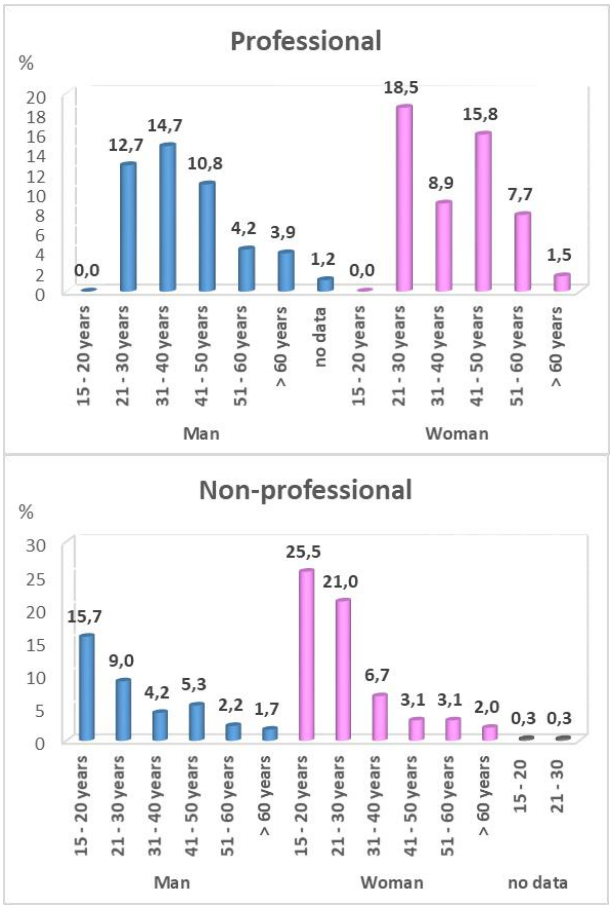

Fig. 1. Distribution of respondents by gender, age and professional status

For the majority of respondents (professionals and non-professionals) awareness of the importance of IAS is from medium to unsatisfactory level (Fig. 2). As expected, the share of positive responses among professionals is

higher. The only exceptions are two issues concerning the distribution of IAS in their natural habitats and their socio-economic impact. There are no significant differences in the answers to these questions between professionals and non-professionals.

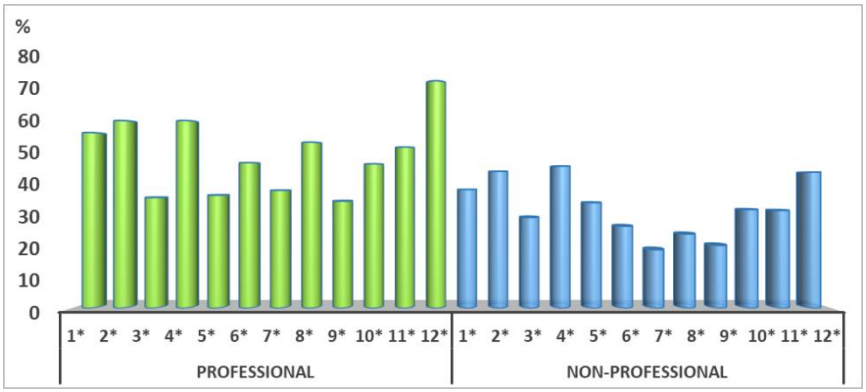

Fig. 2. Awareness of Invasive Alien Species (IAS).

Legend:
1*. Do you think that the term "invasive species" should refer to organisms that have a negative impact, regardless of whether they are expanding their range?
2*. Do you think that the term "invasive species" should refer to organisms that expand their range, regardless of their impact?
3*. Do you think that some species can be considered "invasive" in the places of their natural distribution?
4*. Do you consider invasive species to be one of the main threats to biodiversity?
5*. Do you think that invasive species can have a positive socioeconomic impact?
6*. Have you encountered information about invasive species in various information sources?
7*. Did you know that a Regulation on invasive alien species has been adopted in the European Union (Regulation No. 1143/2014)?
8*. Can you name one or more invasive alien species relevant to the European Union?
9*. Would you name a pet that is an invasive species of importance to the European Union?
10*. Can you give an example of the negative impact of invasive species?
11*. Can you indicate a way/way for introduction (transfer) of alien species in Bulgaria?
12*. Can you name a structure/organization that you think is responsible for preventing the penetration and spread, as well as the control of invasive alien species in Bulgaria?

More than 73% of the surveyed professionals indicate a structure/organization that is responsible for preventing the penetration, dissemination and control of IAS in Bulgaria. In the general public, the percentage is approximately twice as low. More than 60% of professionals believe that the term 'invasive species' should refer to organisms that expand their range, regardless of their impact, and that IASs are one of the main threats to biodiversity. On the other hand, for non-professionals this share is about 15 points lower and is in the range between 44-46%.

Just over 50% of professionals can indicate one or more IAS relevant to the EU for non-professionals, this percentage is about 30 points lower. This is a clear sign of the low awareness of both the general public and the experts regarding the IAS in Bulgaria. Unfortunately, just over 46% of the surveyed professionals have found information about invasive species in various information sources, this share is

more than 20 points lower among non-professionals. The results show the insignificant awareness of both experts and the general public regarding the important issue of IAS in Bulgaria. The lack of well-structured information campaigns aimed at both experts and the general public is clearly evident in the results obtained. Despite the fact that IAS have a strong media coverage and this issue is not attractive and does not represent journalistic and media interest, their role in terms of biodiversity has been proven. This gives us reason to look for errors in terms of awareness on this issue, both in terms of professionals and the general public. The survey clearly outlined the gaps and white spaces in this direction. Less than 40% of professionals and respectively less than 20% of non-professionals are familiar with the adopted regulation regarding IAS in the EU, this share is extremely small. Compared to other European countries, and here comes the role of CS, through the transfer in an accessible way of knowledge and competencies from experts to the general public. Despite the lower awareness of both experts and non-professionals regarding the IAS. With regard to the question of who we need to inform, if we notice a mass multiplication of plant and animal species in nature. Both groups of respondents put in the first place the structures of the Ministry of Environment and Water, environmental NGOs, the structures of the Ministry of Agriculture, Food and Forestry, including the Executive Forest Agency and others. etc. In this respect, there are no significant differences in the answers of both professionals and non-professionals. Both groups of respondents know the roads and are clear about the principle of alerting the competent authorities in the country in case of environmental problems.

Regarding the next section of the survey, concerning the level of awareness of the existing IAS initiatives in the UK, no significant differences in responses were observed (Fig. 3). An exception, according to experts, according to 2/3, of which the initiatives to promote CS, means conducting activities to promote science among the general public. In contrast, among non-professionals this share is insignificant, less than 15% of respondents answer positively.

Logically, in terms of experience in the observation or registration of plants and animals, experts and professionals answer a higher percentage of positive questions. It is noteworthy, however, that the general public, despite the fact that it has not participated in such initiatives and rarely receives information about such events and actions, readily responds that it would participate in the implementation of such activities (Fig. 4).

A significant part of the study is the issues related to motivation and appropriate ways of participation of both experts and the general public in initiatives related to CS and in particular IAS. Despite the fluctuations in the answers of the two groups of respondents, Factors that would motivate them to participate in CS-related initiatives are similar (Fig. 5) In the first place, both groups outline the care for nature, followed by the commitment to contribute to nature conservation, etc.

The two leading reasons that limit the participation of respondents in CS-related initiatives are, respectively, the lack of time and the lack of sufficient information about similar opportunities and actions related to citizen initiatives for IAS (Fig. 6).

The importance of scientific institutions and the scientific community for initiating activities related to CS is clearly outlined in the answer to the question related to the most appropriate and convenient way to participate in such activities (Fig. 7). More than half of the respondents from both groups outline the leading role of research institutions in organizing CS-related initiatives.

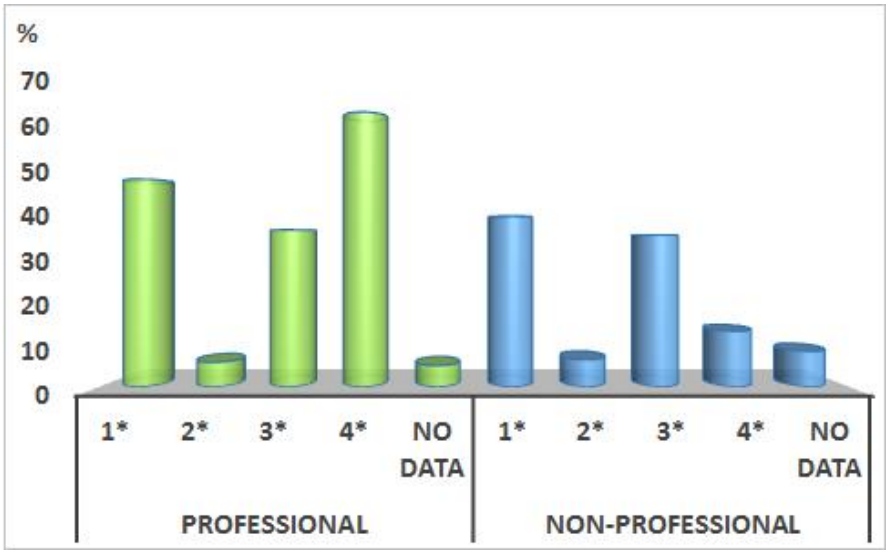

Fig. 3. Answers to the question "What do you think the term" citizen science "means?".

Legend:
1*. Transfer of knowledge from professionals to non-professionals (trainings, information campaigns).
2*. Sharing information on Facebook forums.
3*. Voluntary collection of information and its provision for subsequent analysis and use.
4*. Initiatives to promote science among the general public.

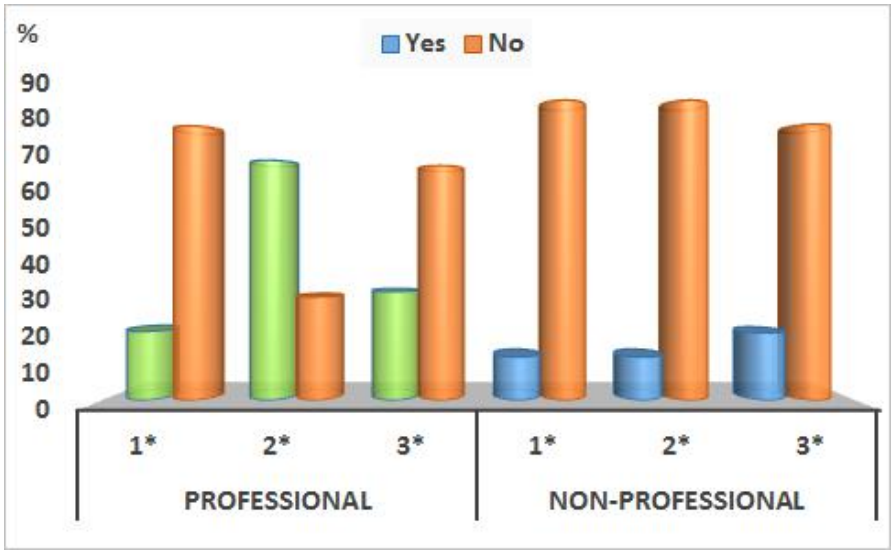

Fig. 4. Level of awareness of existing IAS CS initiatives in Bulgaria and experience of IAS monitoring or registration.

Legend:
1*. Do you have information about a project/website or a CS initiative related to biodiversity?
2*. Have you participated independently or in an organized manner in the registration/monitoring of plant and animal habitats?"
3*. Have you been involved in reporting (and sending data) on plant and animal habitats?

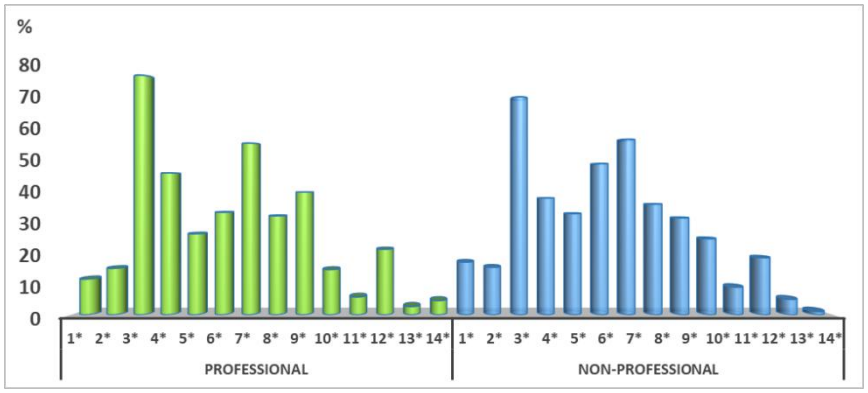

Fig. 5. Answers to the question "Indicate what would motivate you to participate in citizen science initiatives".

Legend:
1*. Loss prevention for my business.
2*. Prevent damage to my hobby.
3*. Caring for nature.
4*. Engaging the younger generation with the topic of threats to biodiversity.
5*. To be connected with nature.
6*. To learn more about nature.
7*. To contribute to nature conservation.
8*. To spend more time in nature.
9*. To contribute to science.
10*. To notice as many species as possible.
11*. It gives meaning to my life.
12*. To work in a team with other nature lovers.
13*. Others.
14*. No answer.

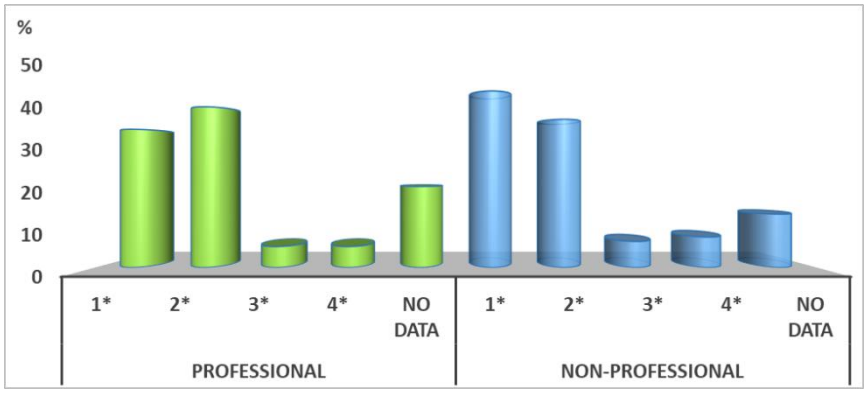

Fig. 6. Answers to the question "Give a reason why you would not participate in CS initiatives".

Legend:
1*. I have no time
2*. I do not have enough information about such a possibility
3*. I do not want to share information
4*. Other
No answer

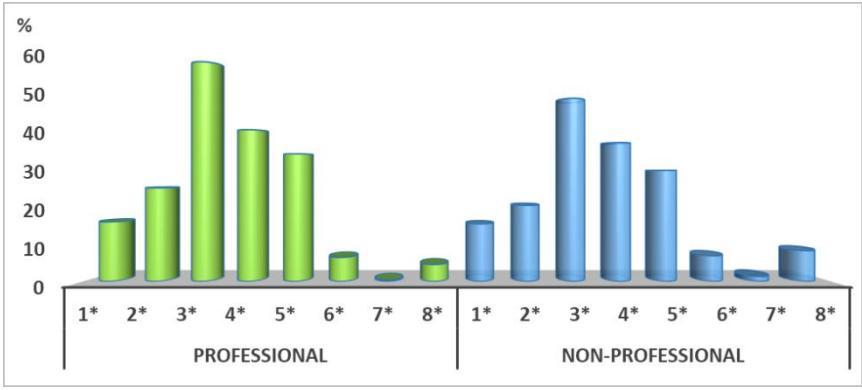

Fig. 7. Answers to the question "Indicate the most appropriate/convenient way for you to participate in citizen science initiatives".

Legend:
1*. Independently.
2*. Organized by NGOs.
3*. Organized by a scientific institution.
4*. Using mobile applications for smartphones.
5*. Submitting data to internet forums/sites.
6*. Filling in paper forms.
7*. Other…
8*. No answer.

The study focuses on young people, on whom the solution of environmental problems will depend in the future, including as a result of the IAS. Respondents say that the main motive for their participation in CS-related initiatives would be their personal contribution to environmental protection, as well as the opportunity to spend time in nature. The "new reality" that has emerged in recent years has contributed to the reduction of group initiatives, so participation in many projects is done independently, whether in online projects or environmental monitoring. This combined with a lack of awareness to deter potential participants who want to meet like-minded people and join the CS volunteer community.

Conclusions

The main reasons for the low participation of citizens in CS initiatives are the lack of available information on the negative impact on biodiversity of the IAS, as well as the lack of tools and initiatives on these issues, which are well promoted in Bulgaria. For most of the questions, the survey showed a similar attitude and motivation among both professionals and non-professionals.

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