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Involvement of young people in the citizen science of invasive alien species in Bulgaria

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Abstract: *Citizen science plays an important role in the early detection of invasive alien species (IAS). The involvement of young people in initiatives related to citizen science in Bulgaria could contribute to better monitoring of IAS because of mobility and digital skills of those people. Based on a questionnaire survey, key aspects of involvement of young people in citizen science initiatives were analysed. Two groups of respondents, including professionals (with an educational background in biology or with professional activities related to the bioresources) and non-professionals (not connected with bioresources) were asked to make judgments about their own level of knowledge about: (1) IAS issues, (2) the level of awareness of citizen science; (3) the motivation and preferable ways to participate in citizen science; and (4) the most appropriate approaches for IAS awareness raising. A total of 337 young people in the age range of 15-30 years were questioned during the period 2019-2021. The results show that there is no significant difference between the responses of the two groups of respondents to the questionnaire - professionals and non-professionals. In both groups, less than 50% of respondents are aware of issues related to IAS. Less than 40% of respondents indicated the correct definition of citizen science. The leading motivation factor to participate in citizen science initiatives is "caring for nature" followed by "to contribute to nature conservation" and "to learn more about nature". Most of the respondents are interested in additional information related to IAS and prefer online sources for information.*

Keywords: motivation, questionnaire survey, awareness raising

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Introduction

Invasive alien species (IAS) are among the main and growing causes of biodiversity loss and the disappearance of some species. The EU's 2030 Biodiversity Strategy [1] aims to minimize and, where possible, eliminate the introduction and establishment of alien species in the EU environment. According to an EC report from October 2021 on the implementation of Regulation (EU) 1143/2014 for IAS in the period 2015-2018, the costs for management range from EUR 17,000 to EUR 40 million per Member State, with the total estimated costs in all Member States amounting to around EUR 75 million over a four-year period [2]. Good awareness about the negative impact and early detection of IAS is crucial for the prevention of their introduction and spread.

Citizen science (CS) initiatives actively involve citizens in a scientific endeavor that generates new knowledge or understanding [3] and play an increasingly important role in the early detection of new invaders. Globally, there is a tendency to increase the number of participants in CS initiatives, and here it is extremely important to successfully involve in such initiatives younger groups in view of their good knowledge and use of various digital resources, applications, and related technologies.

Young people need to be involved in CS activities through appropriate motivation in order to make the most of the potential of the accumulated experience, good practices, tools, and functionalities. For this reason, the scope of the relevant initiatives needs to be strictly defined before their start. Motivation of the participants in environmental-based CS and stakeholders from ‘science’, ‘policy’, and ‘practice’ are studied by [4] aimed at understanding of why and how people (nonprofessional volunteers) participate in CS initiatives. Analysis of the challenges, opportunities, and examples of good practice in CS for environmental monitoring and reporting is presented by [5]. Despite increasing public involvement in monitoring and control of IAS [6] found that only a limited number of studies have investigated volunteer motivations to participate in such activities. In order to maintain the sustainability of the CS initiatives undertaken for IAS in Bulgaria, this study aimed at analyzing and clarifying the key aspects of involvement of young people in CS initiatives as: IAS and CS awareness, motivation for participation in IAS CS initiatives, and preferable approaches for IAS awareness raising of young people in Bulgaria.

Material and methods

Questionnaire surveys were conducted to assess the key aspects of the involvement of young people in the citizen science of invasive alien species in Bulgaria during the period 2019-2021. Two groups of respondents were questioned: professionals (with an educational background in biology or with professional activities related to the bioresources) and non-professionals (not connected with bioresources). The

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respondents were asked to make judgments about their own level of knowledge about: (1) IAS issues, (2) the level of awareness of CS; (3) the motivation and preferable ways to participate in CS; and (4) the most appropriate approaches for IAS awareness raising. The questions included in the questionnaire are presented in Figures 1-9.

A total of 337 young people in the age range of 15-30 years were questioned. Approximately 1/4 of the respondents deal professionally with biological sites, and the rest are representatives of the general public - non-professionals. There are no surveyed professionals among young people between 15-20 years old. The group of non-professionals includes 57.8% of pupils and young students from the initial courses aged between 15-20 years, and the rest are aged between 21-30 years.

Results and discussion

The results show that in both surveyed groups of young people (professionals and non-professionals) less than 50% of respondents are aware of issues related to IAS (Fig. 1). As expected, the awareness of professionals is higher, but nevertheless, only three questions were answered correctly by more than 50% of respondents. More than 65% of professionals believe that the term "invasive species" should refer to organisms that expand their range, regardless of their impact. The large percentage of positive answers to questions No 2 and No 5 show that both groups of respondents are not sufficiently familiar with the definition of invasive species emphasizing their negative impact [7]. Less than 30% of respondents are aware of Regulation No 1143/2014.

More than 74% of the surveyed professionals indicate a structure or organization that is responsible for preventing the introduction and spread, as well as the control of invasive alien species in Bulgaria, but for non-professionals this percentage is twice lower. In case of increased abundance, professionals would inform structures of the Bulgarian Ministry of Environment and Water. In contrast, more than 60% of young non-professionals would contact environmental related NGOs. Our result clearly outlined the need for an awareness-raising campaign, particularly focused on young non-professionals. The level of IAS awareness of the most respondents (professionals and non-professionals) is from medium to unsatisfactory. A review of the content of more than 20 textbooks for secondary education showed that IAS-related information consists of a single paragraph at best. In the most textbooks, IAS are mentioned in a single sentence describing potential threats to the biodiversity of the planet.

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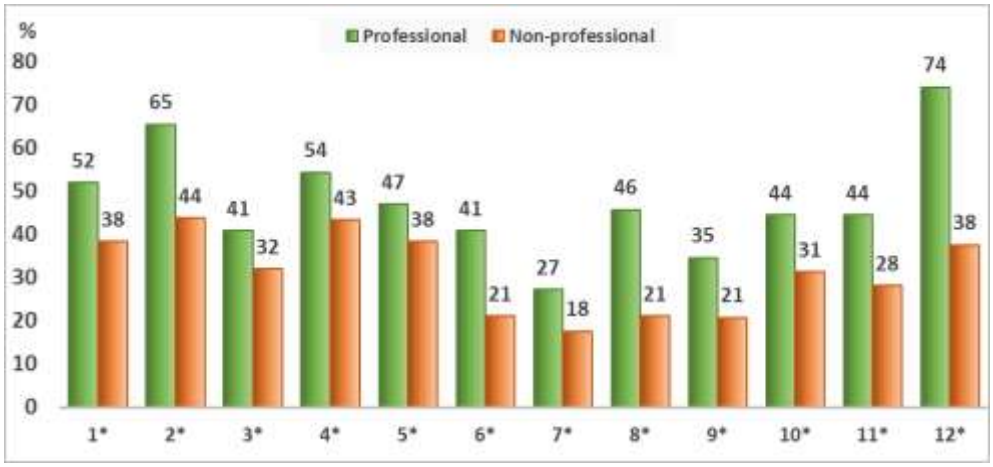


Figure 1. Awareness of invasive alien species (IAS). Positive answers (in %)

Legend: Questions

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*. Do 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 of Union concern?

9*. Would you name a pet that is an invasive alien species of Union concern?

10*. Can you give an example of the negative impact of invasive species?

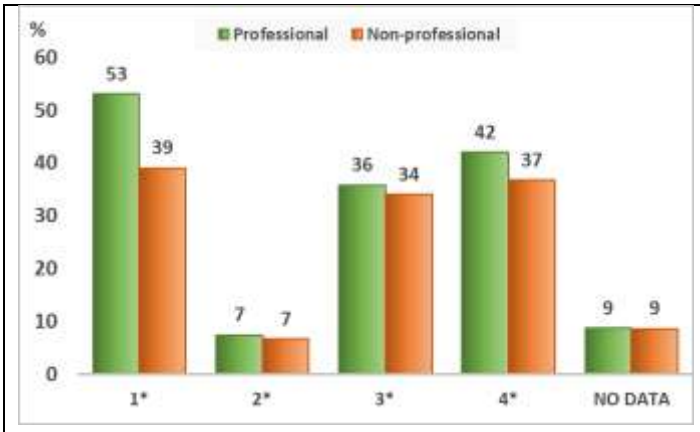
11*. Can you indicate a pathway for introduction of alien species in Bulgaria?

12*. Can you name a structure / organization that you think is responsible for preventing the introduction and spread, as well as the control of invasive alien species in Bulgaria?

The results about the level of CS awareness are presented in Fig. 2 and show that both groups of respondents are not sufficiently informed about the meaning of the term "citizen science" as well. Less than 40% of respondents indicated the correct definition of CS as “Voluntary collection of information and its provision to professional scientists for further analysis and use”. The majority of respondents do not

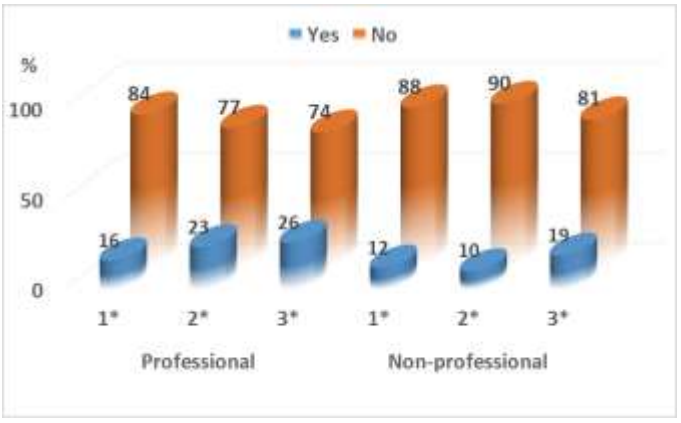
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distinguish between awareness-raising and CS. In addition, very few respondents have information about CS initiatives in Bulgaria and experience in biodiversity monitoring or registration (Fig. 3). Logically, in terms of experience in the observation or registration of plants and animals, experts and professionals gave a higher percentage of positive answers.



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

Figure 2. Answers to the question "What do you think the term "citizen science" means?" Respondents indicated one answer (in %)



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

Figure 3. Level of awareness of existing CS initiatives in Bulgaria and experience in biodiversity monitoring or registration. Positive answers (in %)

There is no significant difference between the responses of the two groups of respondents regarding their motivation to participate in citizen science initiatives (Fig. 4). The leading motivation factor is “caring for nature” followed by “to contribute to nature conservation” and "to learn more about nature". Threats to the business and hobbies of the respondents are not a strong motivating factor for participating in such initiatives.

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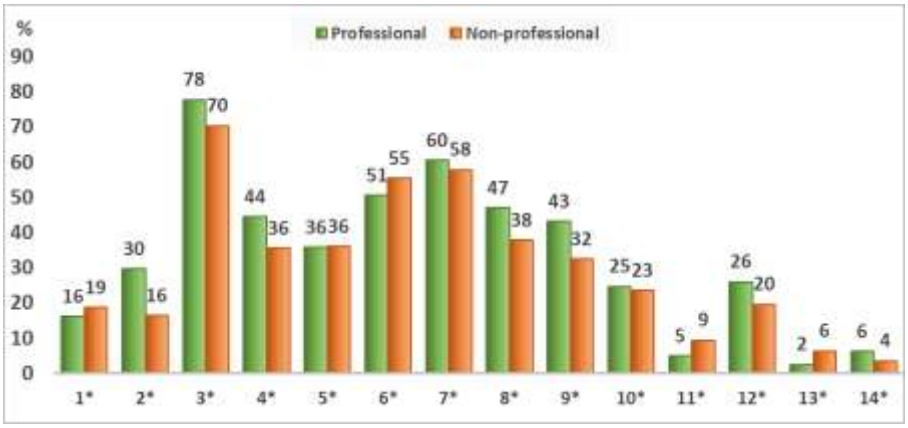


Figure 4. Answers to the question "Indicate what would motivate you to participate in citizen science initiatives" Respondents indicated one answer (in %)

Legend: Possible answers

1*. To prevent losses to my business

2*. To 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

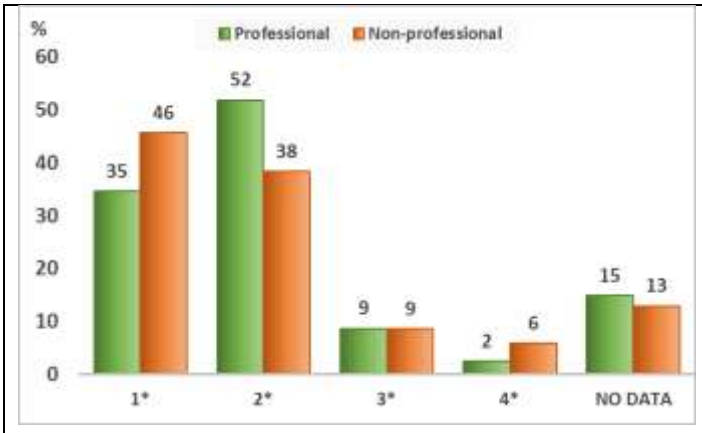
12*. To work in a team with other nature lovers

13*. Others

14*. No answer

The two leading factors that would limit the participation of respondents in CS initiatives are the lack of time and lack of sufficient information about such opportunities in Bulgaria (Fig. 5).

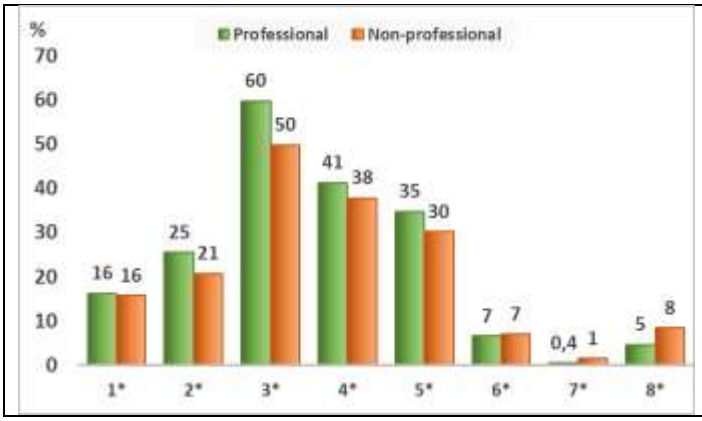
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Legend: Possible answers
1*. I have no time
2*. I do not have enough information about such a possibility
3*. I do not want to share information
4*. Other
No data

Figure 5. Answers to the question "Give a reason why you would not participate in citizen science (CS) initiatives" Respondents indicated one answer (in %)

The importance of the scientific community for initiating activities related to CS is clearly highlighted in the answer to the question related to the most appropriate and convenient way to participate in such activities. About 60% of the professionals and approximately 50% of the non-professionals indicate the leading role of the scientific institutions in organizing CS-related initiatives in Bulgaria (Fig. 6).

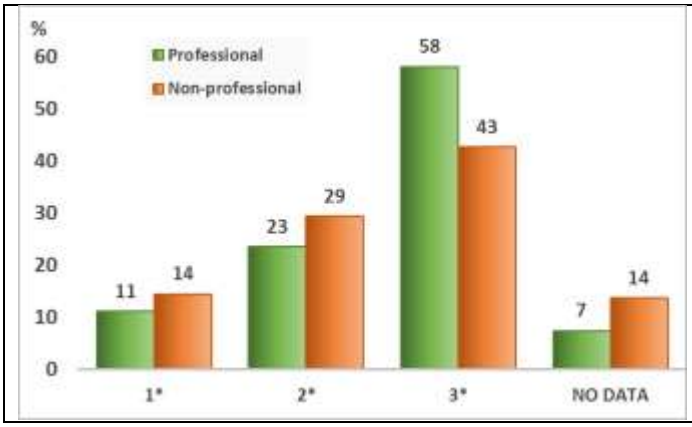


Legend: Possible answers
1. Independently
2. Organized by NGOs
3. Organized by a scientific institution
4. Using mobile applications for smartphones
5. Submitting data to internet forums/sites
6. Filling in paper forms
7. Other …
8. No answer

Figure 6. Answers to the question "Indicate the most appropriate/convenient way for you to participate in citizen science initiatives" Respondents indicated one answer (in %)

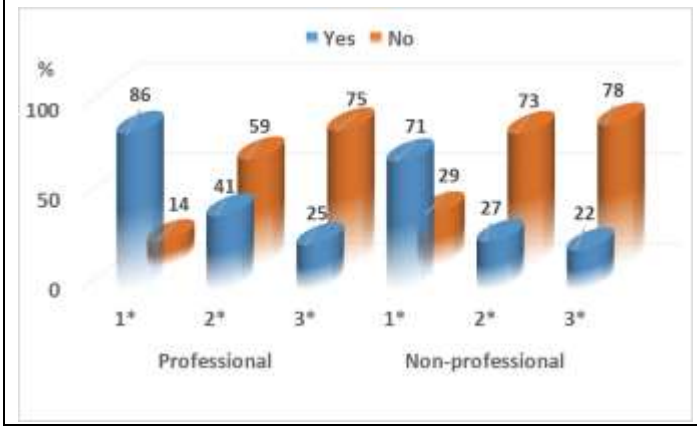
Most respondents from both groups would provide data for general use (Fig. 7) and are not interested in indicating how much data have provided and the use of data (Fig. 8).

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Legend: Possible answers
1. You have no claims and are not interested in using the data
2. The data is your property and you do not think it should be used without your permission
3. The data is provided for general use
4. No answer

Figure 7. Answers to the question "Indicate your attitude towards the ownership of the data you have provided" Respondents indicated one answer (in %)



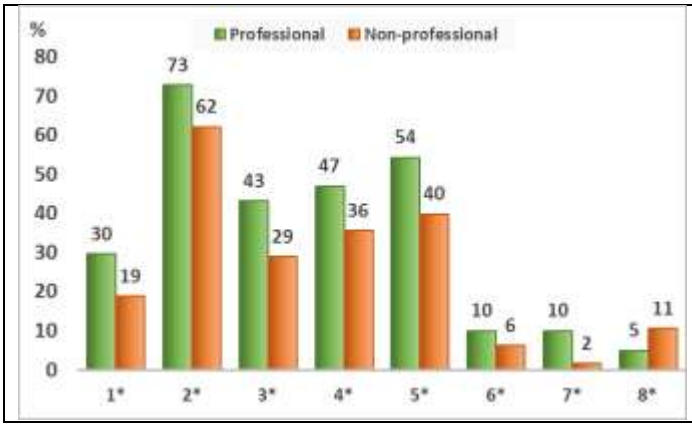
Legend: Questions
1. Would you take the time to participate in an information event on IAS?
2. Do you want to indicate somewhere how much data you have provided?
3. Do you want to be informed about the use of the data you have provided?

Figure 8. Answers to the question about the use of data provided. Positive answers (in %)

Answers from both groups of respondents about the most appropriate way for awareness raising are surprisingly similar. Most of the respondents are interested in additional information related to IAS and prefer online sources for information (Fig. 9).

For more than a decade, Europe has been focused on IAS, placing them at the forefront of the continent's biodiversity threat. Unfortunately, this topic does not have such dimensions in Bulgaria in respect of involvement of young people in CS initiatives. It is advisable to pay more attention to IAS issues, both in the curriculum of schools and universities, through non-formal education activities [8] and the information channels of our society. IAS awareness could help to gain greater support for IAS CS initiatives from many stakeholders: politicians, scientists, teachers, students, non-formal learning teachers, young people and the general public.

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Legend: Possible answers
1. Printed materials - bulletins, newspapers, articles
2. Electronic materials / internet
3. Direct contact with experts from government agencies
4. Direct contact with representatives of professional organizations
5. Seminars or group trainings
6. No need for information
7. Other:
8. No answer

Figure 9. Answers to the question "What is the most appropriate form for you to raise your awareness about invasive species?" Respondents indicated one answer (in %)

The main reasons for the low level of IAS awareness and of participation of young people in CS-related activities are the lack of national campaign, engagement of mass media and low number of IAS CS tools and initiatives in Bulgaria. There is no significant difference between the responses of the both groups of respondents of questionnaire - professionals and non-professionals. The low level of awareness of IAS issues among young people aged 15-20 is evident, which is most likely due to the low representation of these topics in the curriculum in secondary schools. The issues related to IAS and their potential threats should be included in formal and non-formal educational programs, using new educational tools to attract the attention of the younger generation.

Conclusions

The results show that there is no significant difference between the responses of the two groups of respondents - professionals and non-professionals. In both groups, less than 50% of respondents are aware of issues related to invasive alien species. Less than 40% of respondents indicated the correct definition of citizen science. The leading motivation factor to participate in citizen science initiatives is “caring for nature” followed by “to contribute to nature conservation” and "to learn more about nature". Most of the respondents are interested in additional information related to invasive alien species and prefer online sources for information.

Acknowledgments

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