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Master Thesis

Are ecological citizen science projects able to sustainably change the society?- Participant investigation in the BeeRadar project

Submitted by

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Affidavit

I hereby declare that I have authored this master thesis independently, and that I have not used any assistance other than that which is permitted. The work contained herein is my own, except where explicitly stated otherwise. All ideas taken in wording or in basic content from unpublished sources or from published literature are duly identified and cited, and the precise references included.

I further declare that this master thesis has not been submitted, in whole or in part, in the same or a similar form, to any other educational institution as part of the requirements for an academic degree.

I hereby confirm that I am familiar with the standards of Scientific Integrity and with the guidelines of Good Scientific Practice, and that this work fully complies with these standards and guidelines.

A handwritten signature in black ink, appearing to read 'Eva Hütter', with a stylized, cursive script.

Vienna, 01.03.2022

Eva HÜTTER (*manu propria*)

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Abstract

BeeRadar is a classic ecological citizen science project with the aim of providing environmental education about the current loss of biodiversity, its causes, and risks. Through the knowledge shifts and actions of the participants a change in trend towards more sustainable actions should be created.

In this Master's thesis, I investigate whether the objectives of the BeeRadar Citizen Science Project and its Serbian twin project are being achieved.

To investigate this, I first conducted three qualitative interviews with participants of the project and then used it as a basis to develop a quantitative questionnaire, which was sent to all participants. In all steps, the Citizen Scientists had insight and the possibility to contribute.

The aim of the work is: A) To find out if the participants differ from a control group in terms of environmental knowledge and time spent on environmental issues B) If there is an added value in terms of knowledge and skills gained by participating in the project C) To evaluate the project in terms of communication and knowledge transfer.

A total of 141 direct participants of the project and 595 in the control group participated in the study. This survey revealed the following:

- Participants in the BeeRadar Citizen Science Project have, for the most part, changed their behaviour through participation in the project and are more aware of nature.
- Participants of the Citizen Science Project BeeRadar were mostly able to expand their knowledge in the environmental field through participation in the BeeRadar project.
- Some of the participants of the project already differed from the control group in their perception of and interest in the environment before they joined the project.

These results show that Citizen Science projects, such as BeeRadar, can help people to engage more with environmental issues and have more experiences in nature. They therefore contribute to an awakening interest in nature and dealing with environmental problems.

Kurzfassung

BeeRadar ist ein klassisches ökologisches Citizen Science Projekt mit dem Ziel Umweltbildung betreffend des aktuellen Biodiversitätsschwundes sowie dessen Ursachen und Risiken zu vermitteln. Durch dieses veränderte Wissen und Handeln der Teilnehmenden soll eine Trendwende hin zu einem nachhaltigeren Handeln geschaffen werden.

Um das zu untersuchen, habe ich zuerst drei qualitative Interviews mit Teilnehmenden des Projekts durchgeführt, um dann aufbauend auf dieser Grundlage einen quantitativen Fragebogen zu entwickeln, der an alle Teilnehmenden geschickt wurde. In allen Schritten hatten die Citizen Scientists Einblick und die Möglichkeit mitzugestalten.

Ziel der Arbeit ist es:

A) Herauszufinden, ob sich die Teilnehmenden in den Punkten Umweltwissen und Zeit, die in die Beschäftigung mit Umweltthemen investiert wird, von einer Kontrollgruppe unterscheiden. B) Ob durch Teilnahme an dem Projekt ein Mehrwert in Form von Wissenszuwachs und Gewinn neuer Fähigkeiten stattgefunden hat. C) Das Projekt in Hinblick auf Kommunikation und Wissenstransfer zu evaluieren.

Insgesamt haben an der Studie 141 Personen des Projekts teilgenommen und 595 in der Kontrollgruppe. Diese Befragung hat Folgendes ergeben:

- Teilnehmende des Citizen Science Projekt BeeRadar haben größtenteils durch Teilnahme an dem Projekt ihr Verhalten geändert und nehmen die Natur bewusster wahr.
- Teilnehmende des Citizen Science Projekts BeeRadar konnten meist ihr Wissen im Umweltbereich durch Teilnahme an dem Projekt BeeRadar erweitern.
- Teilnehmende des Projektes heben sich teils bereits vor Beginn des Projektes von der Kontrollgruppe in Umweltwahrnehmung und Interesse ab.

Diese Ergebnisse zeigen, dass Citizen Science Projekte, wie BeeRadar eines ist, dazu beitragen können, dass Personen sich mehr mit Umweltthemen auseinandersetzen und mehr Erlebnisse in der Natur sammeln. Sie liefern daher einen Beitrag zur Steigerung des Naturinteresses sowie zur intensiveren Auseinandersetzung mit Umweltproblemen.

1. Introduction

Many people already know that climate change is happening (Lee et al., 2015), but there is also another, crisis happening, which is not that well known - the biodiversity crisis (Singh, 2002). Biodiversity is the term used to describe biological diversity, which is usually defined by the number of species and their relative abundance in a given area (Meimberg, 2020). Huge fields and landscapes without much variety lead to a decline in biodiversity, because a small variety of planted plants also attracts a smaller variety of insects which leads to less biodiversity (Maxwell et al., 2016; Palma et al., 2017). If the habitat of some species is destroyed and they are not able to find a new one or adapt, they will most likely become extinct (Purvis et al., 2000). Bees in particular are often dependent on certain plants. If these plants are missing and if they cannot adapt to other plants, they will become extinct (Papanikolaou et al., 2017). Another major problem is the use of neonicotinoid, which often has a direct impact on bees and may decimate their population (Woodcock et al., 2016). It is important that more consideration is given to pesticide use with regards to wild bees (Palma et al., 2017; Woodcock et al., 2016). Farmers often make sure that they do not apply pesticides when honey bees are active, because they do not want to kill their own pollinators, and no attention is given to wild bees, (Carsono et al., 2019; Kleczkowski et al., 2017; Papanikolaou et al., 2017). However, it is encouraging that the trend in Austria is moving towards organic farming, and many pesticides that are harmful to bees are being banned (BMLRT, 2021a, 2021b; EU, 2020; Kennedy et al., 2013). In the meantime, 26.5 percent of Austria's land is farmed organically, compared to only 16,5 percent 20 years ago in 2000 (BMLRT, 2021b). Another positive aspect is that Austria offers financial subsidies for flower strips and hedges, which support these measures (AMA, 2021). Invasive species can also contribute to biodiversity loss, for example, introduced predators can have a negative impact on native birdlife (Blackburn et al., 2004). In order to make these possible negative influences visible, the introduced species must be researched as much as possible.

In the past, there have been five mass species extinctions so far, which means that 70-95% of existing species became extinct (Benton & Twitchett, 2003; Conway Morris, 1998). Many studies are pointing out that we are at the beginning of the 6th mass species extinction (Barnosky et al., 2011; Ceballos et al., 2015). The extinction rate is

already about a thousand times higher than the average over the last 10 million years and will probably increase to ten thousand times higher in the future (Vos et al., 2015). Approximately 25%-28% species are already classified as threatened with extinction (IPBES et al., 2019; IUCN, 2021). For all vertebrate species alone, the number of individuals has declined by 70% in the last 50 years (WWF, 2018). The main reason for this is primarily habitat change due to humans (Asafu-Adjaye, 2003; Barnosky et al., 2011). Humans have been using and changing the land for thousands of years (Vasey, 1992). As a result, habitat is lost and ecosystems are often destroyed (Maxwell et al., 2016). For example, the trend in agriculture in high income countries is to create large monocultures (Lowder et al., 2016), where there is less food and shelter opportunities for wildlife (Grant, 2007; Wang et al., 2019). Another factor is direct exploitation, for example, many fish species are threatened by extinction through fishing (Davies & Baum, 2012), but climate change, pollution, and invasive species also play a role (Lee et al., 2017; Portman et al., 2018; Rinawati et al., 2013; Shen et al., 2017). It should be noted that all these reasons are directly or indirectly caused by humans, whereas in the past mass extinctions were caused by major natural disasters, such as volcanic eruptions or asteroid impacts (Benton & Twitchett, 2003; Gong et al., 2017).

Now that humans are at the top of the list, it is especially important to get many people to rethink this mass species extinction we are sliding into, and to try to stop it (Benton & Twitchett, 2003).

The *Megachile sculpturalis*, Smith 1853 bee (engl. Sculptured resin bee), is a rapidly spreading invasive species (Quaranta et al., 2014). Former studies showed, that invasive pollinators may affect native plants negatively and invasive plants positively (Morales et al., 2017). In order to study its spread more closely, a Citizen Sciences Project was launched, where citizens can report findings of the bee (Lanner et al., 2021). Through the Citizen Science Project, participants have the chance to learn about wild bees, their behaviour, and how to distinguish them. , On the other hand, they have the opportunity to educate and inform themselves about these bees (Lanner, 2021b).

1.1 Invasive species

Non-native species or alien species are species that are found outside their original area of distribution (Nentwig, 2010; Regulation (EU) No 1143/2014, 2014). Translocation and introduction are usually done with the help of humans (Adolphi, 2003; Nentwig, 2010). In this way, species can cross obstacles impossible to overcome on their own (Adolphi, 2003; Nentwig, 2010). Uncrossable borders are species-specific, for example, oceans or mountains (Adolphi, 2003). Non-native species may have been consciously introduced, such as the Asian lady beetle for pest control, or accidentally, such as the *M. sculpturalis*, which has probably reached Europe and the USA via dead wood containing its nests (Brown et al., 2008; Moore, 2005). When a species is introduced, it must first establish itself - a step that many species do not overcome due to several reasons, e.g., the competition in the new area is too high or the conditions are not suitable (Nentwig, 2010). If the alien species is also a threat to the local flora and fauna, human health or socio-economic of a country or region, it is classified as an invasive species (Nentwig, 2010; Regulation (EU) No 1143/2014, 2014). This is the case, for example, with the raccoon (*Procyon lotor*) or the American mink (*Mustela vison*) in Europe (Kauhala, 1996). The *Megachile sculpturalis* is spreading very fast in Europe and has already been observed to displace and kill native bees, for example the *Heriades truncorum* (Lanner et al., 2020a; Lanner et al., 2020b)(Lanner, Huchler, et al., 2020; Lanner, Meyer, et al., 2020) (Lanner et al. 2020b; Lanner et al. 2020a) . Therefore it has a high potential to be an invasive alien species (Blackburn et al., 2014; Dubaic´ & Lanner, 2021; Lanner et al., 2021; Lanner et al., 2020a; Lanner et al., 2020b). Several wild bees have already been successfully introduced to the USA (Droege, 2021), most of them are cavity breeders, just like the *Megachile sculpturalis*. This suggests that travelling with wood transport is a very efficient way to spread (Batra, 1998; Moore, 2005).

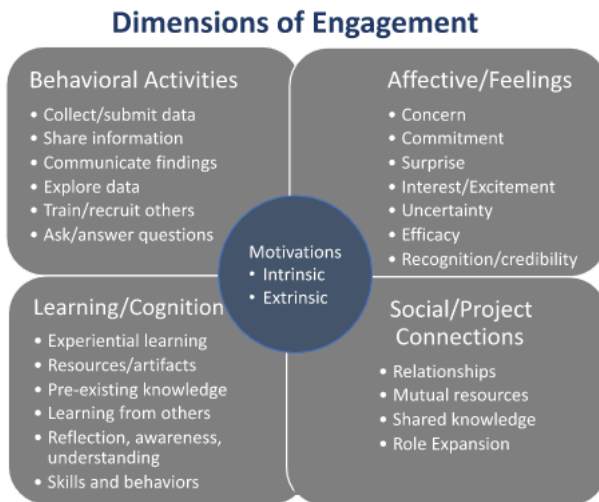
1.2 Citizen Science

“Citizen science broadly refers to the active engagement of the general public in scientific research tasks” (Vohland et al., 2021).

In order to collect scientific data you often need a lot of people to report data, which is why support from non-professionals is used frequently (Miller-Rushing et al., 2012). This can be achieved within the framework of so-called Citizen Science projects, in which non-professional researchers play an important role in data collection (Silvertown, 2009). The data collection is carried out following a predefined system and accompanied by professional scientists (Miller-Rushing et al., 2012). Collecting Scientific data by the public also has a long history, because if we look back in time, in the beginning of the 19th century, the majority of data collection was done by non-professionals, people who did not get paid for their work and this is also the difference between scientists and Citizen Scientists (Porter, 1978; Vetter, 2011). But already before, data by non-professionals was collected over years, for example drought periods, outbreaks of diseases and seed and harvest times (Chuine et al., 2004; Hopkins, 1918).

Not only do the researchers benefit from Citizen Science projects, but the participants also often gain added value (Dibner & Pandya, 2018). This happens in the form of an increase in knowledge, since many of these projects require a closer look at the research object (Dibner & Pandya, 2018). For some projects a certain level of knowledge is required about species to be able to participate, for example, for participation in the annual bird counts of Birdlife Austria, the most common bird species have to be recognised with a reasonable degree of certainty (BirdLife, 2019).

Until now, there have been a few studies exploring the motivation to participate in Citizen Science projects (Maund et al., 2020; Richter et al., 2018). One of the strongest reasons for participation is learning about wildlife (Maund et al., 2020). According to a recent study, 53% of the participants said they had increased their knowledge of biodiversity through a Citizen Science project (Peter et al., 2021). A full 87% even said they had increased their everyday awareness of species' presence and behaviour (Peter et al., 2021). There are also some studies where school (Robinson et al., 2018)



Figur 1: Dimensions of Engagement Framework, CC: (Phillips et al., 2019)

classes took part in a Citizen Science project, and they had an increase in knowledge and a change in awareness (Aivelo & Huovelin, 2020) (Knoll, 2013). In 2019, Phillips et. al. analysed 72 qualitative interviews from Citizen Scientists out of six different projects and defined different dimensions of Engagement (Phillips et al., 2019). This gives a good

overview what participants can get out from Citizen Science projects.

To ensure that Citizen Science participants are not exploited by researchers, ten principles have been defined. For example - participants should get feedback about the data they provided, and they also gain benefits, for example in terms of education, fun or social benefits (Robinson et al., 2018).

This educational value through an active participation in the research projects (Robinson et al., 2018). In the Citizen Science project BeeRadar for example, the participants learn how to identify the *M. sculpturalis* and discriminate the species from native wild bees (Lanner, 2021b). To do this, they receive identification aids in the form of identification charts, pictures and videos, or personal feedback when they submit a presumed photo of a *M. sculpturalis* (Lanner, 2021b). This can happen either in the time they are outdoors anyway, or in extra time they spend on the project.

Involving Citizen Scientists also can be challenging, for example, if not enough volunteers are found, it's leading to a lack in data collection (Conrad & Hilchey, 2011).

Table 1: Summary of benefits and challenges, CC: (Conrad & Hilchey, 2011)

Benefits	Challenges
Increasing environmental democracy (sharing of information)	Lack of volunteer interest/lack of networking opportunities
Scientific literacy (Broader community/public education)	Lack of funding
Social capital (volunteer engagement, agency connection, leadership building, problem-solving and identification of resources)	Inability to access appropriate information/expertise
Citizen inclusion in local issues	Data fragmentation, inaccuracy, lack of objectivity
Data provided at no cost to government	Lack of experimental design
Ecosystems being monitored that otherwise would not be	Insufficient monitoring expertise/quality assurance and quality control
Government desire to be more inclusive is met	Monitoring for the sake of monitoring
Support/drive proactive changes to policy and legislation	Utility if CBM data (for decision-making; environmental management; conservation)
Can provide an early warning/detection system	

An important concern of BeeRadar is also to transfer knowledge to the participants, which should create a win-win situation, and the participants can additionally benefit from the project (Lanner 2021). Participants receive a newsletter, or get information on the homepage, can follow the project on Instagram etc. All of this provides a lot of information about the biodiversity crisis, invasive species, sustainability and wild bees (Lanner, 2021b, 2021a). The aim of the project, apart from collecting data, is to awaken the participants' enthusiasm for nature and to provide them with scientifically reliable information about invasive species, wild bees and environmental protection (Lanner, 2021a).

The *M. sculpturalis* is particularly suitable for Citizen Science projects, as it has a very distinctive appearance and attracts attention due to its size (Lanner et al., 2020a; Quaranta et al., 2014). As it likes to stay on various ornamental plants, it can also be found in gardens, on balconies or in cities (Parys et al., 2015). Since the *M. sculpturalis* can also be observed in nesting aids, which are often set up for environmental education. (Geslin et al., 2020). Bees in general are perceived positively and people are happy to do something to help them. (Alton & Ratnieks, 2020; Huber & Aichberger, 2020; Sumner et al., 2018) .

1.3 Extinction of experiences

Not only wildlife species can go extinct, people spending time in nature is getting less and less common, which makes us disconnected from nature (Soga & Gaston, 2016). In the past, people spent much more time outdoors and had the opportunity to have more experiences in nature (Brämer & Koll, 2021; Puhakka et al., 2018). Some of the

reasons why our lives are increasingly happening indoors are the digital world, television and labour (Bányai et al., 2017; Brämer & Koll, 2021; Pergams & Zaradic, 2006). A survey in the US shows that more than half of the 1,200 participants spend almost no time outside (Robinson & Silvers, 2000). Another study in 2002 in the UK shows that primary school kids are able to name more Pokémon than wild animals (Balmford et al., 2002). Because we are spending less and less time in nature, our relationship to it is becoming weaker and weaker (Kareiva, 2008). Louv described this process as the “nature-deficit disorder” in his bestselling book “Last child in the woods” (Louv, 2010). This weaker connection in turn has an effect on value: if we no longer know exactly what nature is and how diverse our native flora and fauna actually is, we do not have any knowledge of why it is worth conserving (Louv, 2010; Wells & Lekies, 2006). Moreover, many studies show that nature has a positive effect on human mental health and stress level (Bányai et al., 2017; Bowler et al., 2010; Harshfield et al., 2019).

A long-term German study shows that German children on one hand have less outdoor exposure, but on the other hand show a growing interest in nature (Brämer & Koll, 2021). Therefore, Citizen Science projects like BeeRadar are a good opportunity to learn more about nature and experience positive nature-associated sensations (Peter et al., 2021; Wiens et al., 2021). By actively searching for and observing *Megachile sculpturalis*, more experiences are gained in nature and participants can learn more about the world around them. It helps that the *Megachile sculpturalis* is a bee species because many people associate bees with something positive and worth conserving (Sumner et al., 2018). In addition, it is relatively easy to observe the bee, as it can be found on various ornamental plants growing in gardens and flowering areas (Quaranta et al., 2014). The bee's colour and size catches the eye quickly and with a little practice it can be identified with a high degree of certainty (Lanner, 2021b). These experiences, which are gathered through the project in nature, should in turn contribute to a better understanding of the flora and fauna that surrounds us. The aim is to raise awareness of why nature is worth conserving and, above all, how to protect the environment sustainably (Lanner, 2021b). Knowledge is power, a very well-known saying that can also be applied to this case - if humans forget how to spend time in nature and have no connection to it, then we will not feel the urge to protect it anymore (Kareiva, 2008). However, once the importance of protection is known (not just in theory from books, but through your own experiences), it will be considered more worth to be protected (Nisbet et al., 2009).

1.4 Objective of the work

Through my master thesis I would like to find out whether the Citizen Science project of the *Megachile sculpturalis* offers added value in the form of knowledge gain for the participants. In doing so, I am guided by four main objectives:

- Find out if participants gained knowledge through participating in the Citizen Science Project
- Find out if the project has changed their view about their surrounding natural environment
- See if there is a difference in knowledge self-assessment and behaviour within the participants and compared to control groups
- Evaluate the communication to the participants and their motivation

Based on this, I have defined four main research questions:

- Do the participants have improved their knowledge about biodiversity and invasive species?
- Do they recognize the biodiversity in their daily life differently? Do they see more species (animals, plants) around them?
- Is there a difference regarding self-assessment of knowledge and behaviour within the participants (due to origin, age, etc.) and to the control groups?
- Why and how got participants aware of the project and what motivates them?

These research questions will in turn test the following four hypotheses:

1. Participants in the Citizen Science project gain new knowledge about biodiversity and invasive species
2. Participants in the Citizen Science project recognize their environment with more awareness than before

3. Participants have a higher self-assessment of knowledge than the average non-participant and about the same self-assessment of knowledge as students of biology or ecology
4. The participants want to learn about the environment

In order to combine all these questions and hypotheses into one main research question for my Master's thesis, I chose the following main research question:

“Is the Citizen Science project of the Megachile sculpturalis sustainably changing the participants of the project?”

2. *Megachile sculpturalis*

Megachile sculpturalis is a remarkable type of bee because it is particularly large and dark compared to other native bees (Batra, 1998; Dubaicz & Lanner, 2021; Quaranta et al., 2014). Males have a body length of 19-22 mm while females are larger and can reach a length of 21-27 mm. The wings are transparent with a brown tip. The thorax is covered by orange hair. Males also have yellow hair in the area of the supraclypeal plate (Batra, 1998; Bila Dubaicz, 2021; Dubaicz & Lanner, 2021).



Figure 1: Shows a male *Megachile sculpturalis* on a nesting aid waiting for a female to hatch. CC by 4.0 Frei

The development of the larva takes place over the winter (Quaranta et al., 2014). The first bees hatch from the end of June to beginning of July, with the males hatching earlier than the females, therefore it's a protandrous species (Hinojosa-Díaz, 2008; Quaranta et al., 2014).

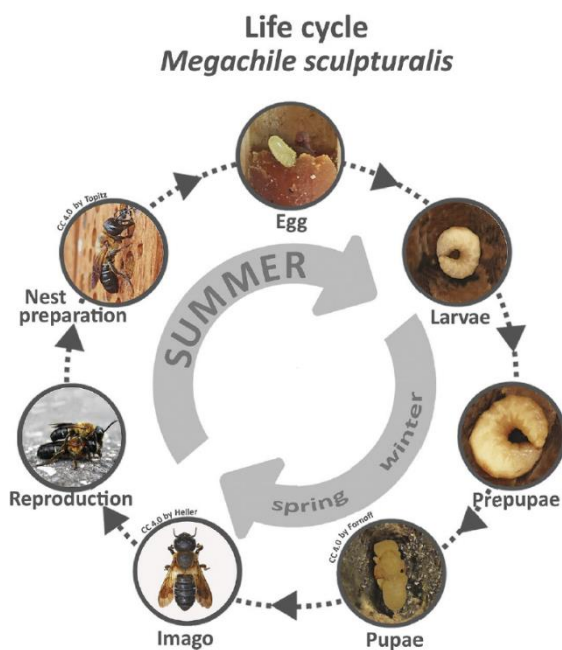


Figure 2: Shows the Life cycle of *Megachile sculpturalis* (Dubaicz und Lanner 2021)

The female *Megachile sculpturalis* collects pollen as food for the larvae and places it into the hole as a food reserve for the larvae (Quaranta et al., 2014). As it is not able to drill a hole in the wood itself, it uses already existing holes (Quaranta et al., 2014). In Europe, it was observed in artificial nesting aids, so-called bee hotels (Geslin et al., 2020). The hole must have a diameter of 8-20 mm (Dubaicz & Lanner, 2021; Quaranta et al., 2014). Depending on the size of the hole, the bee builds around ten

brood cells (Batra, 1998). The bee collects resin and use it as a closure for the nest,

together with mud, wood fibres, leaf fragments, and clay (Batra, 1998; Michener, 2000; Quaranta et al., 2014). This is where the English name “Sculptured Resin Bee” and also the German name “Asiatische Mörtelbiene” comes from (Dubaic´ & Lanner, 2021). The active phase lasts until about mid-September (Batra, 1998; Dubaic´ & Lanner, 2021).

The *Megachile sculpturalis* is found in Europe and the US mainly on exotic plants (Parys et al., 2015), whereas in its original native range it is known as a generalist (Batra, 1998; Kakutani et al., 1990). In Europe, it was often seen on *Styphnolobium japonicum* - especially females while collecting pollen - *Ligustrum lucidum* (Oleaceae), *Buddleja* spp., *Lavandula* spp., and *Wisteria* spp. (Aguado et al., 2018; Lanner, 2021b; Quaranta et al., 2014).

The *Megachile sculpturalis* is originally native to East Asia - China, Japan, Korea and Taiwan, where it is still present (Batra, 1998). Outside its native range it was first observed in 2008 in Allauch, France, near the port of Marseille (Vereecken & Barbier, 2009). Most likely it arrived there by ships through deadwood transportat (Le Féon et al., 2018; Moore, 2005; Vereecken & Barbier, 2009). Likewise in Vienna, it most likely arrived with wooden boxes and pallets (Wiesbauer, 2017). It has been introduced several times and it is spreading rapidly in Europe (Lanner et al., 2021).

In North America, it was introduced several decades ago. The first sighting was 1994 in North Carolina (Mangum & Brooks, 1997). It started spreading in 1994 and it is now found in all states north of the Mississippi river (Parys et al., 2015).

2.1 BeeRadar

After the first discovery of the *Megachile sculpturalis* in Vienna in 2017, the Citizen Science Project, managed by Julia Lanner, was launched in 2018 (Lanner, 2021b).

Participants in the Citizen Science Project can find out more about the *Megachile sculpturalis* via a newsletter, social and classic media, and the project homepage (Lanner, 2021b, 2021c, 2021a). Through these channels followers not only get the chance to learn interesting facts about the *Megachile sculpturalis* but also obtain information about biodiversity, wild bees, invasive species, and sustainability (Lanner, 2021b, 2021c). Critical topics such as bee-washing are also covered (Lanner, 2021c). On Instagram followers are encouraged to get involved, e.g. through quizzes (Lanner, 2021c). Citizens Scientists were also able to vote on the name BeeRadar themselves (Lanner, 2021c).

Regardless of age or educational background, the project is open to all members of society (Lanner, 2021b). To report a find, participants can take a picture of the (presumed) *Megachile sculpturalis* and send it to BeeRadar via email, text message, Instagram or the form on the homepage (Lanner, 2021b, 2021c). If a bee is found, it is also possible to send it or bring it to the University of Life Sciences in Vienna (Lanner, 2021b). The project team will then look at the presumed find and confirm whether it is an *Megachile sculpturalis* or (if possible) determine what other species it is (Lanner, 2021a). Detailed identification aids, photos and videos of the *Megachile sculpturalis* can be found on the homepage and on Instagram (Lanner, 2021b, 2021c). In addition to information about the *Megachile sculpturalis*, the homepage also contains information about its distribution, background knowledge about the project and information about scientific work and petitions (Lanner, 2021b).

The project is advertised in as many places as possible, in newspapers, newsletters, radio reports, podcasts, at scientific conferences, and on notice boards (Lanner, 2021b, 2021a). However, it should be said that the project team is very small and therefore there is still a lot of potential to make the project more visible (Lanner, 2021b, 2021a).

2.2 Monitoring the spread of *Megachile sculpturalis* in Serbia

The Serbian Citizen Science project, which is under the direction of Jovana Bila Dubaić, also has the *Megachile sculpturalis* as the target object. The project is based in Belgrade, Serbia, at the University of Belgrade (Bila Dubaić, 2021). In 2017, the first specimen *Megachile sculpturalis* was found in Belgrade (Ćetković & Plećaš, 2017). After that, the researchers at the University of Belgrade tried to find more specimens, which they only managed to do again in 2019 (Bila Dubaić, 2021). With the great help of Julia Lanner (BeeRadar project manager), Serbian citizen science project was created and launched in June 2020 (Bila Dubaić, 2021). It is particularly noteworthy that this is one of the first Citizen Science projects in Serbia (Bila Dubaić, 2021). The start date was in the middle of the corona pandemic, when field trips were forbidden or highly limited. Owing to the CS project, recordings of *M. sculpturalis* could be made all over Serbia (Bila Dubaić, 2021).

The project was spread at the beginning via (Bila Dubaić, 2021):

- Social Media: Instagram and Facebook
- Friends, family, and work colleagues
- Call on Serbian's beekeeper Society Website
- Email to all students at the Faculty of Biology, University of Belgrade
- Newspapers, TV, and radio stations

Participants can send their (suspected) sightings of the *Megachile sculpturalis* via email, Google Form or Viber, with location and mandatory photo or video (Bila Dubaić, 2021).

As of September 28, 2021, the project's Instagram account has 2254 subscribers. Since the Serbian language is very similar to languages of surrounding countries (Croatian, Montenegrin and Bosnian), around 15% (~300 people) of the followers are from these countries (Bila Dubaić, 2021).

3. Material and methods

3.1 Research project

The BeeRadar project covers Austria, Germany and Switzerland; in my work I refer to this area as the D-A-CH area. Julia Lanner is the project leader of BeeRadar. She is a PhD student at BOKU Vienna, at the Institute for Integrative Nature Conservation Research (Lanner, 2021b). The Serbian project primarily covers Serbia, but there are some participants from neighbouring countries. For an easier understanding of this work, I use the term BeeRadar for both projects, when I distinguish them I speak of the D-A-CH area and Serbia.

There are 155 subscribers for the newsletter, with an average open rate of 77. The Instagram account @beeradar.info is followed by 490 people, with an average of 38 likes in August (as of 27.9.2021) (Lanner, 2021c). In total, the project received 75 records of *Megachile sculpturalis* in 2021 and 45 false reports (= no *Megachile sculpturalis* or cannot be defined with certainty). In the entire project period, there were 332 reports.

3.2 Literature, internet research and data analysis

At the beginning of the work, I conducted an extensive literature search. On one hand I wanted to understand the specificity of the bee, and on the other hand I wanted to find out what is the current state of knowledge regarding education through Citizen Science projects. Since the *Megachile sculpturalis* is the research object of BeeRadar, I also did a literature search on its distribution and biology.

I used the online access of the BOKU library, which gives free access to many scientific journals. When selecting the literature, I paid attention to the relevance of the studies for this work and to their topicality. For Citation I used Citavi (Swiss Academic Software GmbH, 2022).

The surveys were created online via the LimeSurvey software (LimeSurvey, 2021) and were accessible online via a link. I exported the answers from LimeSurvey in an Excel file. For the creation of most of the graphics and tables I used Excel (Microsoft, 2018).

For the statistical ANOVA, t-test, post-hoc tests, and boxplots I used R Studio (RStudio Team, 2020).

3.3 Questionnaire Development

3.3.1 Involvement of Citizen Scientists

According to the principles of Citizen Science, we tried to keep my master's thesis as transparent for the Citizen Scientists as possible (Robinson et al., 2018). That is why we also involved the participants of the project in the development of the questionnaire (see next chapter) and gave them the opportunity to co-design the questions. This involvement of the Citizen Scientists in the beginning of the research makes the project, according to Bonney et. al., a “Co-Created Citizen Science Project” (Bonney et al., 2009). This involvement was also very important to me because the Citizen Scientists gave me very helpful feedback in this process as they see things from the participants' point of view.

Table 2: Models for Public Participation in Scientific Research, CC: (Bonney et al., 2009)

Step in Scientific Process	Steps included in Contributory Projects	Steps included in Collaborative Projects	Steps included in Co-created Projects
Choose or define question(s) for study			X
Gather information and resources			X
Develop explanations (hypotheses)			X
Design data collection methodologies		(X)	X
Collect samples and/or record data	X	X	X
Analyze samples		X	X
Analyze data	(X)	X	X
Interpret data and draw conclusions		(X)	X
Disseminate conclusions/ translate results into action	(X)	(X)	X
Discuss results and ask new questions			X

X = public included in step; (X) = public sometimes included in step

In 2021 Peter et. al. asked 1160 participants of different Citizen Science projects about their own benefits from their projects regarding behaviour and knowledge (Peter et al., 2021). The scientists also offered me to use their questions in my thesis. I first thought I might use these exact questions for doing a comparison on the paper afterwards, but after a long developing process together with Julia Lanner (the project leader from BeeRadar) and Jovana BÍla (the project leader of the Serbian Citizen Science project) we adapted and added new questions, and therefore comparison is no longer possible. But still, the idea and the base of many questions comes from that study (Peter et al., 2021).

3.3.2 Qualitative survey

At the beginning, I interviewed three very engaged participants personally via Zoom or telephone. Since they were all German speakers, I wrote the questionnaire in German and the language of the interview was German as well.

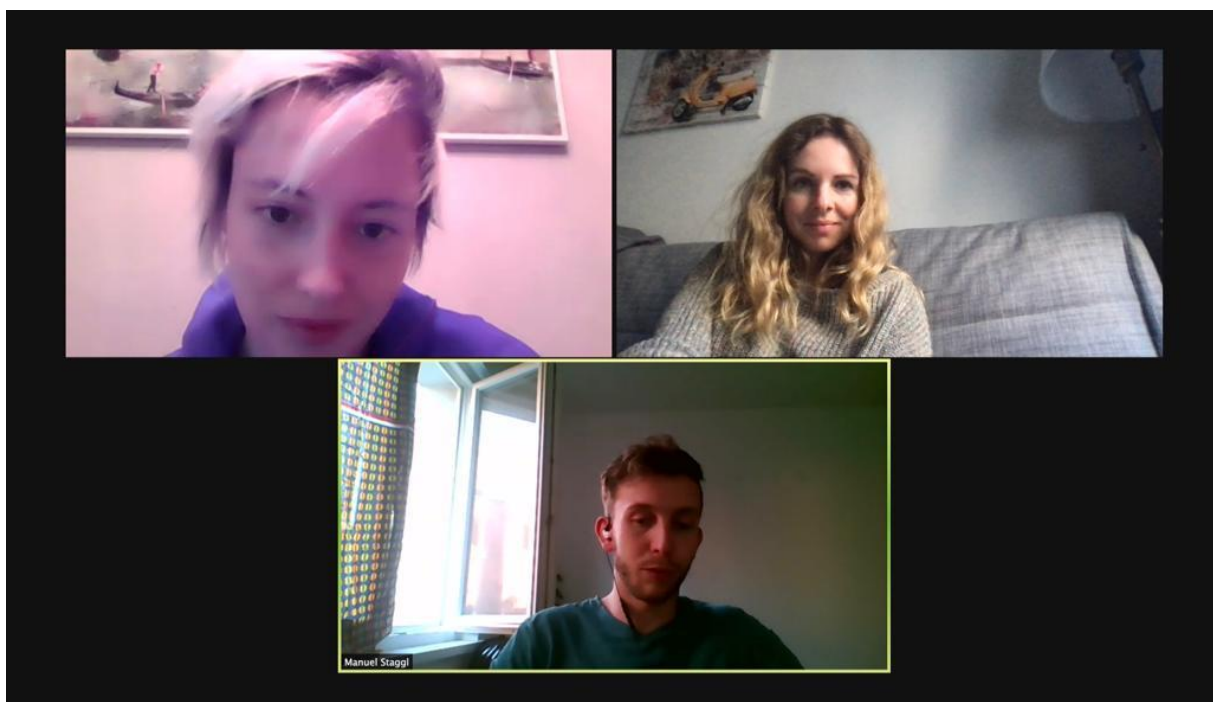


Figure 3: from the left: Eva Hütter, Manuel Staggl and Julia Lanner; CC: Julia Lanner

The aim of the qualitative survey was to ask as much as possible to build up the quantitative survey based on these personal interviews. For this purpose, the survey

was designed in a way that gave the interviewed participants plenty of room to answer freely.

The questionnaire categories were as follows:

- Knowledge gain through BeeRadar
- Behavioural change through Beeradar
- Scientific background and connection

Questionnaire block "Knowledge gain through BeeRadar" and Questionnaire block "Behaviour change through BeeRadar" start with an opening question, where the participants can interpret the question relatively openly and talk about it. For these questionnaire blocks, there are also certain subtopics. I created sub-questions for this purpose, but these questions were only asked if the interviewee did not already refer to the question automatically. Questionnaire block "Scientific background and connection" contains four main questions.

Three interviews were conducted with a duration of 10-20 minutes. The transcription can be found in the appendix.

Knowledge gain through BeeRadar

The aim was to find out if participants get added value from the project and if they get so in which form they get it. The sub-questions asked during this questionnaire block are designed to find out what exactly was learned.

Research Question	Hypothesis	Question(s) asked
Is there a knowledge gain from participating in BeeRadar?	BeeRadar is able to transfer knowledge.	Did you learn anything from the project?
Did the participants gain knowledge in different areas?	The participants gain knowledge in different areas	<ul style="list-style-type: none">- Did you learn specific skills?- Can you identify bees with more confidence?- Do you now know more about biodiversity? What exactly?- Do you know more about wild bees? What exactly?- Do you know more about invasive species?

Behavioural change through BeeRadar

In this section, the aim is to find out if the participants change their behaviour as a result of their participation.

Research Question	Hypothesis	Questions(s) asked
Did participants change their behaviour as a result of their participation in the project?	Participants behave in a more sustainable way and experience nature on their doorstep more consciously as a result of their participation.	Have you changed your behaviour by participating in the project?
Does participation in BeeRadar influence the behaviour of participants in a variety of ways?	BeeRadar influences the behaviour of participants in a variety of ways.	<ul style="list-style-type: none">- Do you spend more time outdoors?- Do you observe the environment more closely?- Do you notice more insects?- Do you pass on your knowledge to others?

Scientific background and connection

We included this questionnaire block to see if there are differences depending on the background of the participants. For example, we thought that a beekeeper who already spends a lot of time with bees starts from a different level on knowledge about bees than non-beekeepers.

Research question	Hypothesis	Asked question
Does the personal background of the participants have an influence on knowledge gain and behaviour change?	People who already spend a lot of time in nature and/or have professional training in the field have a lower knowledge gain and behaviour change.	<ul style="list-style-type: none">• Do you have a professional background in nature or biology?• Are you involved in any other Citizen Science projects?• Are you a beekeeper?• How did you hear about the project?

3.3.3 Quantitative survey

For the creation of the quantitative survey, I first attended the seminar: “Wirtschafts- und sozialwissenschaftliche Umfrageforschung” (engl.: “Economic and social science survey research”) (Vogel, 2021) where I learned how survey research works (economic and social science survey research) in order to be able to create an objective and comprehensive survey (Vogel, 2021). First, I looked what knowledge already exists in literature and designed my survey in such a way that on one hand it is comparable with existing research results and on the other hand to specifically address the BeeRadar project. As mentioned before, the inspirations for many questions came from the paper (Peter et al., 2021).

This questionnaire also went to participants who took part in the Serbian version of BeeRadar. It was translated into Serbian (by the Serbian project leader Jovana Bila Dubaić) and sent out to the participants of her project. In total, the questionnaire was available in three languages: German, English and Serbian.

This questionnaire was sent to different groups:

Participants / Main Group	All participants of BeeRadar or the Serbian CS project (regardless if their observation was a sculpture resin bee or not). Followers who have not reported anything yet, but are following the project
Students	Students of a scientific field of study
Control Group	People who do not belong to any other group

Main Group

At the beginning, we thought for a long time about who the participants of the Citizen Science Project actually are, and then came to the following definition:

- People who actively follow BeeRadar/Serbian Project on Instagram, that means who participate in surveys and respond to stories
- People who have reported a sighting of the *Megachile sculpturalis*
- People who have reported a false report
- People who have subscribed to the newsletter and open it (the newsletter is tracked and it is known who opens it)

We considered whether we should only take participants who have actually reported something. But then we decided to also include people intensively follow the project because they should also get the added value of "knowledge" from the project.

Students Group

The group of students was included to answer the research question:

"Is there a difference in environmental perception and knowledge between Boku students and project participants?"

To test the hypothesis: "Citizen Science participants are comparable to students".

The group of students got the same questionnaire as the control group. To find out which people belong to the students group we added the question: "Are you currently enrolled at a university programme that includes biology and/or ecology?". In total we got 279 persons participating in the student group. Most of the students were from University of Life Science, Vienna, and from the University of Belgrade, because we mostly distributed it to these students.

Control Group

When selecting the control group, we made sure that there was a mix of people from all layers of society. We asked friends and asked them to distribute the survey, and we distributed the questionnaire via the newsletter of a Kneipp club and a dementia relatives' self-help group. This way the participants are fairly balanced in the factors age and education. Overall, we got 316 participants in the control group.

In total, I created two different questionnaires, one for the main group and one for the students and control group. The one for the main group consisted of 21 questions with some sub-questions. The aim was to find out the following:

- Extent, type and since when they have participated in the project.
- Motivation for participation
- Initial knowledge and academic background
- Previous knowledge and knowledge gain through the project
- Previous behavioural habits and behaviour change through the project
- Evaluation of BeeRadar information channels efficacy
- Background and age of the participants

The questionnaire of the control group and that of the students contained eight questions and covered the following topics:

- Baseline knowledge and academic background
- Knowledge
- Behaviour
- Origin and age

In total, there were three question blocks, which were identical in all groups, in order to be able to make a direct comparison afterwards. The full questionnaire of all groups can be found in the appendix.

3. Results

4.1 Demographic evaluation

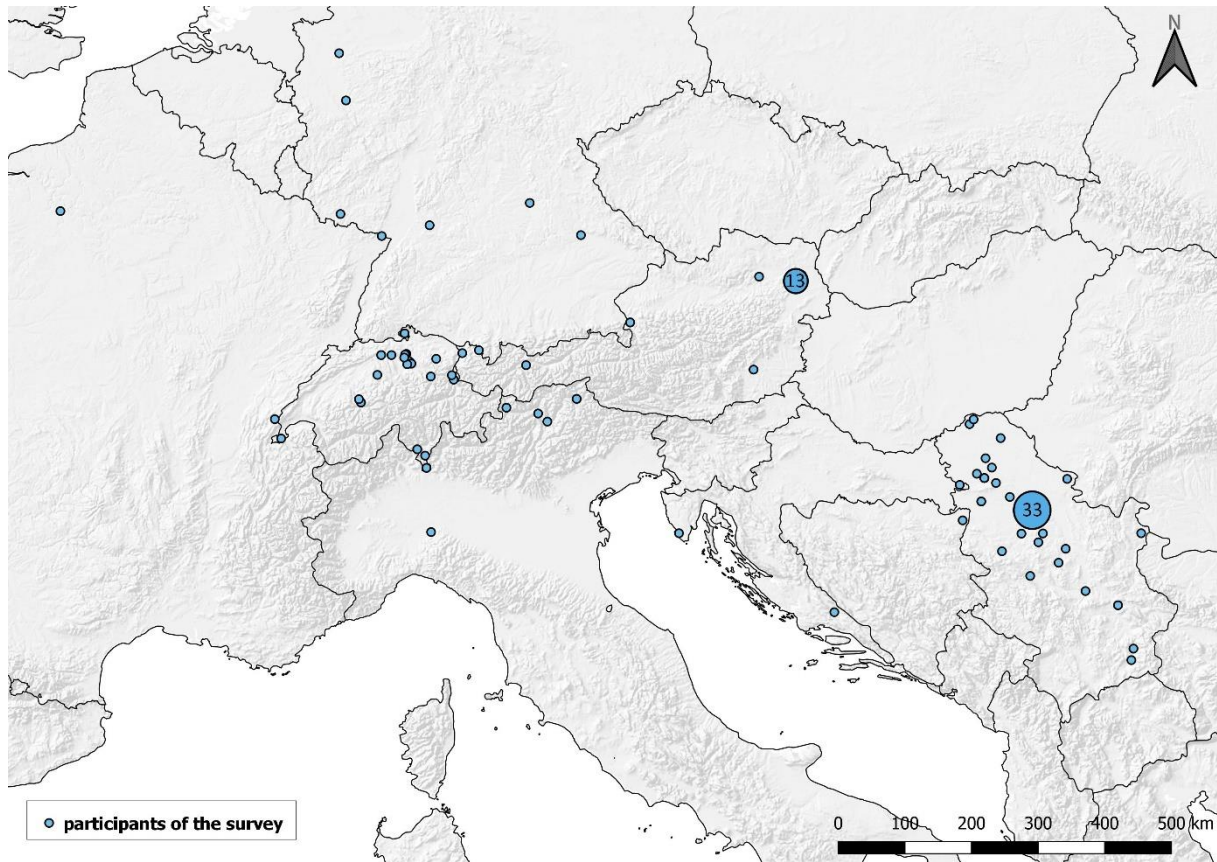


Figure 4: Map of residency of the participants (N=141) of the main survey CC: Bila Dubaić, Jovana

The map of residency shows that 33 people live in the capital of Serbia, Belgrade. The rest of the Serbian participants are dispersed in the country. For the D-A-CH area participants are found in Germany, Switzerland, Italy, and Austria. The largest group of participants of the D-A-CH are living in Vienna (13 people).

Table 3: Numbers of participants in the survey and response rate

	Total Citizen Scientists	Filled out surveys	Response rate
BeeRadar	252	141	56%
D-A-CH	171	67	39%
Serbia	74	74	100%
Student Group	X	279	X
Control Group	X	316	X

From the student group and the control group there isn't an exact number of recipientst and concrete response rate because we distributed the link for the survey in Facebook

groups, via e-mail and through friends, and we cannot exactly say how many people received the link.

For the D-A-CH area there was a call via the newsletter on September 15, 2021, and a reminder on October 1, 2021. On October 17, 2021, there was a call on Instagram where anyone who had watched the story could participate. These people were then invited directly. This makes a total of 176 people - 155 people from the newsletter and 21 via Instagram. Jovana Bila Dubaić wrote directly to all her 74 active participants in the Serbian project.

A total of 76 people filled out the survey, and we got a response rate of 39%. Everybody contacted by Jovana Bila Dubaić filled out the survey, which makes a response rate of 100%. In total we got 141 completely filled out surveys with a response rate of 56%. With this sample size we got a confidence level between 90-95% and a margin of error from 5-6%.

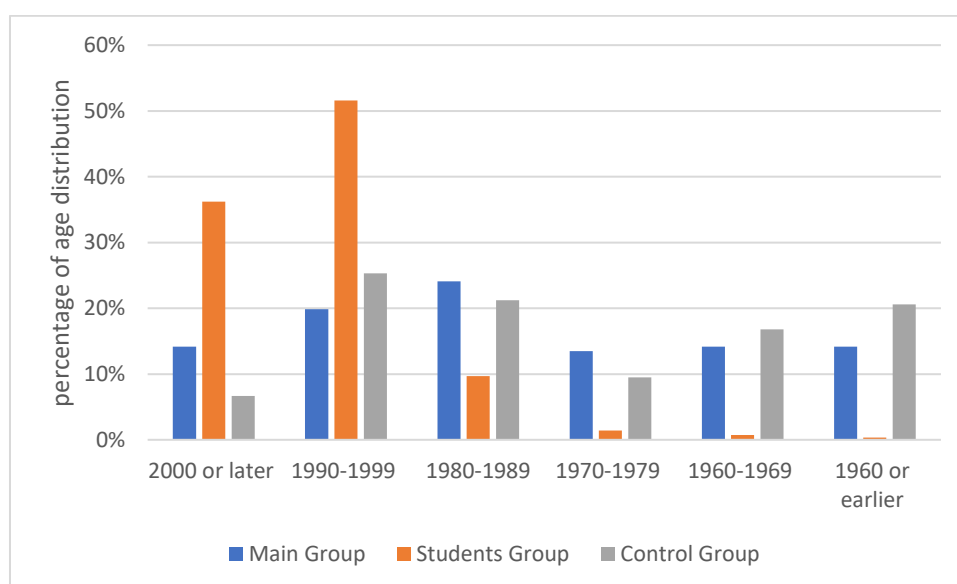


Figure 5: Age distribution of all participants in the survey “Main Group” (N=141), “Students Group”(N=279) and “Control Group”(N=316) in percent

This figure shows the age distribution among the different groups in the survey. In the students group many participants are born 1990 or later. In the main group 19 people are born between 1970 and 1979, the smallest number, and 34, the highest number, are born between 1980-1989.

4.2 Background of the participants

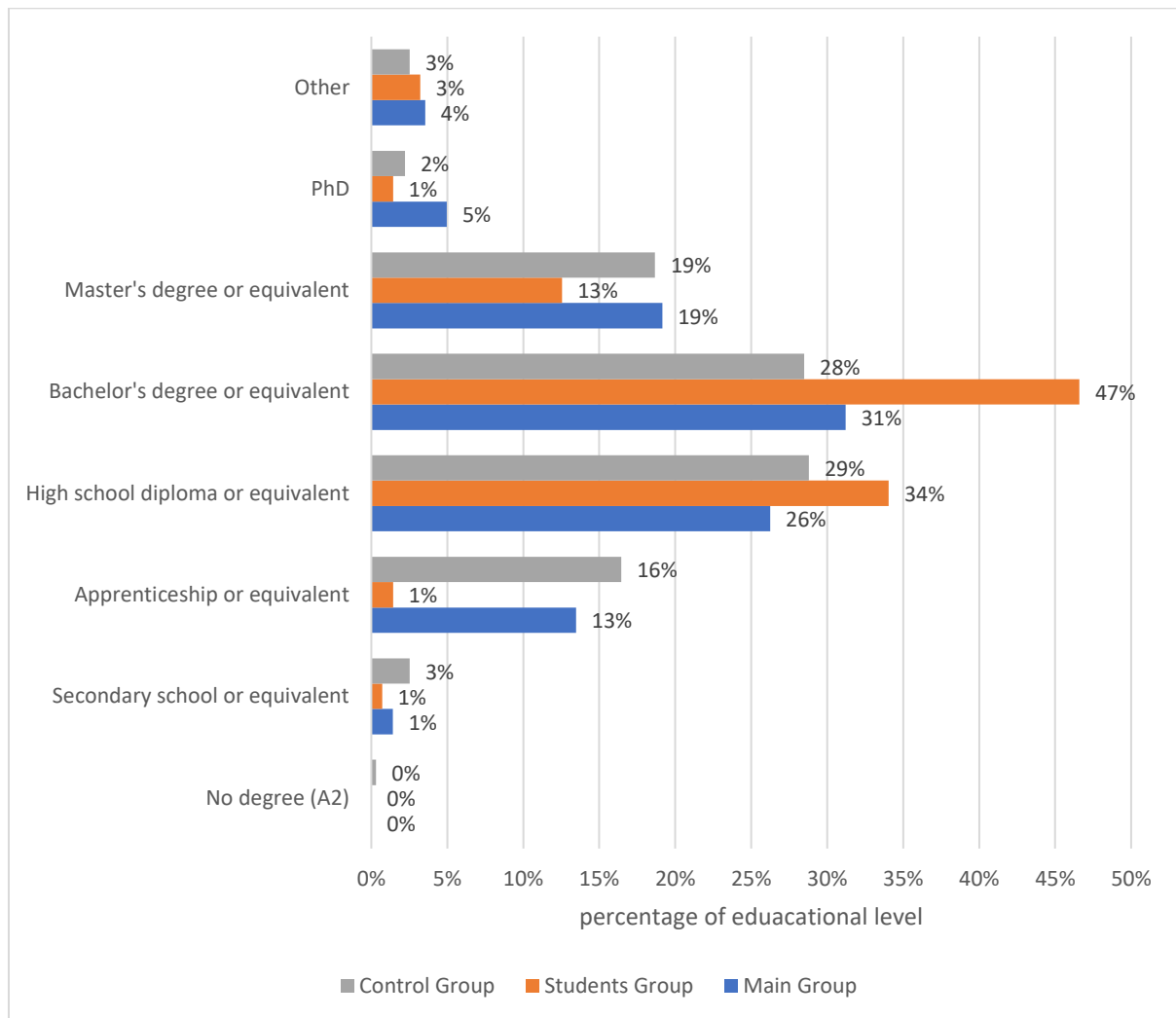


Figure 6: Educational level of all participants in the survey (N=141) in percent

From the main group 55% or 78 participants have a university degree, from the student group 61% or 169 people already have a degree and for the control group 49% or 156 persons have a degree. The highest rate of high school diploma and Bachelor's degree of course has the student group because most of them have finished high school and are now studying for their Bachelor or Master's degree.

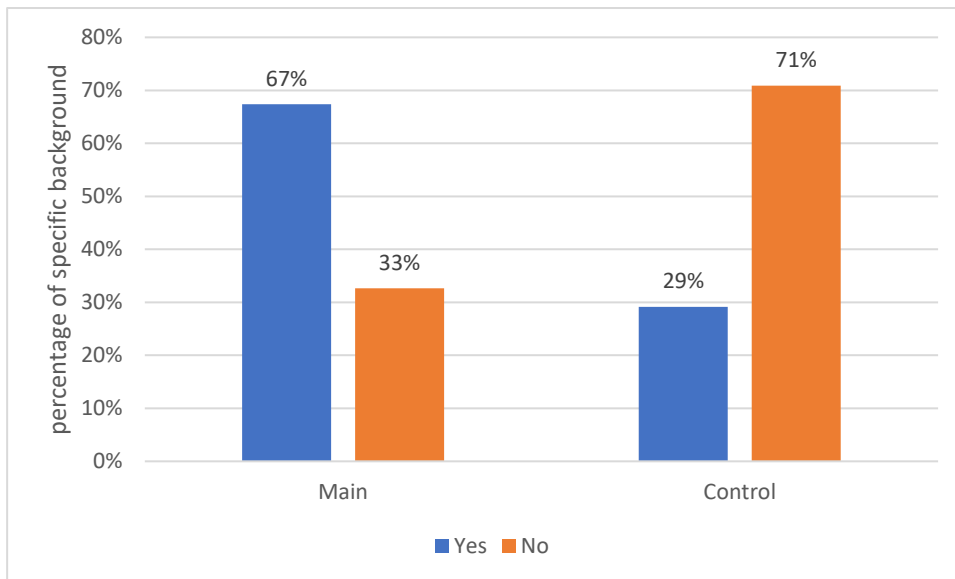


Figure 7: Participants in the Main Group (N=141) and Control Group (N=316) with a background in Biology, environmental education, climate protection, agriculture, forestry, or beekeeping

It shows us that 95 (67%) of the participants in the Citizen Science Project already have a background in biology, environmental education, climate protection, agriculture, forestry, or beekeeping. Whereas in the control group just 92 participants (29%) have a background in these fields. This shows us that the main group already a higher percentage had a background in the mentioned fields.

4.3 Involvement in the project

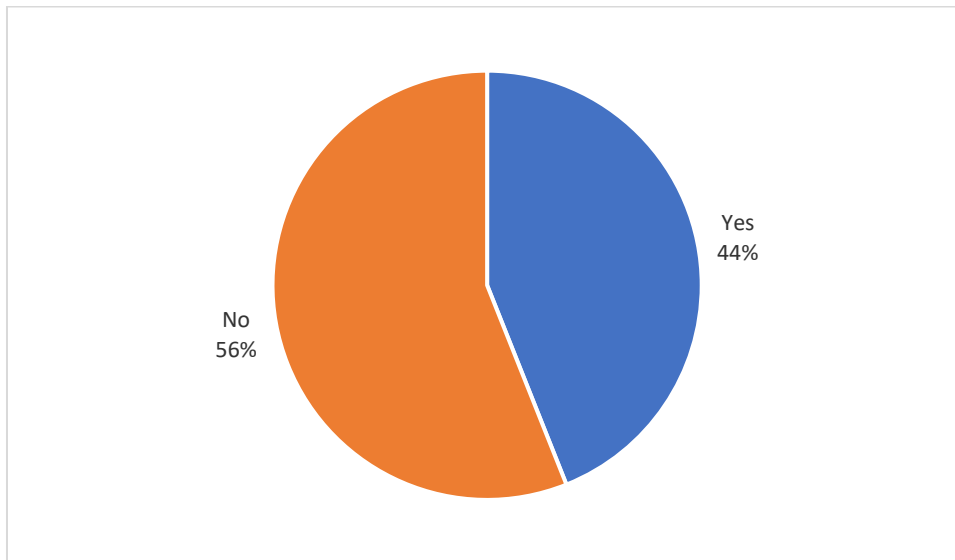


Figure 8: Percentages of participants in the survey (N=141), which want to be involved more in the project

79 of the participants in the Citizen Science project BeeRadar don't want to be more involved in the project and 62 want to be involved more. For finding out in which way they want to be involved more, we asked these participants. 31 answered us:

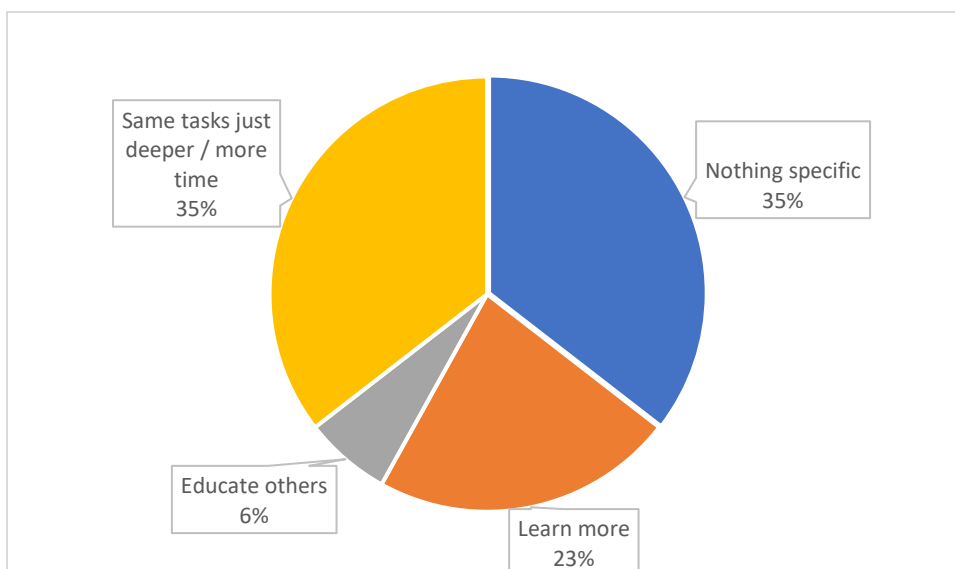


Figure 9: Shows in which form participants (N=31) who want to be involved more from the main group want to be more involved

All the exact answers can be found in the Appendix under "Results Main Survey". From 11 the answers were not specific (answers like "To help as much as I can" or "I have enough spare time to do something that would be useful for the project.") were counted

in this category. The other big group, also 11, where people which want to be involved like before, just with more time or with more specific tasks, e.g.: “Help with specific questions (e.g., collecting bees), scientific evaluation” or “Observation, monitoring, identifying[sic!] species” I counted in this category. 7 wanted to learn more: “To get more useful information and materials to learn more about the required species” or “To learn more and spend more time outdoors” in the “Learn more” category. Two people even want to educate others: “To organize field trips to various locations where we can search for the sculptured resin bee.” or “To do more projects with children”.

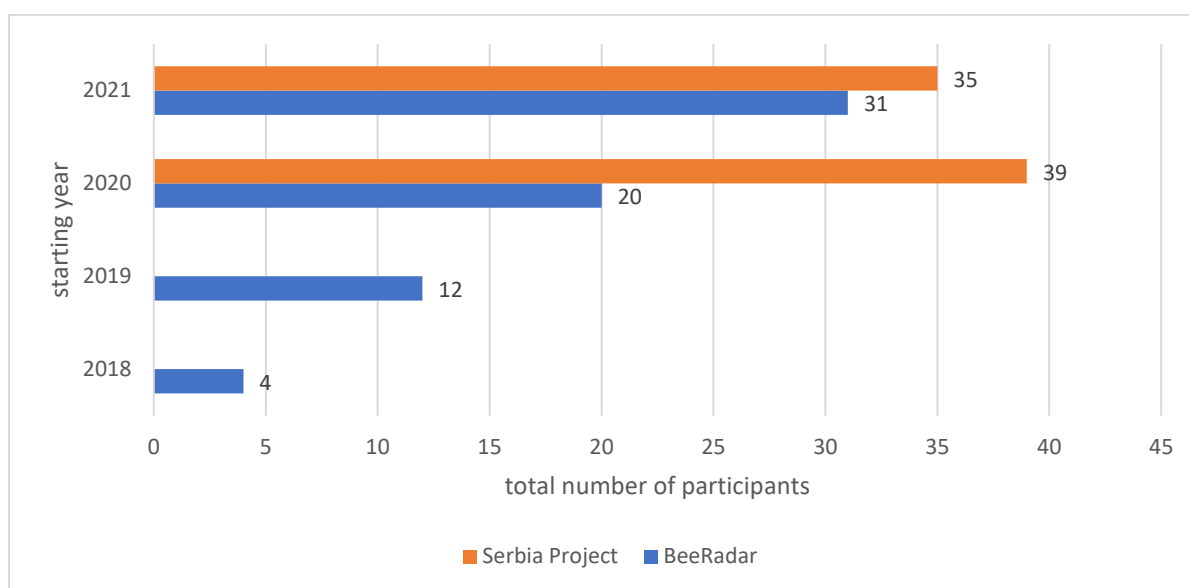


Figure 10 Number of participants in the survey (N=141) and the year they started to participate in the different projects. Note: The Serbian Project just started in 2020

This figure shows how the projects are growing. For the D-A-CH area each year the number of new participants was growing. For the Serbian project it was in their first and second year almost the same number of new participants joining the project.

Table 4: Absolute number of people who became aware of the project through the mentioned channel

	classic media channels	social media	Other people	I don't remember	in total
D-A-CH					
2018	0	1	0	1	2
2019	4	3	2	1	10
2020	4	6	8	3	21
2021	1	12	8	6	27
total D-A-CH	9	22	18	11	60
Serbia					
2020	5	30	5	7	47
2021	5	25	1	2	33
total Serbia	10	55	6	9	80
in total	19	77	24	20	140

Participants could select one, more or no answer, therefore the total number of answers is 140 and not 142. Also, there was the option to say “other”. Four people answered here that they became aware true the platform iNaturalist.

The table shows that social media was an important tool for getting the attention of new participants each year. Classic media attracted many new members in 2019 but was far less important in 2021. The recommendation from other people is also an important tool for getting new participants.

The table also shows that social media is the most important reason why the Serbian project gained new members. In 2020 more than 60% of the new participants got involved because of social media. In 2021 even more than 75%.

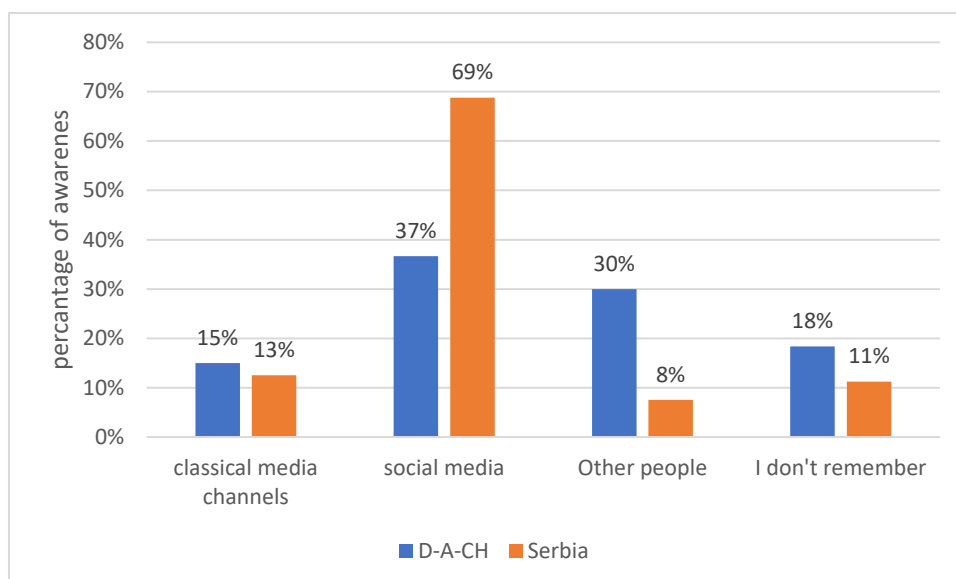


Figure 11: Difference between the project in D-A-CH and Serbia in percentage how participants got aware of the project of all the participants in total over the years

Figure 11 shows that social media is the most important tool for gaining new participants. 22 D-A-CH Citizen Scientist and 55 of the Serbian Citizen Scientist became aware of it through social media. This makes a total of 77 from 141 participants who became aware of it through social media.

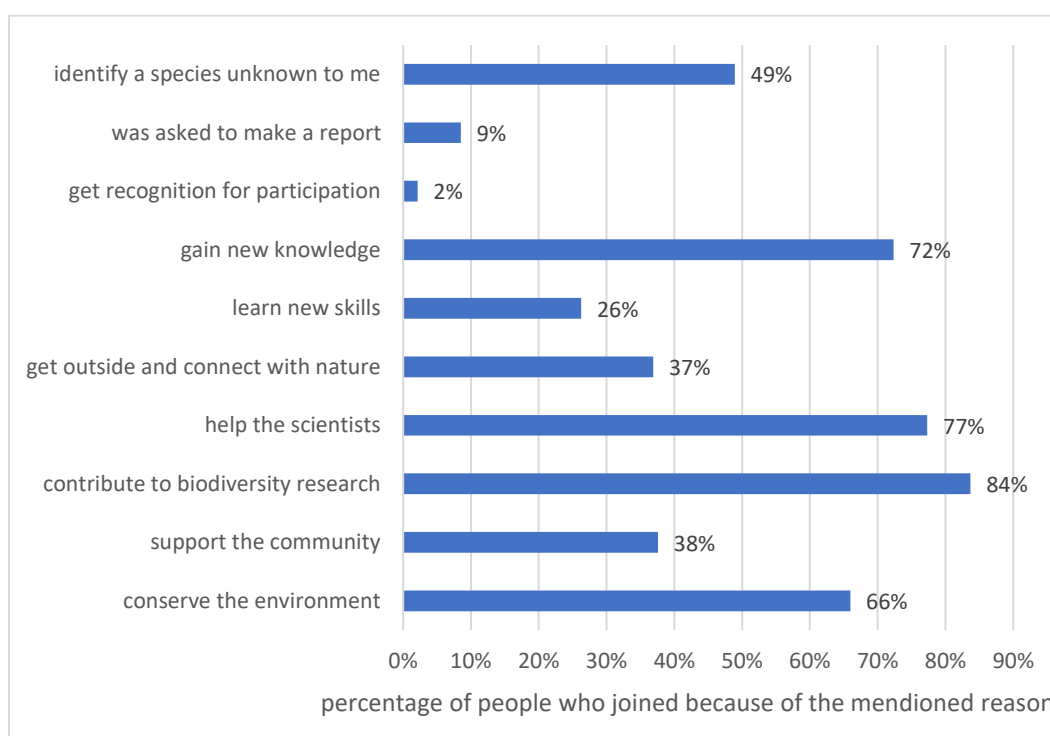


Figure 12: Reasons why participants start to join the Citizen Science Project (n=141)

Figure 12 shows that the most important reason why people joined the project is that they want to contribute to biodiversity research, 118 people mentioned this as a motivation for joining. Followed by helping the scientists (109 people) and gain new

knowledge (102 people). A total of 93 joined because they wanted to conserve the environment. Almost half, 69 people, wanted to help identifying a species unknown to them. A not so important reason for joining was to get recognition for participation - only three people said that this reason was important for them.

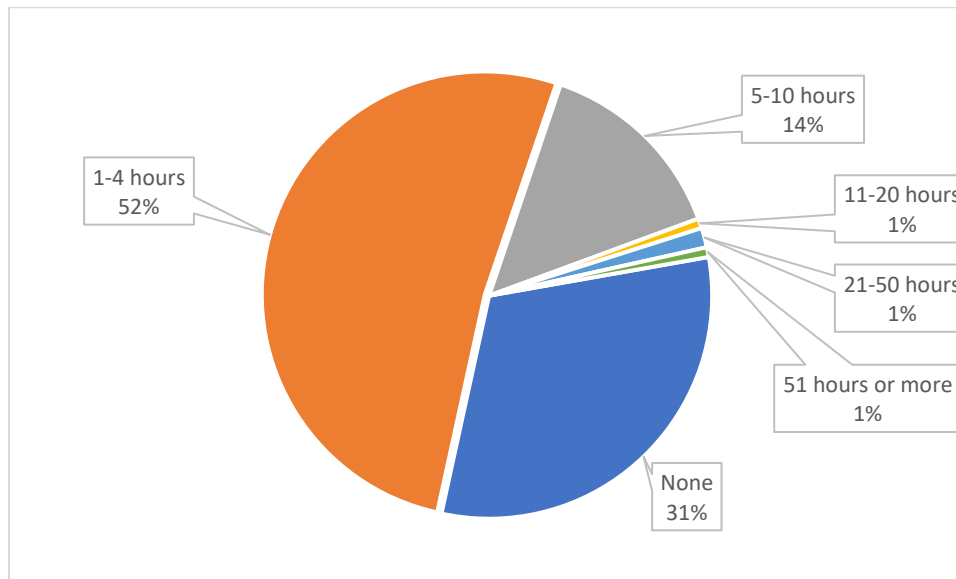
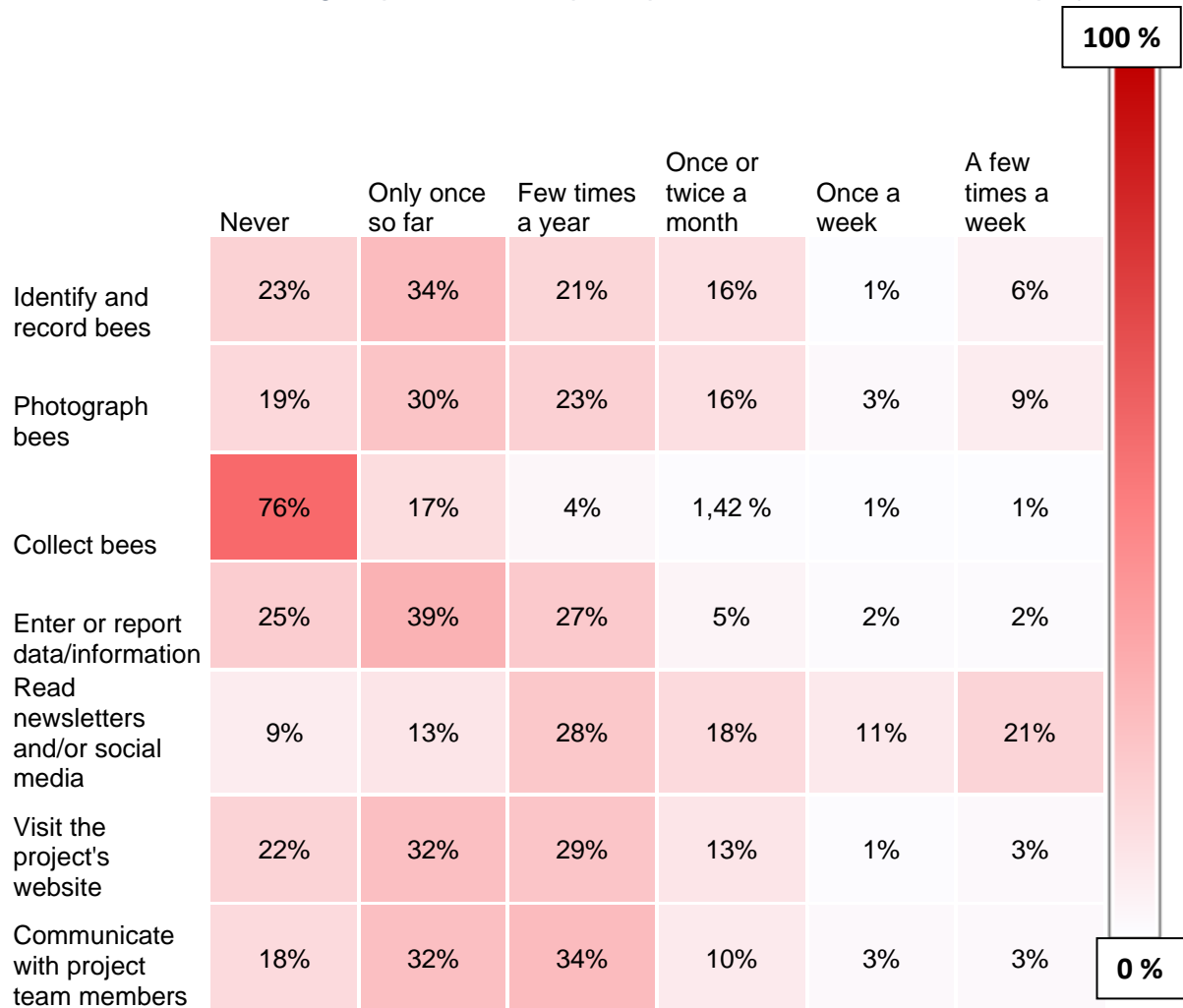


Figure 13 shows how many hours the participants (N=141) spent on the project in the last 3 months

73 of the participants spend 1-4 hours on the project, 20 even spend 5-10%. Three are very active, they even spend time from 11 to over 51 hours on the project. Also 44 didn't even spend a single hour on the project.

4.4 Tasks in the project

Table 5: Shows a Heating map of how often participants do a certain task for the project



The table shows that most of the participants follow the information provided from the project, via social media and/or the newsletter, just 13 participants never follow it, 39 follow it a few times a year and 30 even a few times a week. It also shows that around 30%-40% of participants have done certain essential tasks for the project only once so far, like "Report data/information", "Identify and record bees" or "photograph bees".

4.5 Knowledge and behaviour

Table 6: Shows if participants of the student and control group spend a lot of time on certain aspects, compared to the main group before they started participating in the Citizen Science project

Before participating in the project, did you spend a lot of time on the following aspects? (question for main group)		
Do you spend a lot of time on the following aspects? (question for student & control group)		
Insect awareness		
	Yes	No
Students	40%	60%
Control	41%	59%
Main	72%	28%
Spending time outdoors		
	Yes	No
Students	91%	9%
Control	94%	6%
Main	96%	4%
Species and environment protection		
	Yes	No
Students	75%	25%
Control	72%	28%
Main	87%	13%
Scientific projects		
	Yes	No
Students	51%	49%
Control	25%	75%
Main	39%	61%
Biodiversity		
	Yes	No
Students	69%	31%
Control	52%	48%
Main	74%	26%

Table 6 shows that in the main group there is a higher percentage regarding spent time in almost every mentioned category compared to the other groups. Especially in the category “Insect awareness” 72% (102 people) of the participants of the main group already said that they spent a lot of time on it before they started the project, whereas in the other groups just 40-41% said that they spent a lot of time on it. According to this, participants from BeeRadar already spent more time before starting the project with Insect awareness than the control group.

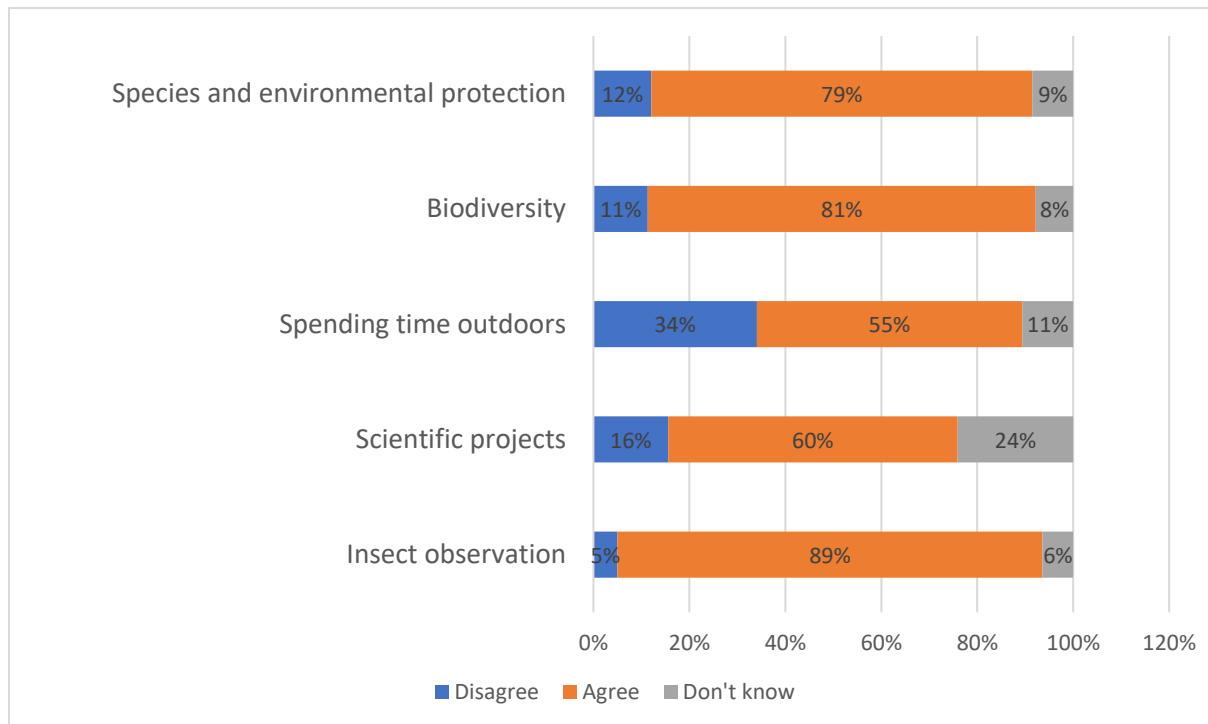


Figure 14: Shows if participants of the main group “Agree” or “Disagree” if they increased their knowledge in the mentioned field

This shows that most of the participants learned something in all the mentioned fields, especially in “Insect observation” 125 of the participants agreed that they learned something, 114 learned something about “Biodiversity” and 112 about “Species and environment protection”. 85 said that they learned through the project more about scientific projects, and 78 people spent more time outdoors.

Table 7: Shows how many participants from different groups do how often a certain task and to which group they belong to

How often do you....												
	Main Group				Students Group				Control Group			
	Never	Rarely	Less Frequently	Frequently	Never	Rarely	Less Frequently	Frequently	Never	Rarely	Less Frequently	Frequently
...report data to (other) Citizen Science projects	34	51	32	24	151	82	35	11	223	68	22	3
...advocate for environmental protection	1	10	29	101	5	39	77	158	10	56	98	152
...avoid pesticides harmful to bees	5	6	5	125	32	19	31	197	33	16	42	225
...sow or plant native and insect-friendly plants	10	14	24	93	69	56	58	96	66	50	71	129
...install insect hotels	42	32	19	48	169	56	38	16	197	55	35	29
...alert others to invasive species	12	24	44	61	56	69	86	68	127	87	69	33
...observe insects	0	9	23	109	21	51	91	116	35	89	89	103
...identify wild bees	15	36	53	37	172	63	38	6	194	73	38	11
...talk to others about animal and/or plant species	2	10	27	102	5	35	79	160	13	95	98	110
...report data to (other) Citizen Science projects	11	19	43	68	83	72	60	64	91	87	75	63
...advocate for environmental protection	29	42	34	36	144	76	38	21	189	71	47	9
...avoid pesticides harmful to bees	0	4	28	109	8	23	62	186	11	44	90	171

Table 8: Shows the percentage of how many participants do how often a certain task and to which group they belong to

How often do you...						
...report data to (other) Citizen Science projects				...advocate for environmental protection		
	Main	Students	Control	Main	Students	Control
Never	24%	54%	71%	1%	2%	3%
Rare	36%	29%	22%	7%	14%	18%
Less Frequently	23%	13%	7%	21%	28%	31%
Frequently	17%	4%	1%	72%	57%	48%
...avoid pesticides harmful to bees				...sow or plant native and insect-friendly plants		
	Main	Students	Control	Main	Students	Control
Never	4%	11%	10%	7%	25%	21%
Rare	4%	7%	5%	10%	20%	16%
Less Frequently	4%	11%	13%	17%	21%	22%
Frequently	89%	71%	71%	66%	34%	41%
...install insect hotels				...alert others to invasive species		
	Main	Students	Control	Main	Students	Control
Never	30%	61%	62%	9%	20%	40%
Rare	23%	20%	17%	17%	25%	28%
Less Frequently	13%	14%	11%	31%	31%	22%
Frequently	34%	6%	9%	43%	24%	10%
...observe insects				...identify wild bees		
	Main	Students	Control	Main	Students	Control
Never	0%	8%	11%	11%	62%	61%
Rare	6%	18%	28%	26%	23%	23%
Less Frequently	16%	33%	28%	38%	14%	12%
Frequently	77%	42%	33%	26%	2%	3%
...talk to others about animal and/or plant species				...encourage others to sow or plant native or insect-friendly plants		
	Main	Students	Control	Main	Students	Control
Never	1%	2%	4%	8%	30%	29%
Rare	7%	13%	30%	13%	26%	28%
Less Frequently	19%	28%	31%	31%	22%	24%
Frequently	72%	57%	35%	48%	23%	20%
...motivate others to participate in a citizen science project				...talk to friends and family about nature and environmental issues		
	Main	Students	Control	Main	Students	Control
Never	21%	52%	60%	0%	3%	3%
Rare	30%	27%	22%	3%	8%	14%
Less Frequently	24%	14%	15%	20%	22%	28%
Frequently	26%	8%	3%	77%	67%	54%

Table 7 and 8 show that participants of the main group are more likely to join other Citizen Science projects. Also, the main group is most frequently advocating for environmental protection, followed by the students group. 89% of the main group frequently makes sure to not use pesticides that are harmful to bees; this is also the

highest number in all of the groups. Two third of the main group sow or plant native and insect-friendly plants, which is also the highest percentage.

Table 9 shows the difference and p-value from the main group to the students group and to the control group from a post-hoc test, for the frequency of the following questions. The higher the number in difference the higher is the difference, if the p-value is under 0.05 its significant and below 0.001 highly significant ***

How often do you...	Main to students group		Main to control group	
	difference	p-value	difference	p-value
...report data to (other) Citizen Science projects	0.6631587	0.0000**	0.9433297	0.0000**
...advocate for environmental protection	0.2405247	0.0098*	0.3906993	0.0000**
...avoid pesticides harmful to bees	0.3644475	0.0007**	0.3205180	0.0029*
...sow or plant native and insect-friendly plants	0.7696942	0.0000**	0.5861612	0.0000**
...install insect hotels	0.87256921	0.0000**	0.84684442	0.0000**
...alert others to invasive species	0.4972165	0.0000**	1.0668821	0.0000**
...observe insects	0.6267826	0.0000**	0.8864350	0.0000**
...identify wild bees	1.23160223	0.0000**	1.21837687	0.0000**
...talk to others about animal and/or plant species	0.2119271	0.0328*	0.6589236	0.0000**
...encourage others to sow or plant native or insect-friendly plants	0.81514528	0.0000**	0.84338810	0.0000**
...motivate others to participate in a citizen science project	0.7754900	0.0000**	0.9385044	0.0000**
...talk to friends and family about nature and environmental issues	0.2177991	0.0155*	0.4124024	0.0000**

Table 9 shows that the main group shows a significant difference in all categories compared to the students group and control group. Especially in the section “identify wild bees” the difference is the highest.

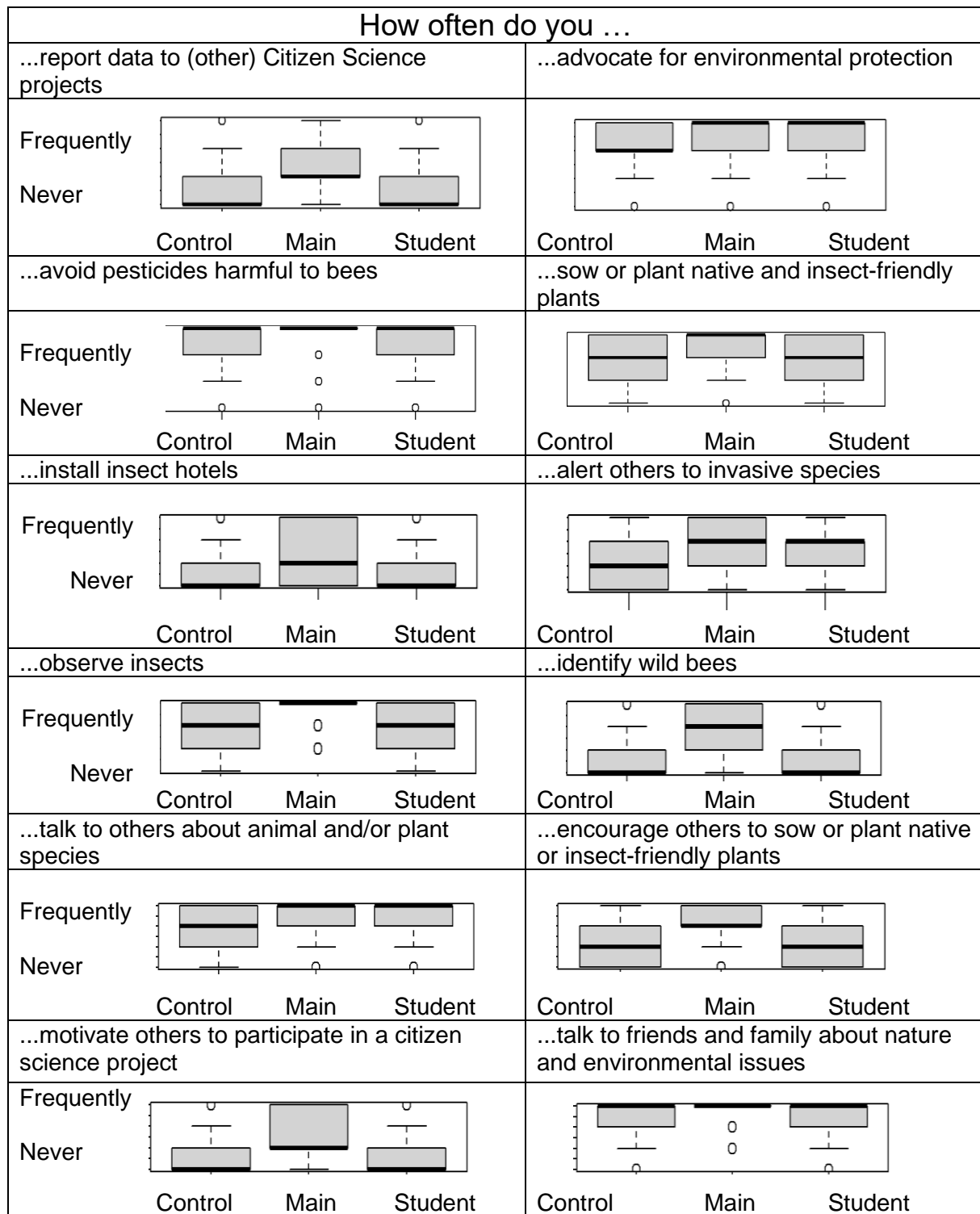


Figure 15: Boxplots showing how frequently the different groups do a certain task

It shows that the boxplots from the main group and the student group are more often similar than compared to the control group. The main group does activities more often than the other two groups. The mean of the main group is always the highest, mostly followed by the student group. Looking at these boxplots and at the post-hoc test, the main group did all the mentioned tasks the most frequent.

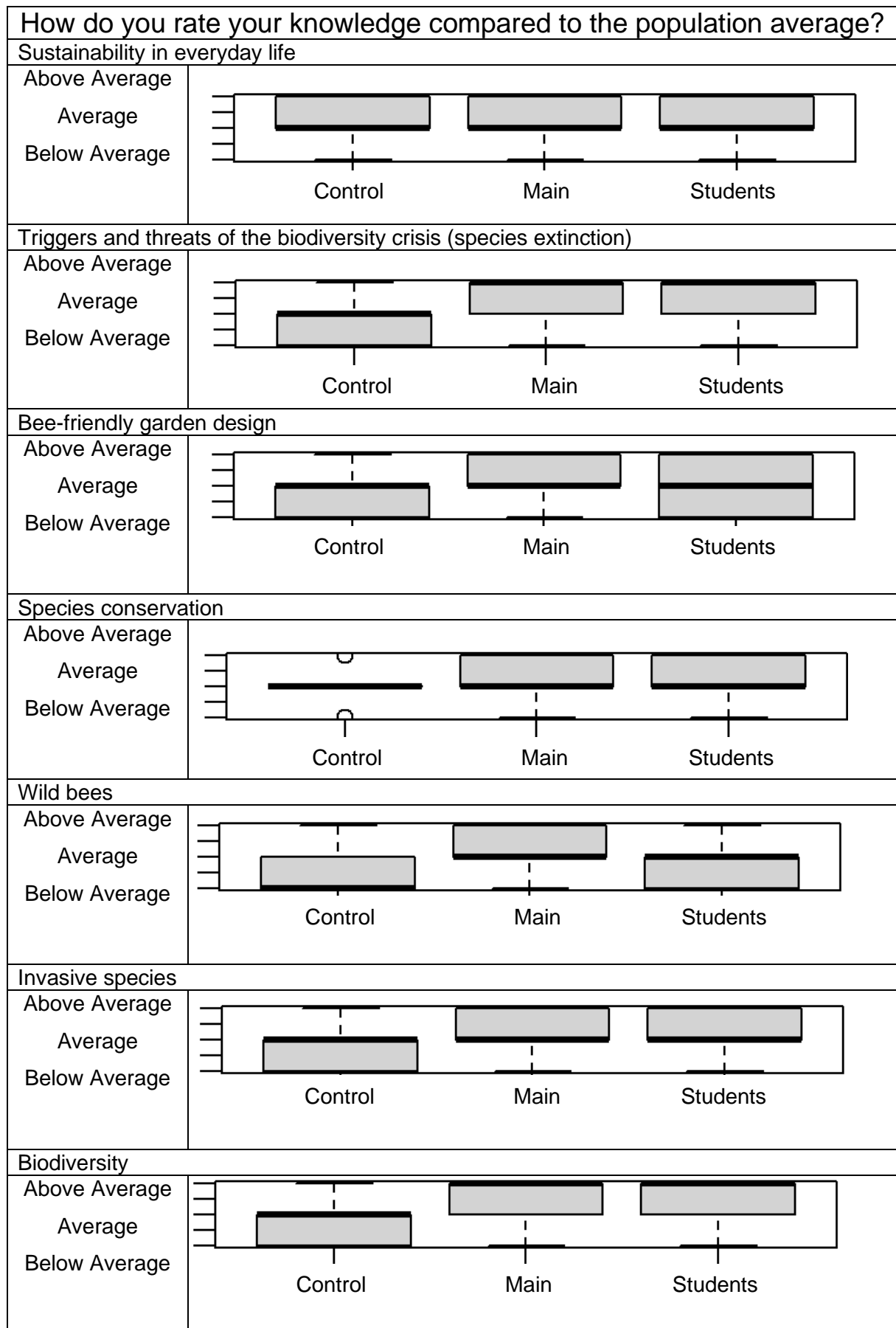


Figure 16 : Shows how the different groups rate their knowledge compared to the population average

This figure shows that the Main Group and the Students group believe that they know more in most of the fields compared to the average of the population. The Control group tends to say that their knowledge is average or below average.

*Table 10: Shows the difference and p-values from the Main Group of the Students Group and to the Control group from a post-hoc test. of the self-assessment of the following fields. the higher the number in difference the higher is the difference. if the p-value is under 0.05 its significant * and under 0.001 it's highly significant **

How do you rate your knowledge compared to the population average?	Main to Students Group		Main to Control Group	
	difference	p-value	difference	p-value
Sustainability in everyday life	0.009837566	0.9869630	0.263376425	0.0000835**
Triggers and threats of the biodiversity crisis (species extinction)	-0.04415466	-0.8067889	0.56629859	0.0000000**
Bee-friendly garden design	0.4008236	0.0000001**	0.5261469	0.0000000**
Species conservation	-0.03988408	0.793385	0.37905108	0.000000**
Wild bees	0.4887516	0.00e+00**	0.7190951	0.00e+00**
Invasive species	0.05071303	0.7491104	0.59697908	0.0000000**
Biodiversity	-0.04438344	0.7798242	0.57808152	0.0000000**

Table 10 shows that the difference of knowledge for the Main group compared to the Students group is not significant in the following fields: “Sustainability in everyday life”, “Triggers and threats of the biodiversity crisis (species extinction)”, “Species conservation”, “Invasive species”, and “Biodiversity”. However, there is a significant difference in these fields compared to the control group, which said that they know less about these fields.

3. Discussion

5.1 Who are the Citizen Scientists?

The Citizen Scientists are divided into all age groups, from under 20 to over 60. More than 55% have an academic degree, but this does not differ much from the control group. However, there is a big difference to the control group in the natural science/ecological background. 67% have a background- this number is more than twice as high (29%) as in the control group. The participants also spent more time on the core topics of the project before the project began: The Citizen Scientists spent 31% more time on insect awareness, 15% more on species and environment protection, 14% more on scientific projects and 22% more on biodiversity.

This indicates that people who are already interested in a certain topic are more likely to participate in the BeeRadar Citizen Science project. For example, some participants came to the project after discovering a large black bee unfamiliar to them. To become aware of the project in this way one has to have a certain insect perception, otherwise one might not notice an unfamiliar bee. Accordingly, a Korean study shows that people who already have experiences with insects have a better perception and more knowledge about them (Bae et al., 2013). Another reason could be the dissemination process of the project, as it was significantly promoted within focus groups, e.g., beekeeper community or magazines on environmental topics. Also, many people became aware of the project via social media. It is well-known that suggestions on social media are made on the basis of one's own interests., This could also be the reason why the Citizen Science participants were already more interested in environmental topics before the project (Zuiderveen Borgesius et al., 2016).

Almost half (44%) of the Citizen Scientists want to be involved more, this can also be seen as feedback that they are very interested in the project, and they even want to spend more time on it. The response rate also showed that the interest for the project is very high and people really care and support it.

5.2 Motivation

Contributing to biodiversity research was the most important reason why people took part in the project, which could be explained by the fact that biodiversity is an important topic nowadays and is often hotly debated in the media and in public (Unnerstall, 2021). However, for many (72%) it was also important to learn something new themselves, thereby following a very important concept that drives us humans to learn something new, namely to learn something new for egoistic reasons. This plays an important role especially in Citizen Science projects where people participate voluntarily (Rotman et al., 2012). Why Citizen Scientists stay and are motivated suggests that their expectations of the project are generally fulfilled, or if not, they at least have another reason that they enjoy or care about why they continue.

5.3 Knowledge gain

The majority of participants were able to learn about biodiversity, insect observation and science work through the project. In the areas: “Triggers and threats of the biodiversity crisis (species extinction)”, “Bee-friendly garden design”, “Species conservation”, “Wild bees, Invasive species” and “Biodiversity” they rated their knowledge as above average. In this aspect they also stand out from the control group, who rates their knowledge as average. Often, they are on the same level as the group of students in these areas. A study conducted in 2020 by Peter and associates came to similar conclusions (Peter et al., 2021). In this study, 1160 citizen science participants from 63 different projects were surveyed on the areas of knowledge, skills of data collection and data analysis, self-efficacy, interest in environmental, and science topics, motivation for environmental and science activities and behaviour (Peter et al., 2021).

This increase in knowledge corresponds to the expectations that the participants had about the project. Eventually, for almost two quarters, gaining new knowledge was an important reason for joining the project. Knowledge transfer is also an important point in the principles of Citizen Science projects (Robinson et al., 2018).

5.4 Behaviour of the Citizen Scientists

Most of the participants (52%) spent 1-4 hours on the project. This might be because they saw the bee just once. 33% said that they didn't spend any time on the project, which could be explained because they are just following the project, or they live in areas where there is still no presence of the *Megachile sculpturalis*. For future work, it will be interesting to see if these people change their behaviour and spend time on the project. I also included this 33% in all my calculations, so maybe for further projects people who said that they didn't spend any time on the project shouldn't be part of further calculations. On the other hand, some of these participants said that they also gained knowledge from the project. In this case, they might have misunderstood the question, maybe because they never found the *Megachile sculpturalis* and thought they are not an actual Citizen Scientist.

Many of BeeRadar's Citizen Scientists are also involved in other Citizen Science projects, which makes them significantly different from the control and student group. This could be explained by the fact that once people have become aware of Citizen Science approach, they search for other projects more purposefully. For example, in Austria there is a network called "Österreich Forscht" (Austria Researches), which lists all Austrian Citizen Science projects (<https://www.citizen-science.at> (Universität für Bodenkultur Wien, 2021)).

The Citizen Science participants were more committed to environmental protection compared to the control group, which could be due to the fact that they were already more interested in it before the start of the project, but also that they have become more involved with it as a result of the project. A total of 79% stated that they had increased their knowledge in the field of environmental protection as a result of the project.

The participants are most likely to show consideration for bees in the garden by stating that they avoid products that are harmful to bees. Here as well, we see a significant difference compared to the other two groups, with all of them indicating that they tend to avoid these products (Thierbach and Nickmann 2010). This could also be due to the fact that the participants want to present themselves better, as bees have a strong positive image, and many do not want to indicate that they are harming them (Thierbach and Nickmann 2010; Sumner et al. 2018). A lack of knowledge may also

be a factor, as many are probably unaware of which products are harmful. It should be added that this question did not give a choice for people who do not have a garden/balcony where they could apply bee-harmful pesticides, so they are more likely to have said that they do not do so. If the survey is to be used in the future again, this question should be changed.

This may also relate to the question of whether they plant native insect-friendly plants. Here the main group clearly stands out from the others, one reason could be that these people possibly own a garden more often, in contrast to students who often live in shared flats or with their parents (Orr et al. 2011).

On the question of whether insect hotels are set up, there is a particularly large spread in the main group, which is possibly due to the fact that the participants know through the project in the D-A-CH region that a large number of non-native insects often feel at home in bee hotels (Geslin et al., 2020). On the other hand, participants have come to the project because they have discovered the *Megachile sculpturalis* in their own bee hotel, so they continue to use it for observation purposes.

In the points of insect observation and wild bee identification, the main group clearly stands out from the control group and the student group. This is most likely due to the fact that these two points are core tasks of the project (Lanner, 2021b).

The main group talks most often with others about plants and animals, closely followed (as seen in the boxplot) but still with a significant difference (as seen in the statistical analysis) compared to the student group. Both groups, main and student, talk more often about plants and animals than the control group. This shows that an interest in biodiversity is higher than the average and participants even like to share and talk about it with others. A study made by Peter et al. in 2020 also showed that participants are talking more often to others about plant and animal species after joining a Citizen Science project (Peter et al., 2021).

Overall, the project participants stand out slightly from the student group when it comes to how much time they spend on environmental issues. The control group is, as expected, below the other two groups. As a result, active participants spend more time in nature, which contributes to their connection to the nature. However, it must be pointed out that many of them had already been more involved with environmental

issues before they start of the project, which may also be a reason why they dealt with these issues more.

6 Conclusion

Regarding the results from our survey, participants of the BeeRadar Citizen Science project were able to gain new knowledge in the field of biodiversity, wild bees, insects and scientific project. Participation changed their behaviour in a way that they started spending more time on environmental topics. This might not be the solution for all the environmental problems we have right now, but it's a good start. It shows us that by joining a Citizen Science project we can make a personal change and create more awareness about the nature around us. If many people would join a Citizen Science project and would also actively take part in it, it might be an important step regarding what we as a society can do against our current environmental problems. I'm not saying that it's the only thing we can do, it's just one of many things. In order to really make a change towards a more sustainable world we need a lot more projects which are raising awareness, motivation, and knowledge. Citizen Science projects can be a significant part of this much needed change in our society.

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Appendix

Main Survey

BeeRadar - How sustainable is Citizen Science?

Thank you for choosing to participate in the survey.

The questions relate to the entire period since you became aware of BeeRadar.

Questions marked with a red star are compulsory to complete.

Data protection:

I will save, analyse and publish your answers as part of my master's thesis. It is not possible to establish a personal reference on the basis of the survey. Of course, you can end the survey at any time without giving any reason.

If you agree, please click on continue.

There are 21 questions in this survey.

Part 1

How often do you carry out the following activity as part of the Citizen Science project? *

Please choose the appropriate response for each item:

	Never	Only once so far	Few times a year	Once or twice a month	Once a week	A few times a week
Identify and record bees						
Photograph bees						
Collect bees						
Enter or report data/information						
Read newsletters and/or social media						
Visit the project's website						
Communicate with project team members (phone, email, online forum)						

Please select the applicable answer for each item

What other activities did you carry out as part of the project?

Please write your answer here:

How has your participation in the project changed over time since you started (e.g. more frequent or longer observations...) ?

Please write your answer here:

Approximately how many hours have you spent participating in the project in the last 3 months? *

Choose one of the following answers

Please choose **only one** of the following:

- None
- 1-4 hours
- 5-10 hours
- 11-20 hours
- 21-50 hours
- 51 hours or more

I participated in the project because I want to *

Check all that apply

Please choose **all** that apply:

- conserve the environment
- support the community
- contribute to biodiversity research
- help the scientists
- get outside and connect with nature
- learn new skills
- gain new knowledge
- get recognition for participation
- was asked to make a report
- identify a species unknown to me
- Other:

How did you become aware of the project? *

Check all that apply

Please choose **all** that apply:

- TV, Newspaper, article in magazine (= classical media channels)
- Instagram, Facebook, Twitter (= social media)
- Internet research
- Other people recommending the Project
- I don't remember
- Other:

Part 2

How long have you been following BeeRadar? *

Choose one of the following answers

Please choose **only one** of the following:

- 2018
- 2019
- 2020
- 2021

Before participating in the project, did you spend a lot of time on the following aspects? *

Please choose the appropriate response for each item:

	Yes	No
Insect awareness		
Scientific projects		
Spending time outdoors		
Biodiversity		
Species and environment protection		

The project increased my knowledge and interest in the following topics: *

Please choose the appropriate response for each item:

	Disagree	Agree	Don't know
Insect observation			
Scientific projects			
Spending time outdoors			
Biodiversity			
Species and environmental protection			

"How often do you..." *

Please choose the appropriate response for each item:

	Frequently	Less frequently	Rarely	Never
report data to other Citizen Science projects				
advocate for environmental protection				
avoid pesticides harmful to bees				

	Frequently	Less frequently	Rarely	Never
sow or plant native and insect-friendly plants				
install insect hotels				
alert others to invasive species				
observe insects				
identify wild bees				
talk to others about animal and/or plant species				
encourage others to sow or plant native or insect-friendly plants				
motivate others to participate in a citizen science project				
talk to friends and family about nature and environmental issues				

How do you rate your knowledge compared to the population average? *

Please choose the appropriate response for each item:

	Below average	Average	Above average
Biodiversity			
Invasive species			
Wild bees			
Species conservation			
Bee-friendly garden design			
Triggers and threats of the biodiversity crisis (species extinction)			
Sustainability in everyday life			

Is there anything else you do differently as a result of participating in this project?

Please write your answer here:

Part 3

How many hours do you spend outdoors per day on average? *

Choose one of the following answers

Please choose **only one** of the following:

- Less than one
- 1-2
- 3-4
- 5-6
- 7-8
- 9-10
- 11 or more

Have you received information from project members on the following topics? *

Please choose the appropriate response for each item:

	Yes	No
Aim of the project		
Scientific background		
Processes & results of the project		
Publications in presentations & articles		

How would you rate the information content of the project? *

Please choose the appropriate response for each item:

	Too much	Suitable	Too little	Do not follow
Homepage				
Instagram				
Newsletter				
Personal communication				

Would you like to be more involved in the project? *

Please choose **only one** of the following:

- Yes
- No

If yes, in what form?

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '16 [C1]' (Would you like to be more involved in the project?)

Please write your answer here:

What is your date of birth? *

Choose one of the following answers

Please choose **only one** of the following:

- 2000 or later
- 1990-1999
- 1980-1989
- 1970-1979
- 1960-1969
- 1960 or earlier

What is your highest educational qualification? *

Choose one of the following answers

Please choose **only one** of the following:

- No degree
- Secondary school or equivalent
- Apprenticeship or equivalent
- High school diploma or equivalent
- Bachelor's degree or equivalent
- Master's degree or equivalent
- PhD
- Other

Are you professionally or hobbyistically active in any of the following areas: Biology, environmental education , climate protection, agriculture & forestry, beekeeping? *

Please choose **only one** of the following:

- Yes
- No

What is your postcode? *

Please write your answer here:

Thank you for your participation! Please keep your eyes open and report sightings of the Sculptured Resin Bee and spread the word about our project. The more reports we receive, the more accurately we can monitor the habits of the Sculptured Resin Bee. For identification help, you can also visit our new homepage: <https://beeradar.info> .

Thank you and kind regards,

the BeeRadar team

Submit your survey.

Thank you for completing this survey.

[Survey Student and Control Group](#)

Sustainability in everyday life

Thank you for choosing to participate in the survey.

Data protection:

I will save, analyse and publish your answers as part of my master's thesis. It is not possible to establish a personal reference on the basis of the survey. Of course, you can end the survey at any time without giving any reason. If you agree, please click on continue.

There are 8 questions in this survey.

Part 1

Do you spend a lot of time on the following aspects? *

Please choose the appropriate response for each item:

	Yes	No
Insect awareness		
Science projects		
Spending time outdoors		
Biodiversity		
Protecting species and the environment		

Frequency of the following activities: "How often do you..." *

Please choose the appropriate response for each item:

	Frequently	Less Frequently	Rare	Never
report data to Citizen				
Science projects				

	Frequently	Less Frequently	Rare	Never
advocate for environmental protection				
avoid plant protection products which are harmful to bees				
sow or plant native and insect-friendly plants				
set up insect hotels				
inform others about invasive species				
observe insects				
identify wild bees				
talk to others about animal and/or plant species				
encourage others to sow or plant native or insect-friendly plants				
motivate others to participate in a citizen science project				
talk to friends and family about nature and environmental issues				

How would you rate your knowledge compared to the population average? *

Please choose the appropriate response for each item:

	Below average	Average	Above average
Biodiversity			
Invasive species			
Wild bees			
Conservation of species			
Bee-friendly garden design			

Below average

Average

Above
average

**Triggers and dangers of the
biodiversity crisis (species
extinction)**

Sustainability in everyday life

Part 2

When were you born? *

Choose one of the following answers

Please choose **only one** of the following:

- 2000 or later
- 1990-1999
- 1980-1989
- 1970-1979
- 1960-1969
- 1960 or earlier

Are you a professional or amateur in one of the following areas: Biology,
Environmental Education , Climate Protection, Agriculture & Forestry, Beekeeping? *

Please choose **only one** of the following:

- Yes
- No

Are you currently enrolled at a University programme that includes biology and/or
ecology? *

Please choose **only one** of the following:

- Yes
- No

What is your postcode? *

Please write your answer here:

What is your highest educational qualification? *

Choose one of the following answers

Please choose **only one** of the following:

- No degree
- Secondary school or equivalent
- Apprenticeship / vocational training or equivalent
- Abitur high school or equivalent

- Bachelor or equivalent
- Master's degree or equivalent
- PhD
- Other

Thank you for your participation! If you are interested in learning more about wild bees, we would be grateful if you take a look and see if the Sculptured Resin Bee is also present in your area.

It is the first immigrating wild bee in Europe. With the help of Citizen science, the Project BeeRadar aims to investigate its behaviour and distribution. Owing to its remarkable size and distinctive appearance, the Sculptured Resin bee is easily recognizable for everybody. For more information on how to identify and spot this

species, you can visit our Homepage: <http://beeradar.info>

Thank you very much and best regards,

the BeeRadar-Team

Submit your survey.

Thank you for completing this survey.

Results Main Survey

Total number of records
in this survey:

141

Summary for A1(SQ002)[Identify and record bees]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	32	22,70%
Only once so far (A2)	48	34,04%
Few times a year (A8)	29	20,57%
Once or twice a month (A5)	22	15,60%
Once a week (A6)	1	0,71%
A few times a week (A7)	9	6,38%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A1(SQ003)[Photograph bees]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	27	19,15%
Only once so far (A2)	42	29,79%
Few times a year (A8)	33	23,40%
Once or twice a month (A5)	22	15,60%
Once a week (A6)	4	2,84%
A few times a week (A7)	13	9,22%

No Answer	0	0,00%
Not shown	0	0,00%

Summary for A1(SQ004)[Collect bees]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	107	75,89%
Only once so far (A2)	24	17,02%
Few times a year (A8)	6	4,26%
Once or twice a month (A5)	2	1,42%
Once a week (A6)	1	0,71%
A few times a week (A7)	1	0,71%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A1(SQ005)[Enter or report data/information]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	35	24,82%
Only once so far (A2)	55	39,01%
Few times a year (A8)	38	26,95%
Once or twice a month (A5)	7	4,96%
Once a week (A6)	3	2,13%
A few times a week (A7)	3	2,13%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A1(SQ006)[Read newsletters and/or social media]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	13	9,22%
Only once so far (A2)	18	12,77%
Few times a year (A8)	39	27,66%
Once or twice a month (A5)	26	18,44%
Once a week (A6)	15	10,64%
A few times a week (A7)	30	21,28%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A1(SQ007)[Visit the project's website]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	31	21,99%
Only once so far (A2)	45	31,91%
Few times a year (A8)	41	29,08%
Once or twice a month (A5)	18	12,77%
Once a week (A6)	2	1,42%
A few times a week (A7)	4	2,84%
No Answer	0	0,00%

Not shown	0	0,00%
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Summary for A1(SQ008)[Communicate with project team members (phone, email, online forum)]

How often do you carry out the following activity as part of the Citizen Science project?

Answer	Number	Percentage
Never (A1)	26	18,44%
Only once so far (A2)	45	31,91%
Few times a year (A8)	48	34,04%
Once or twice a month (A5)	14	9,93%
Once a week (A6)	4	2,84%
A few times a week (A7)	4	2,84%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A2

What other activities did you carry out as part of the project?

Answer	89	63,12%
No Answer	52	36,88%
Not shown	0	0,00%

ID

Answer

- 31 Publikationen mitverfassen, Verhaltensbeobachtungen machen, Filmen
- 34 Beobachtungen der Asiatischen Mörtelbiene geschildert, Fragen gestellt.
- 38 No
- 41 Foto,Film,Einsendung Damen
- 43 Meldung einer seltenen Bienenart
- 47 Ne
ich habe versucht, herauszufinden, wo die Mörtelbienen Nektar sammeln
- 49 und wo sie ihr Verschlussmaterial holen.
- 56 Deljenje sadržaja online
- 57 Ne
- 59 No
- 60 No
- 63 Vorkommnisse gemeldet
- 65 Ne za sada ali bih vrlo rado.
- 67 ne
- 68 Ne
- 70 Saljem slike i pitanja vezano za vrste koje me za imaju..
- 71 Ne
- 73 Beobachtung und Sammlung
Beleženje mesta gde se nalaze biljke koje posećuje azijska pčela
- 74 smolarica
- 75 Nisam
- 76 Ne
- 78 No
- 81 No
- 82 ne
- 88 Tražila biljke koje pčele smolarice vole
- 90 Prüfe sehr oft, ob die Mörtelbiene im Garten ist.
- 91 No
- 92 Envoi d'observations et de photos
- 93 Ich halt ausschau nach der asiatischen moertelbiene
- 96 Teilen des Projekts (shoutouts über SocialMedia; Spotify)

103 No
 105 Ne.
 108 Ne
 109 Öffentlichkeitsarbeit, Abstimmung mit Validierenden, Projektmanagement
 111 Ne
 113 Nisam
 Wir senden unser Beehome regelmässig ein, dort wird registriert und
 116 kontrolliert, welche Bienen es benützt haben.
 Sem što sam motrila dolazi li na gnezdo pčela kad god sam kod kuće,
 118 ništa više 😊
 119 Ne
 120 Ne
 121 Ne
 122 ne
 124 Ne
 127 -
 130 Ns
 131 No
 135 Ne
 I was recruited when I reported an invasive bee on iNaturalist. I was only
 136 asked to collect the invasive bees, as many as I could, so I did so.
 139 ne
 140 Ne
 148 Ne
 149 Ne
 Pisala sam saopštenje u kojem je objašnjeno čime se projekat bavi i kako
 166 građani mogu da pomognu.
 168 ne
 184 Ne
 190 Ne.
 193 Ne
 194 Ne.
 197 Ne, nisam.
 201 Ne.
 209 Ne
 215 Ne
 219 Ne
 223 Monitoring, Laborarbeit (Master-Arbeit)
 228 Ne
 229 Ne
 234 Beobachtung bei Spaziergang
 243 Ne
 245 Ne
 246 Ne
 247 Ne
 248 Ne
 251 Ne
 253 Nisam.
 255 Ne
 261 Ne
 Pratila aktivnosti i rezultate istraživača u otkrivanju azijske pčele
 smolarice; sa pojačanom pažnjom pratila i druge vrste insekata, koji mi do
 262 tada nisu bili poznati
 264 Aushang der Informationsseite im Schaukasten der Berg- und Naturwacht
 265 Foto eingesandt
 266 Ne
 267 No

Fotos geteilt bzw Meldung von besonderen Funden (Wildbienen und
 268 andere Insekten)
 272 Sichtung Asiatischer Mörtelbienen gemeldet.
 273 No
 274 Ne
 276 ich habe meine 2 Häuschen zum genau anschauen geschickt
 277 viel Beobachtungen
 286 No weiteren Tätigkeiten.
 287 No

Summary for A3

How has your participation in the project changed over time since you started (e.g. more frequent or longer observations...) ?

Answer	92	65,25%
No Answer	49	34,75%
Not shown	0	0,00%

ID

Answer

30 No Beobachtungen, da No Megachile mehr bei mir
 31 häufiger, länger und bewusster
 Man sieht mehr, wenn man mehr über die beobachteten Species weiß
 34 und wenn man weiß, dass die Beobachtungen wertvoll sind.
 37 Öfter im Garten schauen was da rumfliegt :-)
 38 ja ich beobachte die asiatischen Mörtelbienen oft
 40 No Beobachtungen mehr, weil im Moment No Megachile hier nistet.
 41 abnehmend
 43 No Veränderung
 47 Da jeste
 leider seltenere Beobachtungen, weil ich nicht am Ort der Mörtelbiene
 49 ständig wohnhaft bin.
 50 eher weniger aus Zeitmangel
 56 Duza posmatranja, malo vise upoznata sa svime
 57 Ne
 59 beachte diese Bienen öfter
 60 Es gab leider nur eine Beobachtung.
 62 Počela sam više da posmatram pčele ali i druge insekte
 63 Nichts
 65 Apsolutno, više sam zainteresovan za određene vrste.
 68 Više obraćam pažnju na pčele, aktivnije tražim, češće fotografišem
 Svaki dan sam na putu do plaze dok sam bila u Crnoj Gori, na jednom
 zbunu pokušavala da uočim smolaricu među gomilu bumbara, ali nista.
 70 (Bila sam 2 nedelje na odmoru)
 Da, duže posmatram okolinu. Obradujem se kada uočim pčelu smolaricu.
 Ja učešće u ovome ne doživljavam kao obavezu, više kao usputnu
 71 aktivnost kada sam već negde napolju.
 72 Mnogo duže i strpljivije posmatram pčele oko sebe.
 73 Häufiges Beobachten
 74 Češća posmatranja, više iskustva u prepoznavanju
 75 Da, vise sam obracala paznju na pcele
 76 Za pocetak, primecujem razlike
 78 No Teilnahme am Projekt, außer auf Instagram verfolgen
 79 Noch mehr Beobachtungen
 81 Gar nicht
 82 ne
 88 Obraćam više pažnje na pčele i rastinje koje vole

90 Erkenne zwischenzeitlich Wildbienen
 91 hab die Instagram-Seite erst vor ein oder zwei Wochen entdeckt
 92 Plus d'observations au début et moins maintenant
 93 Ich bin viel interessierter an Bienen
 Gezieltere Beobachtungen, unregelmäßige Erwähnung des Projekts je
 96 nach Gelegenheit
 Längeres und genaueres Beobachten speziell von Bienen. Zudem gehe
 98 ich viel aufmerksamer durch die Natur.
 105 Ne.
 108 Ne
 109 Häufigere Beobachtungen
 Da, od pasivnog posmatrača društvenih mreža do aktivnog učesnika i
 111 zagovornika
 113 Česce
 Als aufmerksame Garten- und Naturfreunde sind wir an allem sehr
 116 interessiert.
 119 Detaljnije posmatram
 120 Da
 121 Podigla mi se svijest o pčelama oko mene.
 122 ne
 124 Redovno posmatranje i traženje pčele u okolnim staništima
 126 Längere Beobachtungen nicht immer mit Projektbezug
 127 -
 Bila sam obazrivija i trudila sam se da pogledam svaku pčelu pored koje
 130 sam prošla
 Projekat me je zainteresovao da se više uključim u aktivnosti posmatranja
 135 pčela u svojoj okolini
 136 I still scan flowers for the invader, but haven't seen any since early July.
 138 Wildbienen bewusster beobachten
 Da, više se trudim da nađem soforu, ali ona sada više ne cveta pa nema
 pčela. Obratuiću sledeće godine više pažnje na sofore, nadam se na
 139 vreme.
 140 Ne. Istina, kako je počela jesen prestao sam tražiti.
 Da, počela sam više da obraćam pažnju na pčele, više sam ih zavolela i
 149 zainteresovana sam u vezi pčela.
 166 /
 168 ne
 184 Češće zastajem da posmatram insekte na biljkama
 190 Nikako.
 193 Ne
 Promenile su se lokacije na kojima trazim pčele jer sam se bolje
 194 informisala o njima.
 197 Ne.
 201 Posmatram pčele, ali trazenu vrstu nisam uocila.
 215 Dodatno sam se zainteresovao za divlje vrste pčela
 219 Nije se menjalo.
 223 Häufigere, längere Beobachtungen
 228 Duža posmatranja i brža uočavanja pčela
 229 Ne
 234 Denke bei jedem Spaziergang daran auf die Biene zu achten
 243 Značajno
 245 Ne
 246 Ne
 247 Da
 248 Nije
 251 Vise obracam pažnju na insekte
 253 Nije se promenilo.
 261 Da, svuda gde bi moglo biti smolarice zagledamo.

Svakako, češća i duža posmatranja, posebno, insekata koji mi do tada
 262 nisu bili poznati
 Bei meinen wöchentlichen Begehungen des Naturschutzgebietes habe
 264 ich geachtet, ob ich eine As. Mörtelbiene sehe.
 265 gelegentliche Beobachtung, warten auf erstes Erscheinen im neuen Jahr
 Promenila se u tome sto sam duze posmatrala pcele kako bih mogla da
 266 uocim da li je neka od njih ona o kojoj se radi u projektu.
 267 Momentan auf Standby
 Beobachtungszeitraum ausgedehnt von Frühjahr bis Herbst, bessere
 268 Kenntnis der Wildbienen und ihrer Bedürfnisse
 272 häufigere Beobachtung
 274 Ne
 276 häufigere Beobachtungen
 277 eben nicht viele Beobachtungen von mörtel Biene
 Wir halten seitdem bewusst Ausschau nach asiatischen Mörtelbienen und
 286 haben bienenfreundliche Blumen/Pflanzen besorgt. Konsequenz.
 287 Ja, häufigere und längere Beobachtungen
 Intensiveres Beobachten weil mehr Anreiz durch wertschätzung der
 289 Entdeckungen

Summary for A4

Approximately how many hours have you spent participating in the project in the last 3 months?

Answer	Number	Percentage
None (A2)	44	31,21%
1-4 hours (A3)	73	51,77%
5-10 hours (A4)	20	14,18%
11-20 hours (A5)	1	0,71%
21-50 hours (A6)	2	1,42%
51 hours or more (A7)	1	0,71%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A7

I participated in the project because I want to

Answer	Number	Percentage
conserve the environment (001)	93	65,96%
support the community (002)	53	37,59%
contribute to biodiversity research (003)	118	83,69%
help the scientists (004)	109	77,30%
get outside and connect with nature (005)	52	36,88%
learn new skills (006)	37	26,24%
gain new knowledge (010)	102	72,34%
get recognition for participation (007)	3	2,13%
was asked to make a report (008)	12	8,51%
identify a species unknown to me (009)	69	48,94%
Sonstiges	6	4,26%

ID**Answer**

- 41 Sensibilisierung
 71 Imam zanimljive informacije za učenike sa kojima radim.
 Ich habe kaum Berührung mit dem Projekt und wäre mir auch nicht sicher,
 wie ich mitmachen könnte und ob ich Bienen richtig bestimmen könnte,
 81 nur über die Info, die ich auf Instagram so mitbekomme.
 142 Nisam učestvovao
 257 pomognem kolegici koja je nama puno pomogla oko naseg projekta
 268 Biodiversität im eigenen Garten kennenlernen und schützen

Summary for A8

How did you become aware of the project?

Answer	Number	Percentage
TV, Newspaper, article in magazine (= classical media channels) (001)	19	13,48%
Instagram, Facebook, Twitter (= social media) (002)	77	54,61%
Internet research (003)	24	17,02%
Other people recommending the Project (004)	20	14,18%
I don't remember (005)	1	0,71%
Sonstiges	18	12,77%

ID**Answer**

- 31 Kontaktaufnahme nach i-Naturalist-Meldung
 Ich habe ein Foto gepostet und jemand hat mich darauf aufmerksam
 49 gemacht, diese Biene beim Projekt einzumelden.
 52 iNaturalist
 70 Preko člana porodice
 82 <https://www.facebook.com/groups/158575897678831>
 116 Beehome
 127 Kontakt mit Julia (e-mail)
 130 Student sam Biološkog fakulteta
 Preko FB posta Ane Teklerović koja je podelila negativna iskustva vaše
 135 istraživačice na društvenim mrežama u vezi sa istraživanjem
 136 Recruited via my report on iNaturalist
 166 Putem mejla
 199 Putem primljenog mejla.
 223 Bin Teil des Projekts :)
 228 Putem emaila
 229 Preko mejla koji je stigao od fakulteta
 meine Meldung auf www.naturbeobachtung.at und die persönliche
 264 Kontaktaufnahme durch die Projektleiterin
 267 Schweizerische Bienenzeitung
 274 Gmail

Summary for X1

How long have you been following BeeRadar?

Answer	Number	Percentage
2018 (A1)	4	2,84%
2019 (A2)	12	8,51%
2020 (A3)	59	41,84%

2021 (A4)	66	46,81%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ001)[Insect awareness]

Before participating in the project, did you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	101	71,63%
No (A2)	40	28,37%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ002)[Scientific projects]

Before participating in the project, did you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	55	39,01%
No (A2)	86	60,99%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ003)[Spending time outdoors]

Before participating in the project, did you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	136	96,45%
No (A2)	5	3,55%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ004)[Biodiversity]

Before participating in the project, did you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	105	74,47%
No (A2)	36	25,53%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ005)[Species and environment protection]

Before participating in the project, did you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	122	86,52%
No (A2)	19	13,48%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1(SQ002)[Insect observation]

The project increased my knowledge and interest in the following topics:

Answer	Number	Percentage
Disagree (A2)	7	4,96%
Agree (A3)	125	88,65%
Don't know (A4)	9	6,38%

No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1(SQ003)[Scientific projects]

The project increased my knowledge and interest in the following topics:

Answer	Number	Percentage
Disagree (A2)	22	15,60%
Agree (A3)	85	60,28%
Don't know (A4)	34	24,11%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1(SQ004)[Spending time outdoors]

The project increased my knowledge and interest in the following topics:

Answer	Number	Percentage
Disagree (A2)	48	34,04%
Agree (A3)	78	55,32%
Don't know (A4)	15	10,64%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1(SQ005)[Biodiversity]

The project increased my knowledge and interest in the following topics:

Answer	Number	Percentage
Disagree (A2)	16	11,35%
Agree (A3)	114	80,85%
Don't know (A4)	11	7,80%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1(SQ006)[Species and environmental protection]

The project increased my knowledge and interest in the following topics:

Answer	Number	Percentage
Disagree (A2)	17	12,06%
Agree (A3)	112	79,43%
Don't know (A4)	12	8,51%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ002)[report data to other Citizen Science projects]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	24	17,02%
Less frequently (A3)	32	22,70%
Rarely (A4)	51	36,17%
Never (A5)	34	24,11%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ013)[advocate for environmental protection]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	101	71,63%
Less frequently (A3)	29	20,57%
Rarely (A4)	10	7,09%
Never (A5)	1	0,71%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ003)[avoid pesticides harmful to bees]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	125	88,65%
Less frequently (A3)	5	3,55%
Rarely (A4)	6	4,26%
Never (A5)	5	3,55%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ004)[sow or plant native and insect-friendly plants]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	93	65,96%
Less frequently (A3)	24	17,02%
Rarely (A4)	14	9,93%
Never (A5)	10	7,09%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ005)[install insect hotels]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	48	34,04%
Less frequently (A3)	19	13,48%
Rarely (A4)	32	22,70%
Never (A5)	42	29,79%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ006)[alert others to invasive species]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	61	43,26%
Less frequently (A3)	44	31,21%
Rarely (A4)	24	17,02%
Never (A5)	12	8,51%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ007)[observe insects]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	109	77,30%
Less frequently (A3)	23	16,31%
Rarely (A4)	9	6,38%
Never (A5)	0	0,00%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ012)[identify wild bees]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	37	26,24%
Less frequently (A3)	53	37,59%
Rarely (A4)	36	25,53%
Never (A5)	15	10,64%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ008)[talk to others about animal and/or plant species]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	102	72,34%
Less frequently (A3)	27	19,15%
Rarely (A4)	10	7,09%
Never (A5)	2	1,42%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ009)[encourage others to sow or plant native or insect-friendly plants]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	68	48,23%
Less frequently (A3)	43	30,50%
Rarely (A4)	19	13,48%
Never (A5)	11	7,80%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ010)[motivate others to participate in a citizen science project]

"How often do you..."

Answer	Number	Percentage
Frequently (A2)	36	25,53%
Less frequently (A3)	34	24,11%
Rarely (A4)	42	29,79%
Never (A5)	29	20,57%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ011)[talk to friends and family about nature and environmental issues]

"How often do you..."

Answer	Number	Percentage
--------	--------	------------

Frequently (A2)	109	77,30%
Less frequently (A3)	28	19,86%
Rarely (A4)	4	2,84%
Never (A5)	0	0,00%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ002)[Biodiversity]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	13	9,22%
Average (A3)	50	35,46%
Above average (A4)	78	55,32%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ003)[Invasive species]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	22	15,60%
Average (A3)	57	40,43%
Above average (A4)	62	43,97%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ004)[Wild bees]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	22	15,60%
Average (A3)	67	47,52%
Above average (A4)	52	36,88%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ005)[Species conservation]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	13	9,22%
Average (A3)	62	43,97%
Above average (A4)	66	46,81%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ006)[Bee-friendly garden design]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	15	10,64%
Average (A3)	56	39,72%
Above average (A4)	70	49,65%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ008)[Triggers and threats of the biodiversity crisis (species extinction)]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	16	11,35%
Average (A3)	47	33,33%
Above average (A4)	78	55,32%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ009)[Sustainability in everyday life]

How do you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	11	7,80%
Average (A3)	60	42,55%
Above average (A4)	70	49,65%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B3

Is there anything else you do differently as a result of participating in this project?

Answer	40	28,37%
No Answer	101	71,63%
Not shown	0	0,00%

ID

Answer

- 31 Schnurbäume studieren ;)
- 38 nein
- 47 Samo nastavite
Nein. Ich war vorher bereits an Wildbienen und Artenschutz interessiert
- 49 und bin das nach wie vor.
Brinem o svom sčelinjaku mnogo vise negi sto je to bilo pre i to radim s
- 62 puno ljubavi prema pčelicama
- 70 Ne
Da, počela sam da uočavam pčelu smolaricu dok neobavezno hodam
nekuda i onda sa ljudima koji su tu pričam o njoj. Što verovatno ne bi bio
- 71 slučaj da se nisam uključila u istraživanje.
- 74 Sakupljam uzorke za naučnike koji proučavaju opnokrilce
- 76 Ne
- 82 ne
- 88 Manje se plašim insekata
Recensement des fourmis du canton de Genève, en préparation une
- 92 étude les fourmis dans les ruches
- 93 Ich schenke insekten viel mehr aufmerksamkeit
Svesnija dan prirode oko sebe, van svog dvorišta, pogotovo u urbanim
- 118 delovima.
- 120 Ne
- 122 Imam nameru da postavim nekoliko hotela.
- 124 Ne
Povećala se želja da naučim nove informacije o oblastima o kojima
- 135 nemam puno saznanja.
- 136 Nope.
- 138 bewusster beobachten

- 139 više obraćam pažnju na to gde ima sofore
 140 Ništa posebno jer ionako stalno pratim nove invazivne vrste.
 166 Ne
 190 Ne bih.
 194 Izgubila sam svoj strah od pcela/osa/bumbara...
 201 Cesce razmislijam o biodiverzitetu i zastiti zivotne sredine.
 209 Da
 215 Ne
 234 Die Augen im Garten offen halten
 Više se interesujem za teme i aktivnija sam u akcijama i reakcijama u
 243 skladu sa mogućnostima.
 246 Ne
 247 Абсолютно све!
 253 Ne.
 261 Ne, za sada.
 267 Nein, wir leben schon anders als die Masse
 268 In der Nachbarschaft mehr Sensibilisierung für Wildbienenenschutz schaffen
 277 nein
 282 Viel Lavendel anpflanzen
 286 -
 289 Nicht nur Beobachten sondern auch dokumentieren

Summary for C4

How many hours do you spend outdoors per day on average?

Answer	Number	Percentage
Less than one (A1)	3	2,13%
1-2 (A2)	43	30,50%
3-4 (A3)	64	45,39%
5-6 (A4)	15	10,64%
7-8 (A5)	9	6,38%
9-10 (A6)	6	4,26%
11 or more (A7)	1	0,71%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A5(SQ001)[Aim of the project]

Have you received information from project members on the following topics?

Answer	Number	Percentage
Yes (A1)	121	85,82%
No (A2)	20	14,18%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A5(SQ002)[Scientific background]

Have you received information from project members on the following topics?

Answer	Number	Percentage
Yes (A1)	108	76,60%
No (A2)	33	23,40%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A5(SQ003)[Processes & results of the project]

Have you received information from project members on the following topics?

Answer	Number	Percentage
Yes (A1)	95	67,38%
No (A2)	46	32,62%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for A5(SQ004)[Publications in presentations & articles]

Have you received information from project members on the following topics?

Answer	Number	Percentage
Yes (A1)	88	62,41%
No (A2)	53	37,59%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B5(SQ002)[Homepage]

How would you rate the information content of the project?

Answer	Number	Percentage
Too much (A3)	0	0,00%
Suitable (A5)	86	60,99%
Too little (A7)	5	3,55%
Do not follow (A8)	50	35,46%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B5(SQ003)[Instagram]

How would you rate the information content of the project?

Answer	Number	Percentage
Too much (A3)	1	0,71%
Suitable (A5)	76	53,90%
Too little (A7)	2	1,42%
Do not follow (A8)	62	43,97%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B5(SQ004)[Newsletter]

How would you rate the information content of the project?

Answer	Number	Percentage
Too much (A3)	0	0,00%
Suitable (A5)	38	26,95%
Too little (A7)	8	5,67%
Do not follow (A8)	95	67,38%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B5(SQ005)[Personal communication]

How would you rate the information content of the project?

Answer	Number	Percentage
Too much (A3)	0	0,00%
Suitable (A5)	98	69,50%
Too little (A7)	6	4,26%

Do not follow (A8)	37	26,24%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C1

Would you like to be more involved in the project?

Answer	Number	Percentage
Ja (Y)	62	43,97%
Nein (N)	79	56,03%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C2

If yes, in what form?

Answer	38	26,95%
No Answer	24	17,02%
Not shown	79	56,03%

ID

Answer

- 31 bin für alles offen
- 45 Da pripomognem koliko god je u mojoj mogucnosti. :)
- 47 Da radim projekte sa decom
- 55 Posmatranjem
- 57 Kao i do sad da se odazovem kad je neka akcija
Da dobijem jos korisnih informacija i materijala kako bih saznala vise o
- 62 trazenoj vrsti
- 65 Fotografije određenih vrsta bih slao na mejlove.
- 70 Volela bih vise informacija na sta vise treba da obratim paznju..
Ako kolege smatraju da mogu da me uključe na bilo koji način, znaju da
- 71 mogu da računaju na mene.
Bei gezielten Fragestellungen helfen (z.B. sammeln von Bienen),
- 87 wissenschaftliche Auswertung
- 88 Da nastavim da tražim i izlazim više u prirodu
- 90 Email
- 91 weiß nicht
- 92 mail
- 106 Učenje, posmatranje, fotografija
- 108 Da pronađem još pčela i saznam najnovije podatke o nalazima.
- 111 Na bilo koji način da je potrebna pomoć
- 113 Da dobijam informacije o rasprostranjenosti smolarice
- 118 To znaju oni koji bi me uključili, ja sam svakako za 😊
- 120 Posmatranjem, fotografijom, ako treba hvatanjem uzoraka
- 122 Imam vremena da uradim nešto što bi bilo korisno za projekat.
- 124 Terenski rad, pronalaženje staništa, praćenje u Potiskom regionu
- 126 Persönlicher Kontakt
- 127 e-mail
Volela bih da pomažem organizatorima projekta, takodje bih volela da
- 130 napokon vidim smolaricu, a ne truta medonosne pčele
I dalje ću nastaviti da posmatram prirodu oko sebe i nastaviti da se
- interesujem za rast i napredak projekta, kao i slati svoj doprinos u okviru
- 135 svojim mogućnosti.
- 136 I didn't even know you folks had a newsletter. How do I find it?
- 139 Želim da na više mesta tražim i nađem pčelu smolaricu tamo gde je ima.
- 149 Više da se informišem i boravim više vremena u prirodi.

Da se moj rad ne svede samo na određivanje lokacije, već da budem
 184 uključena i u analize.
 Da ucestvujem u organizaciji izleta na razlicite lokacije u svrhu potrage za
 194 azijskom pcelom smolaricom.
 209 Kada položim biodiverzitet ukoliko mogu nakon toga
 Iskreno, nisam sigurna na koje sve načine je to izvodljivo, ali me
 243 definitivno interesuje.
 247 Да,се више информишем...
 251 Posmatranje, pracenje, identifikovanje vrsta
 253 Terenskim radom
 Ich kann weitere Beobachtungen in meinem Wohnort bzw. bei
 264 Wanderungen durchführen.
 268 Vorkommen von Wildbienen und Insekten, die aus Süden einwandern

Summary for C8

What is your date of birth?

Answer	Number	Percentage
2000 or later (A2)	20	14,18%
1990-1999 (A3)	28	19,86%
1980-1989 (A4)	34	24,11%
1970-1979 (A5)	19	13,48%
1960-1969 (A6)	20	14,18%
1960 or earlier (A7)	20	14,18%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C5

What is your highest educational qualification?

Answer	Number	Percentage
No degree (A2)	0	0,00%
Secondary school or equivalent (A3)	2	1,42%
Apprenticeship or equivalent (A4)	19	13,48%
High school diploma or equivalent (A5)	37	26,24%
Bachelor's degree or equivalent (A6)	44	31,21%
Master's degree or equivalent (A7)	27	19,15%
PhD (A8)	7	4,96%
Sonstiges	5	3,55%
No Answer	0	0,00%
Not shown	0	0,00%

ID

Answer

184 Master
 228 Trenutno student 3. godine Biološkog fakulteta
 247 Крај факултета,никад завршио.задњу годину...
 253 Još nekoliko ispita do završetka osnovnih studija
 262 master inženjer

Summary for C6

Are you professionally or hobbyistically active in any of the following areas: Biology, environmental education , climate protection, agriculture & forestry, beekeeping?

Answer	Number	Percentage
Ja (Y)	95	67,38%
Nein (N)	46	32,62%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C7

What is your postcode?

Answer	141	100,00%
No Answer	0	0,00%
Not shown	0	0,00%

ID	Answer
30	3653
31	1020
34	D 76227
35	5000
37	6850
38	6576
40	3653
41	8706
43	5020
45	11253
47	11070
49	Wohnort: 2232, Mörtelbienenstandort: 9020
50	9475
51	1100
52	1022
53	11200
54	8706
55	21000
56	8517 Narvik, Norway
57	11000
59	8704
60	5607
62	37000
63	9496
65	34220
67	11000
68	18000
69	6424
70	11000
71	11080
72	11120
73	39031 I
74	26300
75	11090
76	11090
78	93055
79	8500
80	6130
81	1020 Wien

82		21470
83		90419
85	20153 (Italy)	
86		1090
87		45144
88		11070
90		8868
91		66386
92	1213 Genève	
93	Nr13ab	
94		1140
95		39011
96		53840
106		11108
98		6923
100		1220
101	Ch 6949	
102	A5020	
103		1120
104		8942
105		11000
108		11000
109		8045
111		11080
112		11306
113		17542
114		11000
115		11000
116		3612
117		11160
118		11080
119		11000
120		19300
121	52212, Hrvatska	
122		32234
123		24217
124		24430
125		76300
126		39024
127		1180
130		11400
131		8037
132		39100
134		1180
135		18000
136		27312
138		6890
139		22
140	21230 Sinj, Hrvatska	
142	/	
148	11 000	
149		11030
162		11000
166		11060
168		17510
171		11000

177	21000
184	11120
190	11000
193	21000
194	11070
197	34308
199	32000
201	11221
202	11250
209	13
215	21480
219	21235
223	1170
228	11193
229	22300
234	8700
243	34000
245	21205
246	18
247	21000
248	22000
251	11000
253	11080
254	1020
255	11060
257	14000
260	24000
261	21000
262	11563
264	8700
265	6850
266	11000
267 CH-8213	
268	9122
269	1090
272	8010
273	3653
274	11000
275	5000
276	6576
277	1265
279	75050
282 39031 Italien	
286	5000
8704. Die Frage wieviel Zeit man draussen verbringt ist komisch, denn es kommt ja auf die Jahreszeit an, im Winter bin ich ja nicht oft im	
287 Garten.....	
289	3131

Results Control and Student Group

Number der Datensätze in dieser Abfrage:	595
Gesamtzahl der Datensätze dieser Umfrage:	595
Anteil in Percentage:	100,00%

Summary for B1zu1(SQ001)[Insect awareness]

Do you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	239	40,17%
No (A2)	356	59,83%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ002)[Science projects]

Do you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	221	37,14%
No (A2)	374	62,86%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ003)[Spending time outdoors]

Do you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	553	92,94%
No (A2)	42	7,06%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ004)[Biodiversity]

Do you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	356	59,83%
No (A2)	239	40,17%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B1zu1(SQ005)[Protecting species and the environment]

Do you spend a lot of time on the following aspects?

Answer	Number	Percentage
Yes (A1)	437	73,45%
No (A2)	158	26,55%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ002)[report data to Citizen Science projects]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	14	2,35%
Less Frequently (A3)	57	9,58%
Rare (A4)	150	25,21%
Never (A5)	374	62,86%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ013)[advocate for environmental protection]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	310	52,10%
Less Frequently (A3)	175	29,41%
Rare (A4)	95	15,97%
Never (A5)	15	2,52%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ003)[avoid plant protection products which are harmful to bees]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	422	70,92%
Less Frequently (A3)	73	12,27%
Rare (A4)	35	5,88%
Never (A5)	65	10,92%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ004)[sow or plant native and insect-friendly plants]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	225	37,82%
Less Frequently (A3)	129	21,68%
Rare (A4)	106	17,82%
Never (A5)	135	22,69%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ005)[set up insect hotels]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	45	7,56%
Less Frequently (A3)	73	12,27%
Rare (A4)	111	18,66%
Never (A5)	366	61,51%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ006)[inform others about invasive species]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	101	16,97%
Less Frequently (A3)	155	26,05%
Rare (A4)	156	26,22%
Never (A5)	183	30,76%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ007)[observe insects]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	219	36,81%
Less Frequently (A3)	180	30,25%
Rare (A4)	140	23,53%
Never (A5)	56	9,41%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ012)[identify wild bees]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	17	2,86%
Less Frequently (A3)	76	12,77%
Rare (A4)	136	22,86%
Never (A5)	366	61,51%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ008)[talk to others about animal and/or plant species]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	270	45,38%
Less Frequently (A3)	177	29,75%
Rare (A4)	130	21,85%
Never (A5)	18	3,03%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ009)[encourage others to sow or plant native or insect-friendly plants]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	127	21,34%
Less Frequently (A3)	135	22,69%
Rare (A4)	159	26,72%
Never (A5)	174	29,24%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ010)[motivate others to participate in a citizen science project]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	30	5,04%
Less Frequently (A3)	85	14,29%
Rare (A4)	147	24,71%
Never (A5)	333	55,97%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B2(SQ011)[talk to friends and family about nature and environmental issues]

Frequency of the following activities: "How often do you..."

Answer	Number	Percentage
Frequently (A2)	357	60,00%
Less Frequently (A3)	152	25,55%
Rare (A4)	67	11,26%
Never (A5)	19	3,19%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ002)[Biodiversity]

How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	105	17,65%
Average (A3)	281	47,23%
Above average (A4)	209	35,13%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ003)[Invasive species]

How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	172	28,91%
Average (A3)	285	47,90%
Above average (A4)	138	23,19%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ004)[Wild bees]

How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	281	47,23%
Average (A3)	270	45,38%
Above average (A4)	44	7,39%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ005)[Conservation of species]

How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	67	11,26%
Average (A3)	346	58,15%
Above average (A4)	182	30,59%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ006)[Bee-friendly garden design]

How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	175	29,41%
Average (A3)	291	48,91%
Above average (A4)	129	21,68%

No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ008)[Triggers and dangers of the biodiversity crisis (species extinction)]
How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	126	21,18%
Average (A3)	248	41,68%
Above average (A4)	221	37,14%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for B4(SQ009)[Sustainability in everyday life]
How would you rate your knowledge compared to the population average?

Answer	Number	Percentage
Below average (A2)	57	9,58%
Average (A3)	318	53,45%
Above average (A4)	220	36,97%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C8
When were you born?

Answer	Number	Percentage
2000 or later (A2)	122	20,50%
1990-1999 (A3)	224	37,65%
1980-1989 (A4)	94	15,80%
1970-1979 (A5)	34	5,71%
1960-1969 (A6)	55	9,24%
1960 or earlier (A7)	66	11,09%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C6
Are you a professional or amateur in one of the following areas: Biology, Environmental Education ,
Climate Protection, Agriculture & Forestry, Beekeeping?

Answer	Number	Percentage
Ja (Y)	331	55,63%
Nein (N)	264	44,37%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C9
Are you currently enrolled at a University programme that includes biology and/or ecology?

Answer	Number	Percentage
Ja (Y)	279	46,89%
Nein (N)	316	53,11%
No Answer	0	0,00%
Not shown	0	0,00%

Summary for C7

What is your postcode?

Answer	595	100,00%
No Answer	0	0,00%
Not shown	0	0,00%

ID

Answer

10	3013
11	6095
12	6094
13	6094
14	6410
15	8700
16	8700
17	9155
18	65197
19	1020
20	871w
21	1170
22	8793
23	3400
24	4050
26	8101
27	1160
28	1120
31	8712
32	1200
33	8712
34	1090
35	1160
36	1170
37	1020
38	94267
41	8700
42	6020
43	1030
44	8793
46	1069
47	1100
49	8700
50	4177
52	8793
53	3254
54	1030
55	1200
56	1040
57	1140
58	87oo
59	1090
60	8101
61	8700
62	8101
63	8700
64	1170
66	1220

67	8650
69	8793
70	3151
71	39057
72	1040
73	3341
74	1210
75	2120
76	8051
77	6020
78	1150
79	1050
80	8605
81	87527
82	1050
83	8642
84	4810
85	6157
86	2423
87	2423
88	5081
89	8200
91	2842
93	1170
94	8793
95	39024
96	8793
97	8700
98	1040
99	8700
101	8792
102	8793
104	9500
105	8793
106	9500
108	8700
109	1090
110	1200
111	1080
112	1160
113	4294
115	1200
116	1170
117	1200
118	1190
119	1180
120	1170
125	8043
126	8700
127	3601
129	8700
130	1160
132	512
133	1180
134	8700
135	1130

136	1170
137	39100
138	3100
139	1180
140	1070
141	9754
142	8793
144	1210
145	8774
146	8700
147	8700
148	8792
149	8712
150	8712
151	1150
153	8720
154	4464
155	4464
156	1040
157	8700
158	8700
160	1170
161	8700
162	8700
163	1190
164	8700
165	8700
167	1160
168	1170
169	8042
170	8792
171	8770
173	1200
174	8045
175	8700
176	8770
177	8792
178	8700
179	9155
180	8114
181	8410
182	2700
184	8160
185	870ü
186	8700
187	8160
188	8774
189	2700
190	8582
191	8793
192	8582
193	1030
194	8793
195	8151
196	8712
197	5121

198	8652	
199		1180
200		8700
201		1140
202	8700	
203		8501
204		1190
205	8793	
206		4030
208		1020
209		1030
210		1050
211		8663
213	8792	
214		8793
215	8712	
217		8605
218		66879
219		9541
220		1170
221		7041
223		3340
224		1100
226		3270
228		9400
229		39028
231		1210
232		1080
233		1120
234		1140
235		1030
237		8700
238		1020
240		1160
241		7152
242		2493
246		1230
247		8102
248		1220
249		8700
250		1160
252		1120
253		1200
254		2460
255		1200
256		7162
257		2571
258		1180
259		16278
260		1020
262		1230
263		1160
264		8504
265		1010
266		8723
267		1220

268		1170
269		1210
270		4050
271		4040
272		4020
273		1020
275		1170
278		3874
279		2203
280		4020
281		4060
284		1200
285		4209
286		50827
287		1150
288		1180
289		1170
291		1210
292		3385
293		2345
295		1190
296		8793
297		4070
298		4020
299		8700
300		1170
301		6020
302		1030
303		1110
304	8045	
307		1050
308		1170
309		1150
310		8700
311		1020
313		1090
314		9342
315		7143
316		1070
319	CH-2562	
320		1180
324		1170
325		8774
326		1120
327		1160
329		1160
330		1020
331		1040
332		3011
333		1190
334		1070
335		6094
336		6176
337		6094
339		6065
340		8712

341	8712
342	6094
343	6121
345	6095
346	6091
347	8101
348 6091	
349	6094
350	3380
352	3441
355	1180
356	8700
357	1120
358	1130
361	9900
362	8041
363	1220
364	2320
365	1190
366	1140
367	1150
368	8591
370	1190
372	1220
377	11000
380	11000
384	11000
385	11000
386	11000
387	11070
389	11070
393	11070
394	11000
395	32240
396	11000
398	11040
399	11070
400	11000
402	11226
403	63200
404	11000
405	11010
406	11000
407	11080
410	11160
414	11273
418	11070
419 11000	
420	20000
422	11000
426	11070
427	24000
429	11000
430	11000
431	11000
432	11000

433	11070
434	11070
435	11080
436	11000
437	11351
438	11000
440	11000
444	11000
447	11000
449	11070
450	11000
453	11070
454	11010
455	11060
456	21413
457	11000
458	11040
459	11000
461	11000
462	11000
463 23274	
465	11080
467	11000
470	11000
474	11000
476	11050
477 21 000	
480	11060
483	11000
484	11211
485	11070
486	36103
487	11111
488	25000
489	11000
493	11070
494	11000
495	11070
496	11000
497	11000
498	11160
499	11000
500	11000
501	11
503	11030
504	11120
505	11000
506	11000
507	11279
508	11000
509	11050
510	11000
511	11060
512	11000
513	11111
514	11212

518	11000
519	11000
521	11080
522	11000 Beograd
524	37
525	21000
529	11260
530	11000
531	11000
532	11070
533	11000
535	11070
536	11070
539	11
541	11000
543	11000
545	11080
546	11000
547	11000
548	9000
549	11060
550	11050
551	11000
554	11030
555	11000
556	17501
557	11000
563	26300
566	26300
568	26300
569	26300
570	26300
571	26360
572	26300
573	26340
575	26334
576	26340
577	11000
578	11000
579	12000
581	37000
582	11000
586	11000
587	11070
588	11000
592	11500
591	11080
593	11070
594	22330
595	11070
596	11000
597	15307
598	37220
600	16101
601	11080
602	11070

603	11000
608	11273
609	37000
611	11427
612	11000
615	11000
617	11010
619	11000
622	11060
623	11000
625	11070
626	31300
627	12374
628	18000
634	1100,
635	11000
636	11000
637	11000
640	11030
642	11000
644	11000
645	32205
646	26000
647	11000
648	11000
649	11080
651	14210
653	11070
655	11000
656	11030
657	26000
658	18400
660	11000
661	18000
663	11400
665	11050
666	11271
667	18000
668	11050
672	22320
673	11000
674	11000
676	17510
678	11010
680	11070
681	11010
683	11050
685	36000
686	11000
687	11090
689	11000
690	11300
691	11070
694	11136
696	15000
697	38213

698		18000
699	Ilije djurica 39	
700		11000
702		11000
703		11090
704		11010
705		11000
706		11000
708		32104
709		11550
712		32300
713		11309
714		11060
715		18000
716		11080
718		11000
721		32000
722		23300
723		11550
724		35250
728		11030
729		11000
733	11090	
737		11000
738		11300
740		26370
741		11000
742		11000
744		11000
747		11000
748		11000
749		11070
750		11210
751		11000
755		11070
756		15305
757		11000
758		32000
760		18207
761		81000
762		11185
763		21220
766		11000
767		6511
769		11000
772		11211
775		34300
776		11000
777		85320
778		32252
779		22000
780		85320
781		85310
784		32250
785		32250
787		32250

789	101801
790	11030
792	11309
794	22320
796	34209 Kragujevac
797	15000
798	34228
800	11080
801	11070
802	11000
803	11211
804	38239
805	23000
807	11000
808	11080
809	12
811	11507
812	11000
813	79101
815	11550
817	11000
818	14000
819	11120
820	11126
821	88280
823	26000
824	34000
828	11000
829	11080
830	21000
831	11070
833	22404
835	18224
836	11221
840	18000
842	1190
843	11000
845	11 000
846	11307
848	11000
849	34300
852	11 000
853	11000

Summary for C5

What is your highest educational qualification?

Answer	Number	Percentage
No degree (A2)	1	0,17%
Secondary school or equivalent (A3)	8	1,34%
Apprenticeship / vocational training or equivalent (A4)	52	8,74%
Abitur high school or equivalent (A5)	182	30,59%
Bachelor or equivalent (A6)	228	38,32%
Master's degree or equivalent (A7)	95	15,97%
PhD (A8)	12	2,02%

Sonstiges	17	2,86%
No Answer	0	0,00%
Not shown	0	0,00%

ID

Answer

63 Handelschule
 81 3-facher Vater :-)
 184 Handelsschule
 387 Nisam baš magistar ali jesam master. :(
 434 Master
 493 Master
 548 master
 591 Gimnazija
 674 Master
 702 Gimnazija
 794 gimnazija
 Srednje obrazovanje u trajanju od 4 godine-
 801 gimnazija
 803 Gimnazija
 817 Gimnazija
 840 Srednje obrazovanje -Gimnazija