UNIVERSITY OF HELSINKI
FACULTY OF AGRICULTURE AND FORESTRY

Citizen science in biodiversity monitoring and evaluation – The role of nature and recreation associations in Finland

Kaisa Kettunen

Master's Thesis

University of Helsinki
Master's Program of Forest Sciences
Forest Ecology and Management

October 2021

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Tiedekunta/Osasto Fakultet/Sektion – Faculty Faculty of Forestry and Agriculture	Laitos/Institution– Department. Forestry Department, Magister Programme of Forestry	
Tekijä/Författare – Author Kaisa Kettunen		
Työn nimi / Arbetets titel – Title Citizen science in biodiversity monitoring and evaluation – The role of nature and recreation associations in Finland		
Oppiaine /Läroämne – Subject Forest Ecology and Management		
Työn laji/Arbetets art – Level Master's Thesis	Aika/Datum – Month and year October 2021	Sivumäärä/ Sidoantal – Number of pages. 57

Tiivistelmä/Referat – Abstract

This Master's thesis compares different nature and recreation associations in terms of their activity to organize species observation activities and collect species data. The aim is to fill gaps in knowledge concerning on which volunteer groups are actively producing data, and if some of them could be included stronger in biodiversity monitoring and evaluation work. Further, the thesis evaluates how important the Finnish Biodiversity Information Facility (FinBIF) is for different nature and recreation associations as a data sharing channel. The main study material was collected by a qualitative questionnaire that was sent to variety of different nature and recreation associations. As a result, species enthusiast associations, hunting associations and nature conservation associations were shown to be the most active in organizing species observation, that is in accordance with earlier studies such as Santaoja (2013). From other studied groups the Scouts surprisingly showed relatively high interest toward species observation, but they were not active in data sharing. Evaluating associations willingness to use the FinBIF's services and devises for observation data sharing, revealed, that the FinBIF's channel was not popular among the studied associations, keeping in mind that the study did not examine FinBIF's popularity among individual volunteers. In the light of the results, the FinBIF services and the concept of citizen science should be more actively promoted toward nature and recreation associations, especially to the Scouts who would be potential group to co-operate with in biodiversity monitoring and evaluation work.

Avainsanat – Nyckelord – Keywords
Master's thesis, biodiversity, citizen science, open knowledge, The Finnish Biodiversity Information Facility, third sector's associations

Säilytyspaikka – Förvaringställe – Where deposited
Helsinki University Library – Helda / E-thesis (opinnäytteet) ethesis.helsinki.fi

Muita tietoja – Övriga uppgifter – Additional information

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Tiedekunta/Osasto Fakultet/Sektion – Faculty Maatalous-metsätieteellinen tiedekunta	Laitos/Institution– Department. Metsätieteiden laitos, Metsätieteiden maisteri

Tekijä/Författare – Author
Kaisa Kettunen

Työn nimi / Arbetets titel – Title
Citizen science in biodiversity monitoring and evaluation – The role of nature and recreation associations in Finland

Suomeksi: Kansalaistiede luonnon monimuotoisuuden seurannassa ja arvioinnissa – Luontoharrasteyhdistysten rooli Suomessa

Oppiaine /Läroämne – Subject
Metsien ekologia ja käyttö

Työn laji/Arbetets art – Level	Aika/Datum – Month and year	Sivumäärä/ Sidoantal – Number of pages.
Maisterintutkielma	Lokakuu 2021	57

Tiivistelmä/Referat – Abstract

Tässä maisterintutkielmassa tarkastellaan luontoharrasteyhdistysten aktiivisuutta järjestää eliölajien havainnointiin liittyvää toimintaa ja tuottaa luonnon monimuotoisuuden seurannassa ja arvioinnissa tarvittavaa lajitietoa. Tutkielmassa verrataan erityyppisten harrasteyhdistysten toimintatapoja ja kartoitetaan niiden potentiaalia lajitiedon tuottajina. Lisäksi tutkielmassa selvitetään, missä määrin tutkielmassa tarkastellut yhdistykset jakavat lajihavaintotietoa Suomen Lajikeskuksen lajiportaalin kautta. Tutkimusaineisto on pääosin kerätty luontoharrasteyhdistyksille suunnatulla laadullisella kyselyllä. Eliölajiharrastajat, metsästäjät ja luonnonsuojelijat osoittautuivat aktiivisimmiksi ryhmiksi lajihavainnoinnoin järjestämisessä, mikä käy ilmi myös aiemmista tutkimuksista, kuten Santaoja (2013). Muista tarkastelluista yhdistyksistä partiolaiset osoittivat yllättävän korkeaa kiinnostusta lajihavainnointia kohtaan, mutta he eivät jakaneet lajitietoa aktiivisesti. Suomen Lajitietokeskuksen ylläpitämän lajiportaalin käyttö lajitiedon jakamiseen ei ollut suosittua tutkittujen yhdistysten keskuudessa, mutta on muistettava, että tutkielmassa keskityttiin yhdistysten koordinoimaan toimintaan, ei yksittäisten jäsenten toimintaan. Tutkielman tulosten perusteella kansalaistieteen käsitettä tulisi edelleen tehdä tunnetuksi ja Suomen Lajitietokeskuksen palveluita markkinoida luontoharrasteyhdistyksille, etenkin partiolaisille.

Avainsanat – Nyckelord – Keywords
Master's thesis, biodiversity, citizen science, open knowledge, The Finnish Biodiversity Information Facility, third sector's associations

Säilytyspaikka – Förvaringställe – Where deposited
Helsingin yliopiston kirjasto – Helda / E-thesis (opinnäytteet) ethesis.helsinki.fi

Muita tietoja – Övriga uppgifter – Additional information

CONTENTS

VOCABULARY

Association	An association is an organization set up for the joint implementation of a particular ideological purpose. The association may consist of natural or legal persons or a combination of both.
Biodiversity	Variation between and within the species and their environments
FinBIF	Finnish Biodiversity Information Facility
NBSAP	National Biodiversity Strategy and Action Plan

PREFACE

This thesis study was done in collaboration with the Helsinki Institute of Sustainability Science (HELSUS) and the Ministry of Environment as a part of a HELSUS Co-Creation Lab. The lab aimed to enhance co-operation between the University of Helsinki and external organizations (Helsinki Institute of Sustainability Science, 2021). Each partner brought a lab challenge for students which was used as a basis for the work. The Ministry of Environment's lab challenge was connected to renewal of National Biodiversity Strategy and Action Plan (NBSAP) and urge to implement environmental transition throughout the society. The challenge carried a name Adaptive Biodiversity Conservation in Socio-ecological Systems -Monitoring and Evaluation. Five students worked on the challenge aiming to support the preparatory work of the NBSAP renewal. Four key themes were set to guide working: (1) Adaptive conservation; (2) Transformative Governance; (3) Conflict Reconciliation/resolution; and (4) Monitoring and Evaluation. This thesis study follows the theme biodiversity monitoring and evaluation.

ACKNOWLEDGEMENTS

I want to thank the HELSUS Co-Creation Lab team for facilitating the work, and the Ministry of the Environment for bringing an interesting and important perspective to our master's theses. Further, I want to thank our MoE team for having inspiring discussions on the lab challenge that helped viewing the topic from different perspectives thus forming a holistic picture of the subject. Especially, I want to thank my supervisor Nicholas Hogarth who instructed and supported me throughout the thesis.

1 ABSTRACT

The Finnish National Biodiversity Strategy and Action Plan (NBSAP) is currently being updated to align with the international biodiversity targets for 2030 (Ministry of the environment, 2017). Formulating an effective NBSAP requires understanding about the underlying drivers of biodiversity loss. One key area to focus on is effective biodiversity monitoring and evaluation, which is based on accessible and up to date knowledge about species and their habitats. Observing species in the field is expensive, and therefore volunteers can play a key role in data production (Ministry of the Environment, 2007). Nature enthusiast and outdoor recreation associations organize hobby activities and bring together hobbyists, which makes them of interest from the perspective of species data production. In Finland, associations are key actors within the third sector as there are 107 000 registered associations, and the average Finn belongs to three associations (Finnish Patent and Registration Office, 2021).

In this study, the concept of citizen science and open knowledge are applied as a theoretical framework through which volunteers' contribution to species data production is assessed. The study evaluates the role of Finnish nature and recreation associations in species data production by assessing their activities related to species observation events and sharing of observation data. Data sharing activity is examined on the basis of the visibility of the Finnish Biodiversity Information Facility (FinBIF) among the associations. The study addresses the following research questions: (1) How do nature and recreation associations contribute to biodiversity data production in Finland? and (2) To what extent do associations use the software that transfers observation data to the FinBIF?

Study data were collected in the summer of 2021 using a qualitative questionnaire that targeted six types of hobby associations: nature conservation (n = 33), species enthusiasts (n = 32), hunting (n = 35), fishing (n = 34), Scouts (n = 41), and outdoor sports and recreation (n = 52). The questionnaire was sent to 100 associations within each group (600 in total) and the response rate was 38%. The data were analyzed using the SPSS statistics software. Additional information about the role of the FinBIF was gathered by a key informant interview.

A total of 56% of all respondents had organized species observation activities. Hunting, species enthusiasts and nature conservation associations showed the most interest, with nearly all the respondents within these groups having organized some kind of observation activity. Although active in data collection, they rarely used FinBIF's open-source software for data sharing. From all associations that had organized species observation, only 12.5% had used software that

transfers data to the FinBIF (Laji.fi, Notebook, iNaturalist). Of the 52 hobby associations focusing on outdoor sports and recreation, 13% had organized species observation activities, but their observing events had large variation in terms of type and 'seriousness' of activity. Of the 41 Scout associations that responded to the questionnaire, 43% had organized observation activities but none of the respondents had used any software to record their observations. Associations in general were rarely aware that they could share their observation data to open data repositories such as the FinBIF. The findings indicate that the concept of citizen science is unfamiliar to many Finnish associations, which indicates lost potential in terms of biodiversity-related data collectors.

The Scouts are a well-structured organization that aims to increase its members knowledge on nature. With that in mind, the Scouts could be considered as a key potential collector of species information to whom the FinBIF services could be promoted. The potential of the Scouts as data collectors should be considered in the NBSAP renovation work. Opportunities for stronger cooperation between environmental administration and research sector, and the Scouts could be evaluated in terms of national biodiversity monitoring. As found in the key informant interview, the FinBIF is intended for use by amateurs and citizens while the responsibility to ensure the data quality stays with a data user. Therefore, the FinBIF could be more strongly promoted to different associations with the aim to reach a wider audience, increase the user base, and thereby the amount of biodiversity data made available to inform future Finnish biodiversity strategies and planning.

2 INTRODUCTION

2.1 Biodiversity loss

The ever-growing consumption of natural resources has made biodiversity loss one of the major environmental threats of our time (IPBES, 2019). The scale of the problem is like climate change, with actions urgently needed to halt it. The IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019) summarizes that up to 1 million species from a total of 8 million species living on Earth are threatened with extinction, many within decades. Deterioration of ecosystems will ultimately threaten humankind and the existence of modern society because of the close ties between biodiversity and economies, livelihoods, food security, health, and quality of life.

According to an extensive assessment by the Finnish Environment Institute (SYKE) and the Natural Resources Center (Luke), Finland's biodiversity has continued to decline over the past ten years (Auvinen et al. 2019). The fifth assessment of endangered species in Finland (Hyvärinen et al. 2019) found that 11.9% of the species evaluated were endangered. Forestry, agriculture, construction, pollution, and climate change were identified as the biggest pressures on Finland's biodiversity.

2.2 Finland’s National Biodiversity Strategy and Action Plan (NBSAP)

Biodiversity loss is a so-called wicked problem, which must be viewed through a collaborative multidisciplinary approach as a single solution does not exist (Sharman, 2012). Increasing awareness concerning biodiversity loss has spawned several recent global agreements that demand international cooperation and commitment to stop biodiversity loss. The Convention on Biological Diversity (CBD), a part of UN’s Environment Programme (UNEP), created the concept of National Biodiversity Strategy and Action Plans (NBSAP) to facilitate the implementation of international agreements at the national level (UN CBD, 2020). Finland has formulated a NBSAP through which it is committed to international Aichi biodiversity targets and the strategic goals of the UN Convention on Biological Diversity (The Ministry of Environment, 2007). The strategy was drafted for the years 2012 – 2020 and it had five goals and 20 targets that were in line with the Aichi and CBD targets. Contrary to their aspirations, targets were not met, and biodiversity continues to decline (Auvinen et al., 2020). The goal to halt biodiversity loss is now reset to the year 2030, while formulation of a new NBSAP has started in the Ministry of Environment. In the NBSAP renovation work, more emphasis is put on the underlying causes of biodiversity loss. One key target is to implement an environmental

transition throughout the society, meaning that environmental aspect and biodiversity must be considered in decision-making (Auvinen et al., 2020).

Up-to-date and comprehensive biodiversity information is essential for the achievement of NBSAP objectives. This requires continuous monitoring of species populations and their habitats. Scarcity of resources and knowledge gaps hampers biodiversity monitoring and evaluation. An evaluation report on the impact of the Finnish NBSAP 2012–2020 (Auvinen et al., 2020) proposed a list of actions to overcome the limitations and support effective monitoring work. Besides the recommendation for an increase in resources, the report emphasizes the continuity of long-term monitoring and use of the most advanced technology. Furthermore, the report encourages the active involvement of citizens to collect nature information through new observation systems and applications.

The previous Finnish NBSAP emphasized the importance of biodiversity data availability, and extensive financial resources were allocated to the development of information systems that enable data sharing. The Finnish Biodiversity Information Facility (FinBIF, *Suomen Lajitietokeskus*) was set up by the decision of the Ministry of Environment to collect, digitize and enable the sharing of species information scattered in different organizations. The establishment of the FinBIF was marked as an urgent measure in the previous NBSAP, and nine million Euros funding were allocated during the period 2013 – 2020. The evaluation report encourages the new Finnish NBSAP to continue the development work of the FinBIF.

Civic volunteering has a great importance in safeguarding biodiversity. As funding for science is limited, additional people in species observation allow considerably more data to be collected, both in terms of range and quantity (Chandler et al., 2017). In Finland, individual volunteers and NGOs actively participate in monitoring of species populations and habitats (Ministry of the Environment, 2016). The NBSAP impact evaluation report recognizes the third sector's importance also as an environmental educator. Different organizations organize events and courses that promote an active relationship with nature, such as hiking courses, game and forestry courses, and bird and plant courses. The report recommended integrating NGOs more closely in NBSAP implementation.

3 RESEARCH OBJECTIVES, QUESTIONS AND THE HYPOTHESIS

3.1 Research objectives

Effective biodiversity monitoring and evaluation supports the success of the updated NBSAP. Observing species in the field is labor demanding and requires resources that are often subject to competition. Due to modern technology however, information sharing is faster and easier than before, and given that smartphones and other electric devices are within everyone's reach, opportunities for civic contributions of biodiversity observations have increased. This study contributes to biodiversity monitoring and evaluation by exploring the potential of civic observation and highlighting gaps in volunteer data collection and sharing. The study will examine how actively different nature and recreation associations perform volunteer observation activities, and how they share observation data. In terms of species information sharing, the research topic was narrowed down by focusing on the visibility of the Finnish Biodiversity Information Facility (FinBIF) and the use of its services among different hobby associations. This is because the FinBIF is specifically built to enable information sharing between actors and sectors, considering the opportunities of citizen science and open knowledge (Schulman et al., 2021). The aim is to find out if there are potential hobby associations whose role in volunteer-based biodiversity monitoring and evaluation could be enhanced. Further, the study stresses FinBIF's role as a channel between citizen observers and information users, with the aim to pinpoint where FinBIF promotion should target.

3.2 Research questions

Based on the study objectives the research questions were formulated as follows:

1. How do nature and recreation associations contribute to biodiversity data production in Finland?
2. To what extent do associations use the software that transfers observation data to the FinBIF?

3.3 Research hypothesis

Volunteers have a great role in species observation and the earlier literature reveals the specific importance of hunters and species enthusiasts as data producers (Santaoja, 2013; Ministry of the Environment, 2017). The hypothesis is that associations that focus on nature and species are more active in species observation than associations that focuses on recreation and sports.

The associations that focus on nature and species are also expected to use the FinBIF services more often than the latter. Moreover, variation between different types of associations in relation to their understanding about species observation is expected.

4 THEORETICAL FRAMEWORK

This study is framed with the approaches of citizen science and open knowledge. The approach of citizen science conceptualizes species observation that is based on the voluntary work of nature and recreation hobbyists. The approach of open knowledge is used to inform how to analyze the interaction between the environmental administration and nature hobbyists in terms of information sharing. The concept of open data was chosen as a theoretical framework because the FinBIF is committed to its principles.

4.1 Citizen science

Citizen science can be understood as the participation of people from outside research organizations in a scientific research process that creates new scientific knowledge (Bonney et al. 2014). Cavalier and Kennedy (2016) wrote about citizen science's important influence on the society. They argued that the data collected by citizen scientists has impacted government policy, created new norms and abilities. Accordig to their article, strategic purposes of environmental citizen science projects include for instance empowering communities to take an active role in producing information and establishing ongoing monitoring. Projects also tends to extend research into areas that used to be beyond the capabilities of a government agency. Furthermore, by participating projects citizens get educated about environmental issues (Cavalier & Kennedy, 2016). Gardinel et al. (2012) studied ecological citizen science programs and compared them to professional research programmes. The results show that the use of data collected by citizen scientists were more cost effective than professionally collected data. Gardinel classifies citizen science as being either direct citizen science, where data are studied without verification; and verified citizen science, where only data verified by trained experts are analyzed. Direct or verified citizen science can result in 3–4 times more samples than professional research for the same cost. The lower costs represent a clear advantage for the use of citizen science as a research approach, however the data quality must be verified.

Most critique toward citizen science concerns data accuracy and possible biases (Kosmala et al., 2016). Accuracy of citizen science data has been found to be lower than data produced by professional researchers. In their study, Gardinel et al. (2012) found that data collated through direct citizen science overestimated species richness and diversity values in comparison to verified data. Misidentification of species is a particular concern in ecological research conducted by volunteers. Kosmala et al. (2016) stated that most types of biases that can be found in citizen science datasets can be also found in professionally produced datasets, but that

these can be mitigated with statistical tools. Appropriate verification is therefore needed to make citizen science a cost-effective method for gathering ecological information. Kosmala et al. (2016) introduces several techniques to improve citizen science data quality, whereby volunteers can be trained to collect data and their skills can be tested. Measurement techniques and equipment should be standardized and calibrated. Task and tool design should be developed iteratively to ensure project success. Experts should be used to validate data quality and there should be a mechanism to account random error and systematic bias.

4.2 Open knowledge

Open knowledge can be understood as data that is available and accessible easily and with low-cost. Further the concept legitimizes data reuse and redistribution (Open Knowledge Foundation, 2021). However, the information available must not harm its collectors, users or to the subject of information. information should not threaten security, endangered species, or the privacy of individuals. Technological development enables more efficient processing and merging of large data sets thus increasing data availability, but price, limited user rights and inconsistent data form limits its use (Open Knowledge Foundation, 2021). Egloff et al. (2014) argued that copyright and data protection legislation impede management of biodiversity knowledge in EU. Openly available data enhances transparency of science and policymaking. The increased use of open data in administration has enhanced and improved decision-making (Tuomisto et al., 2017).

5 LITERATURE REVIEW

5.1 Biodiversity information from an environmental administration perspective

The Ministry of the Environment considers biodiversity information as location and characteristic- specific information about species, and their habitats and statistical information. Nature related information in general is a concept that is challenging to define precisely and unambiguously (Ministry of the Environment, 2021). Significant gaps in the coverage of biodiversity information include, among others, most habitat types and the occurrence and characterization of some endangered species. By 'quality of information', the Ministry of the Environment refers to the temporal and geographical coverage of information, the timeliness of information, and the reliability of information in terms of decision-making. Identified through its activities, The Ministry of the Environment designates the FinBIF as one of the key information systems related to the production, processing, and management of biodiversity information. The ministry suggests that information generated in all kinds of tasks and projects should primarily to be stored openly, to ensure the availability of biodiversity information.

According to Hilden (2008) The biodiversity information that is used to support decision-making should be easy to use, easily accessible and its accuracy should be reliably verifiable. The information should also be up-to-date and available in a compatible format. Although there is a lot of information per se, it is often scattered, difficult to find and sometimes difficult to access (*ibid*). The transparency of data production contributes to the assessment of data reliability (*ibid*). Improving access to information, in turn, increases administrative transparency and supports the societal debate on the use of natural resources (*ibid*). Recognition of the data collector is important. A name of the original data compiler should appear in connection with the collected data, especially if it has been collected voluntarily (*ibid*).

Tuomisto et al. (2017) argued that the demand for science-based information in decision-making in general is influenced by the nature of the decision-making situation, the position of the person making the decision, and their competence and interests. He continued that the nature of policy and decision-making hinder the use of scientific data as political decisions require rapid responses to the management of large-scale entities. Scientific research, on the other hand, is slow in nature and questions are examined in depth but often narrowly. In practice, experts, officials, and decision-makers often work separately, and the flow of information is often slow between different groups (Tuomisto et al. 2017). Partly due to the challenge and limitations of utilizing research data, many other types of information are utilized in decision-making. In general, knowledge and expertise can be found in most cases for decision-making, but because there are not always clear structures for the transmission of information, it is not transmitted to

decision-making, and on the other hand, the information needs of decision-making are not identified (*ibid*). Many of the challenges related to the demand and supply of information could be addressed by improving the transfer of research information and information needs between users and producers of information (*ibid*).

In their report that evaluated methods to bind knowledge to decision-making, Tuomisto et al. (2017) recommended a common platform for researchers, officials, and decision-makers, in which the latest research data is closely compiled, and in return the information needs for decision-making are communicated to researchers. The report also suggested that the platform should allow for the co-creation of information as well as broad participation, and therefore the digital platform was seen as the best alternative. Further, the platform should allow the access to the data origin. Wyborn et al. (2018) defines knowledge co-production as approaches that involve collaborations between scientists and other stakeholders with the aim to produce knowledge. They highlighted that institutional change is needed in science-policy interface to enable effective knowledge co-production. Connection between knowledge and action can be built once the processes, capacities, and barriers of knowledge production and flow are understood and considered (Wyborn, 2018).

5.2 The Finnish Biodiversity Information Facility (FinBIF)

5.2.1 *Structure and objectives*

The Finnish Biodiversity Information Facility, shorter FinBIF, is a virtual information system and open access data repository which aims to serve as a single source of biodiversity data that can be utilized by decision-makers, researchers, NGOs, and civil-society (FinBIF, 2021). The service bundles up species observations from different data sources like research organizations, natural history museums, government agencies and civil science. The FinBIF information sharing follows the FAIR principles of open knowledge (FAIR stands for Findable, Accessible, Interoperable and Re-usable).

Managed by the Finnish Museum of Natural History (LUOMUS) the FinBIF implements the Ministry of Finance's open data program that aims to make public information resources available as widely as possible to citizens, businesses, communities, education, research, and public authorities (Ministry of Finance, 2013). The FinBIF is a partner of the Global Biodiversity Information Facility (GBIF), which aims to enhance the availability of biodiversity data internationally (FinBIF, 2021).

According to the FinBIF (2021), it shares data through a web-portal (*Laji.fi*) that is a digital, networked service. Users can find information about species and taxonomy and browse species observations. Registered users can upload their own observations through iNaturalist-application or FinBIF's observation service Notebook. Data is copied to the data warehouse in its original form and further processed into lists, statistics, maps, and charts that are mostly then made publicly available.

Sensitive information considering, for example, a specific location of endangered species is available only by request, and the subscriber must justify the need and use of the sensitive information (FinBIF, 2021). This is to protect vulnerable species but also for bio-safety reasons, as in the case of harmful plant diseases. Sometimes the data is marked as sensitive for reasons related to the ownership and management of the material. Professionals and amateurs have different rights to download, upload, and comment on the data. FinBIF has a separate portal for official authorities through which selected institutions can access sensitive data.

iNaturalist Finland is a network and service for nature enthusiasts who produce primary data on biodiversity. It is a part of international iNaturalist -network managed by the California Academy of Sciences and the National Geographic Society (iNaturalist, 2021). The public can use iNaturalist as a channel to make their species observations publicly available in a transparent way. Registered users record their nature observations in a picture or voice format to the iNaturalist database through a mobile app. In Finland about 14,000 registered users have uploaded 264,000 observations of 7,600 species. Co-users can then comment on the recorded observations with the aim to help in species identification. Observations uploaded into iNaturalistFI software are transferred to FinBIF's portal (FinBIF, 2021).

The Notebook nature observation diary (*Oma Vihko*) is an observation record system developed by the FinBIF where registered users can upload their species observations (FinBIF, 2021). The system covers several different observation record forms made for different situations. Official monitoring and research projects can collect observations using the Notebook system through their own instructions and forms. The observations uploaded in the Notebook are published on FinBIF's portal, which is open for everyone to use with some exceptions. The Notebook and iNaturalistFi are both meant for recording personal observations. Organizations can upload larger data sets from secondary sources through FinBIF's data bank service (*Aineistopankki*). Single observations are possible to record by using a separate form, which is offered in FinBIFs website.

5.2.2 *Data quality control*

The FinBIF controls the data quality by publishing the data author's name and providing opportunity for peer-users to comment on the data quality in connection with the observation (the process is called annotation) (FinBIF, 2021). Comments are shown to users who have the responsibility to decide which data is appropriate for his or her intended use. Each observation gets labelled according to its reliability. Before ending up in the data warehouse, each observation goes through an automatic control for errors.

The Key Informant Interview (KII) that was conducted with the FinBIF representative aimed to better understand the logic of data quality management. The rest of this section (5.3.2) is entirely based on the KII (the interview questions are provided in Appendix 2). In summary, the data quality can be managed in two different ways, as illustrated in Figure 1. Low quality data is prevented from ending up in the database by using an administrator-controlled filter, which is called pre-filtering. Another way to manage data quality is to use 'user-controlled filter', which is called post-filtering. When data comes from multiple sources, it becomes difficult to control the material. It is easier to take in all the data and give the data user the means to filter the data to a suitable quality. The uses are very different, and the user decides which material to use. For example, the quality of the information concerning alien species locations in the municipality areal plan is less important than the quality of information concerning endangered species locations in a new road zoning.

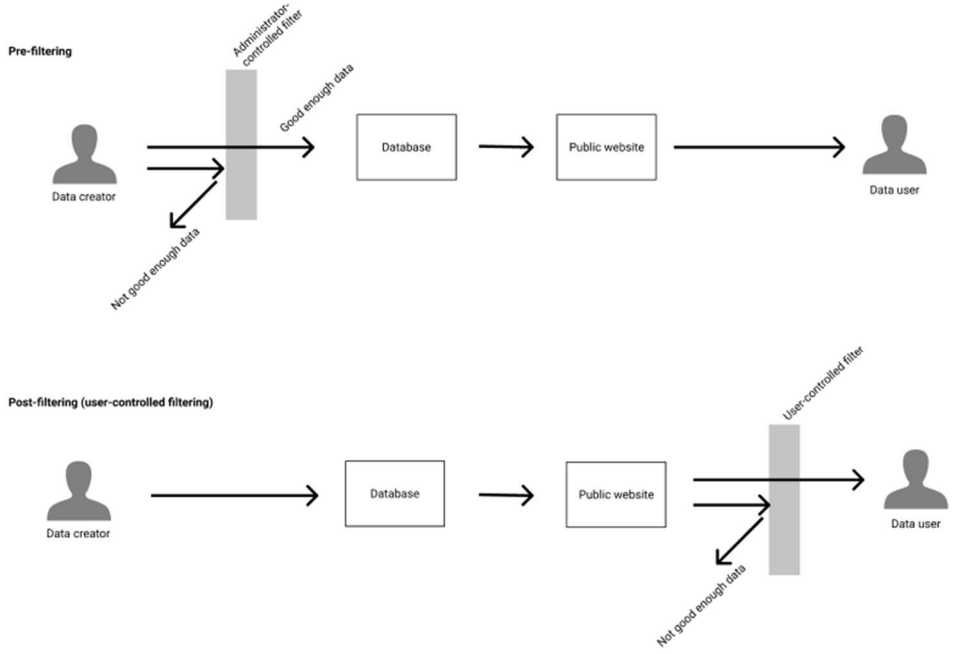

Figure 1. Data quality control presented by two alternative ways. (Picture: Mikko Heikkinen, FinBIF)

FinBIF relies on the post-filtering technique in its data quality management. The FinBIF uses an annotation system to support the data quality controlling, which helps to reveal errors as well as specific observations. As all data is allowed to initially enter the database, annotation ensures that suspicious information is corrected or deleted quickly. The KII revealed that data quality could be classified roughly into three classes by the author groups: citizen observations, advanced species enthusiasts, and professionals. Approximately 25% of citizen observations contained error whereas advanced species enthusiasts' observations had only 5% errors, and professional observations had 1%. This was, however, a rough estimate and was not based on accurate statistics. In addition, all data contains errors at some level. There can be many types of errors: the wrong place, the wrong time, or the wrong type. Traditionally, observations are compiled into a single dataset, and the detection of errors remains the responsibility of the data depositor. If data is sent to the FinBIF and opened to a new user, the errors it might contain will be visible and can thus be corrected. FinBIF supports data quality also by instructing the users, providing identification manuals, and providing and developing quality control tools.

5.3 Nature hobbyists in Finland

A report on the recreational use of nature (Sievänen, 2011) specifies recreational use as a movement, and recreation in the natural environment for recreational purposes. The recreational use of nature includes all outdoor activities that take place in nature, as well as hunting and recreational fishing. According to the report, 96% of the total adult population in Finland engages in some form of outdoor activities during the year. Of the traditional forest outdoor activities, berry picking, mushroom picking, and hunting are the most popular. 300 000 Finns redeem a hunting license annually (LUKE, 2021). Moreover, two out of three Finns are reported to enjoy nature observation and other nature-related hobbies. Fishing and boating are common activities in water environments, with 1.6 million Finns participating in recreational fishing (LUKE, 2021). The Finnish Scout Association has 65 000 members within 750 troops across the country (Finlands Scouter, 2021). Nature hobbies primarily involve voluntary recreation and nature observation, but they also serve some information interests of the environmental administration and nature conservation (Santaoja, 2013).

5.4 Volunteer species observation

5.4.1 *Role of hunters, species enthusiasts and nature conservationists*

Santaoja (2013) studied Finnish amateur naturalism and its societal connections by analyzing enthusiasts from insect, plant, fungal and ornithological associations. The study found that most of the data used in nature conservation work in Finland is collected by volunteers. Although the role of enthusiasts as nature experts is recognized and they have close cooperation with professionals their interests do not always coincide with the environmental administration (*ibid*). Participation in official species monitoring activities motivate some enthusiasts, but the emphasis on scientific species knowledge excludes some enthusiasts and different ways of practicing and knowing (*ibid*). Furthermore, there is a controversy among the nature enthusiasts about whose observations and practices are "the right kind". Eventually, it is impossible to achieve fully comprehensive biodiversity information due to the different observability of the species and their enormous number. Even if not fully understood, the main factors causing biodiversity loss are well known and there is no need to wait for complete knowledge before making active biodiversity policy (Santaoja, 2013).

The number of nature enthusiasts in Finland is numbered in the tens of thousands (Santaoja, 2013). The group is heterogeneous in terms of hobby activities, motivations, and objectives. The trend is that nature enthusiasts are getting older, while younger generations are not as keen to collect observation data (*ibid*). It takes years to become an expert in species identification, which makes some dedicated nature enthusiasts more experienced than an average professional (*ibid*). Therefore, determining differences between data collected by professionals and amateur naturalists can be challenging.

Pellikka et al. (2007) studied hunters' motivations for voluntary wildlife monitoring. They found that hunters have an active role in the monitoring of populations and wildlife richness in Finland, with one specific observation activity conducted by hunters- the Wildlife Triangle Scheme – particularly important, providing annual abundance estimates for about 30 species. The study shows that especially large hunting teams are active in voluntary game monitoring, but also small groups of motivated individuals can successfully participate in the Wildlife Triangle Scheme. According Pellikka (2009) hunters are a functionally diverse group that have statistically significantly more nature hobbies than non-hunters. Pellikka summarizes that hunter's nature relationship is determined by a certain kind of reciprocity where care and use of nature seem to justify each other's necessity and enable each other. According to the action program for the protection of endangered species (Ministry of the Environment, 2017), 15,000

hunters per year voluntarily participate in game population monitoring, while the control of alien species (by hunting small predators) is almost solely left on their shoulders. The value hunters generate for game stock research is calculated to be 90 person-years annually, and the Wildlife Triangle Scheme counting's for forest fowls alone comprises 12,000 kilometers of line that is walked during the animal calculations (Ministry of the Environment, 2017).

Demand for nature information exceeds its supply. In biodiversity monitoring, at least 70% of fieldwork is done on a voluntary basis (Ministry of the Environment, 2001). Without volunteers the cost of monitoring would be several times higher for the environmental administration. Traditionally many nature enthusiasts have permitted the use of their observation data to serve the common good and nature conservation as long as their name is referenced in the publication in return. The rising use of commercial enterprises as authors of nature surveys influences the willingness of enthusiasts to hand over their material. While some enthusiasts deny the use of their data for commercial purposes, others have begun to expect financial compensation for the observational data (Santaoja, 2013).

5.4.2 *Role of other nature recreational groups*

The Finnish Scouts have cooperation with the WWF to raise awareness of biodiversity loss and activate scouts to do small things for the environment (Finnish Scouts, 2018). Cooperation focuses on nature education and joint communication. The cooperation is part of the international Scouts for SDG's movement that aims to achieve the sustainable development goals by contribution of 57 million Scouts worldwide (Scouts, 2021). Projects that Scout organize within the SDG movement are closely related to SDG goals, including biodiversity. For instance, the Scouts of England and Wales has organized in cooperation with WWF an activity called 'Seek out nature' that encourages Scouts to observe biodiversity and record their observations to an observation sheet created by WWF (Scouts of England and Wales, 2021). The Scouts are introduced to the task in terms of equipment required in the observation, how to find of suitable place for observing, which are the common local species, rules during the activity, introduction to the concept of biodiversity and step-by-step introduction to actual observation situation and recording. However, similar activity organized by the Finnish Scouter does not seem to exist.

The Natural Resources Institute Finland (LUKE) encourages fishers to record their fish observations, with a picture of the fish attached to enable identification, through LUKE's open-

data portal (LUKE, 2021). Further, LUKE has started to build an easy-to-use electronic 'My Fish' *(Oma kala)* data sharing service for recreational fishermen, which will be used to collect information on fish catches centrally (Luke, 2021). The goal is to make the 'My Fish' service used by all recreational fishermen by the year 2022. As the number of recreational fishers in Finland is big, the amount of fish observations can be expected to increase if all fishers adapted the LUKE's service.

Outdoor sports enthusiasts' role in species data production generated very little information from search engines (Scopus and Google Scholar). This might be a subject that has not been studied yet, or outdoor sports enthusiasts are simply referred as volunteers in the studies. Lack of studies on outdoor sports enthusiasts' role in species monitoring partly led to the study hypothesis according to which outdoor sports enthusiasts are not active in species observation. Even not studied, the outdoor sports enthusiast's potential in species observation is recognized in many open-knowledge based data sharing services like iMammalia, which works as a smartphone application that allows users record and share mammal observations (mammalnet, 2021). iMammalia explains the inclusion of outdoor sports enthusiasts like hikers, climbers and bikers in species observing citizens because this group visits in different types of natural spaces where is a good opportunity to encounter with nature and local fauna (mammalnet, 2021).

6 MATERIALS AND METHODS

The study material was collected using a questionnaire that was sent out to a broad range of different hobby associations. In addition, a key informant interview was conducted with FinBIF representative to get more detailed information. Due to the large number of associations in Finland, the study sample had to be large enough to represent the whole population with sufficient accuracy. Within the time limitation of this master's thesis, the best option was to conduct an online questionnaire. The key informant interview was relevant method to collect information about FinBIF's role as an information sharing channel as there were key people who hold knowledge about the subject.

6.1 Study population and sample

Earlier research has shown nature enthusiast's significant role in species data production. Nature enthusiasts are represented by many different organizations, some of which are more active in contributing species data collection than others. The variety of different hobby associations within the nature and recreation sector in Finland were included in the study. The previously mentioned report on recreational use of nature (Sievänen, 2011) was used to inform the sample selection with regard to recreation associations, using the list of most common outdoor activities in Finland provided. Potentially, anyone moving in nature can make a species observation. Therefore, associations whose main activity did not focus entirely on species, but rather on enjoying the nature and sports were selected to the study. This meant selecting nature recreation associations including, hikers, skiers, the Scouts, kayakers, boaters, and orienteers. Participants were gathered from bird, mammal, fish, plant, reptile, invertebrate and fungi enthusiast associations, although some of them have limited representation in Finland. The number of associations within one hobby genre is bigger than a number of associations in some other genre which made the design of the research sample challenging. For example, there are more than 2,500 hunting clubs in Finland, while only a few registered mushroom picking clubs. Therefore, it was decided to subdivide the associations so that associations organizing similar activities were classified in the same category. In total, six categories were created: species enthusiasts; nature conservation; hunting; fishing; the Scouts; and other outdoor activities.

Associations were found by using a search engine held by the Finnish Patent and Registration Office, which holds information about all officially registered communities (prh.fi). Associations were searched by using search terms related to outdoor activities, nature, and species. Word endings were cut to include different word suffixes into the search results.

Searches returned the names of different registered communities that were exported to an Excel file. The searches returned thousands of associations, which were organized by their activity type. One hundred associations were randomly selected from each association class, compiling a total of 600 associations to whom the survey was sent. Selected associations' contact information was searched manually from internet, most often from the association's website. The questionnaire form was developed using Google Forms, which was then shared with participants via a link in an e-mail.

6.2 Data collection methods

6.2.1 *Questionnaire*

There is many nature and recreation associations in Finland, and therefore it was justified to use a questionnaire as a data collection method to achieve as comprehensive picture of the associations as possible, given the limitations of the master's research project. Conducting an internet survey enables addressing a wider audience than conducting the survey face-to-face or by phone. As opposed to an interview, the questionnaire must work on its own, without the assistance of the interviewer. The questionnaire's functionality and comprehensibility of the questions was tested before being implemented, by sending it to a test group and getting feedback, based on which the questions were improved.

Examining things statistically requires that data can be measured with different metrics (Vehkalahti, 2014). In a survey, metrics consist of questions and statements. Questions must be clear, concise, and comprehensible and avoid complex wordings and concepts. This was especially important in this study because the questionnaire targeted many different associations whose representative's knowledge about species observation had potentially large variation. Questions can be open-ended or closed. An open-ended question is answered in a free-form way, while the response options in the closed section are pre-defined and should be mutually exclusive. The questionnaire used in this study (see Appendix 1) consisted of both alternatives, but with an emphasis on closed questions. Although open-ended responses may provide research-relevant information that cannot be collected through closed-ended questions, ready-made response options have the benefit of clarifying the measurement and facilitating data processing. In this study's questionnaire, open-ended questions were designed to collect information about opinions and attitudes that could not have been collected with closed questions as the number of response options would have grown too large. The reliability of the study and the ability of the sample to describe the population can be assessed by the number of

respondents to the survey. According to Vehkalahti (2014), typical online survey response rates are less than 50%. If the response rate is clearly lower, the sample can be considered as unrepresentative (Vehkalahti, 2014). Respondents were attracted to answer to the questionnaire used in this study by customizing the questionnaire cover letter to target each group of recipients individually.

Survey questions were designed to evaluate the sample association's role in species data production and willingness to use the FinBIF as an information sharing channel. The questionnaire consisted of 15 questions that measured the association's activities to organize species observation events, willingness to share observation data, and to raise members' species identification capacity. The questionnaire is provided in Appendix 1.

Respondents were asked to define the main purpose of the association by selecting the most suitable alternative from 11 options (Question 1): nature conservation; species enthusiasm; hunting; fishing; mushroom picking; the Scouts; hiking or camping; orienteering or skiing; kayaking; boating or sailing; other nature hobby. Classifying associations according to their main activity enabled the comparative analysis between different associations. The groups 'hiking or camping' and 'boating or sailing' combined two similar activities because many associations within these outdoor activities seemed to deal with both activities e.g., many associations name contained the term 'boating and sailing'. The group called 'orienteering or skiing' combined two outdoor activities mainly because both can be seen purely as a sports activity. Associations were classified by their size (Question 2) as being small (1 to 100 members), average (101 to 500 members), or big (more than 500 members), using a model from the national Finnish sports clubs' barometer (Koski, 2018). This size classification was used to see if there is a significant difference between different sized associations.

Association's activity regarding species information production were assessed from two perspectives: observing activity and capacity building. Observing activity were measured by asking if the association had organized species observation activities (Question 5) and if so, how often these events were organized (Question 7). Respondents were asked what kind of activities they had organized and which species groups they had observed (Question 8). In addition, respondents were asked their observation recording practices (Questions 9, 10 and 11). Regarding observation recording, respondents were asked if they had used an open-source software. Multiple choice questions included Notebook and iNaturalist, which are synchronized to FinBIF. Other options were Tiira and eBird, which are common applications to use for observation recording. Respondents could also select 'another service', which aimed to cover

other services meant for observation recording. Furthermore, respondents were asked about their opinion concerning the use of open-source software. Besides recording observations by using open-source software, it is also possible to use internal accounting systems, which could include, for example, a paper notebook, closed Facebook group, association's Instagram, association's website, or something else. It is possible to estimate how much so called 'hidden data' associations hold by asking about association's internal recording system and their willingness to share its data.

Another way to evaluate association's activity in species information production is to ask how associations have motivated their members to observe species, and how do they raise their members' species identification skills. In the questionnaire, respondents were asked if the association had organized species identification training (Question 3). As Kosmala et al. (2016) stated, volunteer training is one mechanism to minimize errors in data and therefore enhance data quality. Respondents were asked which species groups were targeted in the identification training (Question 4). Capacity building was further assessed by asking if associations had promoted observation-recording software for their member's individual use (Question 13). In the questionnaire respondents had options Notebook, iNaturalist, Tiira, eBird and 'another service'. Associations were also asked if they had an internal record keeping system where members could mark their observations (Question 14).

6.2.2 *Key Informant Interview*

A Key informant interview (KII) is an ethnographic research method where a person who holds the best knowledge over certain topic is being interviewed (Marshall, 1996). A key informant can provide deeper information about the subject than would be possible to gather otherwise. The KII can provide more information in relatively shorter time than other techniques (ibn). Marshall has five criteria to an ideal key informant; A key informant should have access to the information that is sought by the researchers. He should have been absorbed the information and be willing to share it. Further, A key informant should be able to communicate the information that he holds and be objective and unbiased. Marshall further describes possible weaknesses of KII: Problem might occur due to informant's inability to represent or understand the majority view of the group or community he represents. Further, informant might bring up information which is not politically or socially acceptable. According to the good research ethics an informant should not gain harm by participating an interview. If there is a risk that a key informant is forced to participate, or if participating potentially alter his safety, the

interview should not be conducted. Informants' identity and personal information should be handled with care and secured. An informant's thoughts should be expressed as objectively as possible in the study, and he has always the right to stop the interview situation and prevent his interview from the study. Purpose of the study, research organization and form of publication should always be clearly explained to the informant. Permission to recording should be asked.

For this study, a KII was conducted with the FinBIF representative, who was found by contacting FinBIF experts. The Interview was semi-structured and intended to be more of a conversational approach. Interview questions were informed by the literature review, which included several webinars on FinBIF. There were 10 key-questions that guided the interview (see Appendix 2). In addition, refining questions were asked according to interviewee's answers and to complement the conversation. The KII especially aimed to gather information about FinBIF marketing practices and data quality controlling methods. The interview was conducted face-to-face but remotely, and it was recorded. Afterward, the interview record was transcribed. The KII provided additional information that was complementary to the literature review and discussion.

7 ANALYSIS

The data were analyzed by using SPSS statistical software, which enabled the organization and statistical processing of the data, as well as producing the results graphs. The data was transferred manually into SPSS with the aim to get a feel for the quality of the answers and possible errors. The illogicalities in the response material were sought and excluded from the analysis. Inconsistency may have occurred, for example, in a situation where the respondent had stated that he did not conduct species observation but answered the follow-up question that he observed mainly mammals. If the respondent's other responses did not explain the illogicality, the response was excluded from the analysis. The illogicality of the answers could also be due to a typographical error made when filling in the questionnaire, or if the respondent did not understand the question. Responses were not included in the analysis if there was a strong likelihood that the respondent did not understand the question. The questionnaire contained several questions that served as a continuation of the previous questions. Inconsistencies could be interpreted by comparing the answers with the respondent's other answers, especially the open-ended questions answered in writing.

In SPSS the data was organized before further analysis by labelling and coding the questionnaire responses. Each response form was given an identification number so that digitized data responses could be tracked back to the original responses if necessary. Single-choice questions were coded so that each answer option got its own number. Multiple-choice questions first had to be broken down into parts where each answer option were dummy-coded either to get 0 or 1 depending on whether it was selected or not. In the analysis, multiple-choice questions were processed with multiple response tools that aggregated earlier broken-down selection options. Open-ended responses were written as text in the SPSS program but were not statistically analyzed. They were used to support the analysis of other data and provided in-depth information about the responses. The questionnaire produced mainly qualitative data that was processed as a nominal measure. Frequencies were used as descriptive statistics that were also visualized by graphs as presented in the results section. Cross tabulation was applied to analyze dependences of responses in the data.

8 RESULTS

In total, 230 respondents answered to the questionnaire. However, as it was not mandatory to answer each question, some of the questions gained more answers than others. Three questionnaire forms were returned empty and therefore excluded from the analyses, leaving a total sample of 227 questionnaires that were analyzed. The number of respondents for each question is presented in connection with each result.

8.1 Respondent demographics

The questionnaire was sent to associations that belonged to 13 different hobby genres, which were further classified into six larger genres according to the hobby type. Classification was conducted before sending out the questionnaire in order to get similar sized classes to enable comparative analyses. In the questionnaire however, participants were able to select more detailed hobby genres. Figure 2 shows the number of respondents according to the more specific type of hobby.

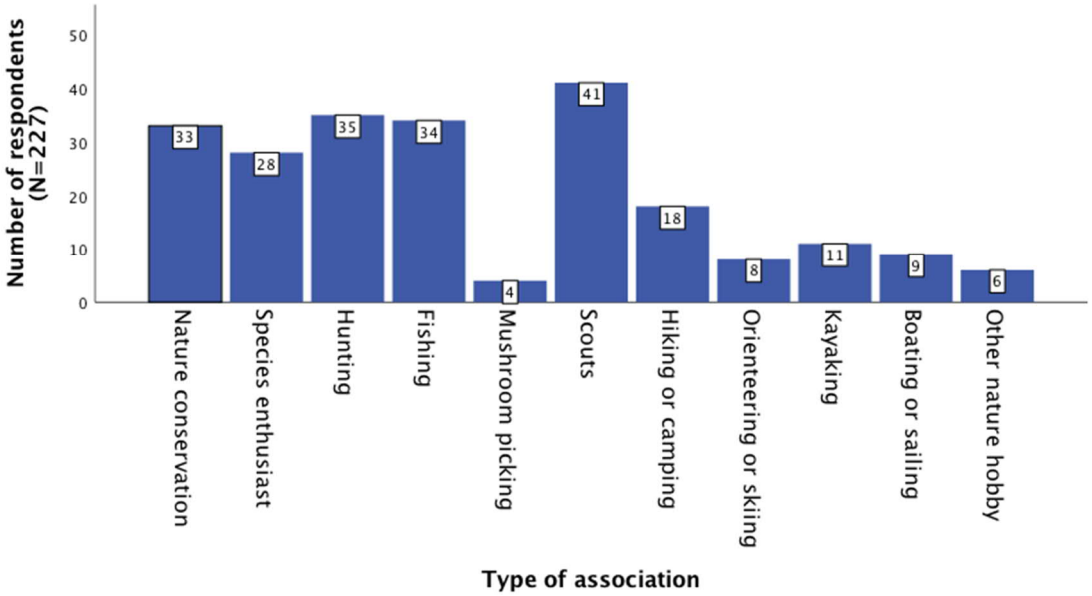

Figure 2. Respondent profile according to the association's specific hobby type.

For the analysis, respondents were again classified into the original six-variable category, the same one used to determine the sample at the beginning of the study (Table 1). Figure 3 shows the number of respondents according to the original classification that was used in the analysis.

Table 1. Change of classification.

Classification in the analysis	**Classification in the questionnaire form**
species enthusiast	mushroom picking, species enthusiast
nature conservation	nature conservation
hunting	hunting
fishing	fishing
Scouts	Scouts
outdoor sports and recreation	hiking or camping, orienteering or skiing, kayaking, boating or sailing, other nature hobby

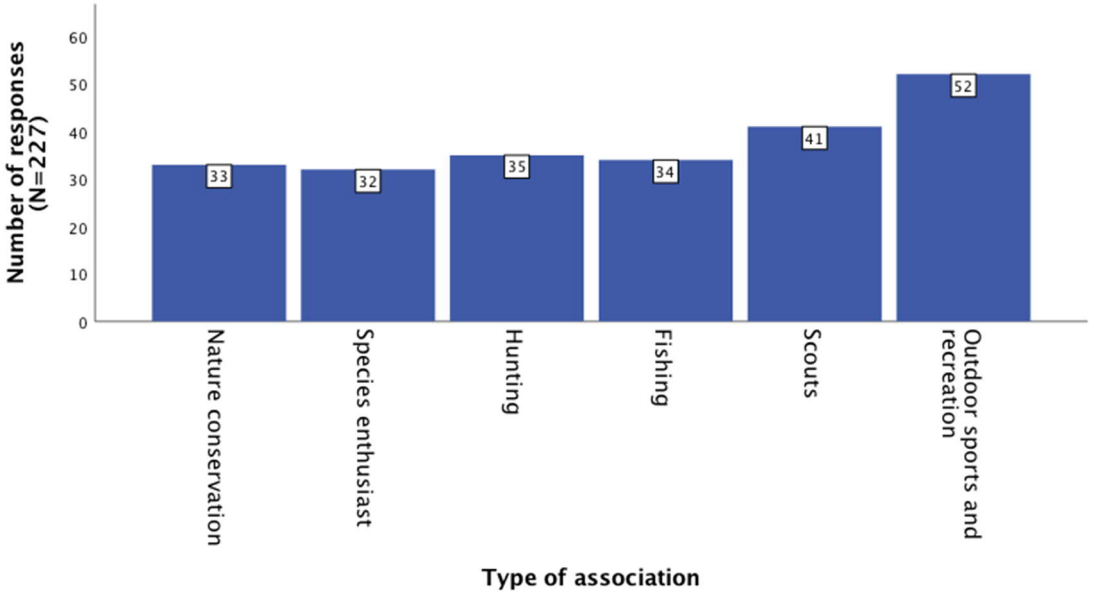

Figure 3. Respondent classification according to the type of association's activity.

Associations were mainly small or average in size. Of all the associations, 41.9% had 100 or less members, 46.7% had 101 – 500 members, and 11.5% had more than 500 members. Figure 4 shows the size distribution of the associations as measured by the number of members.

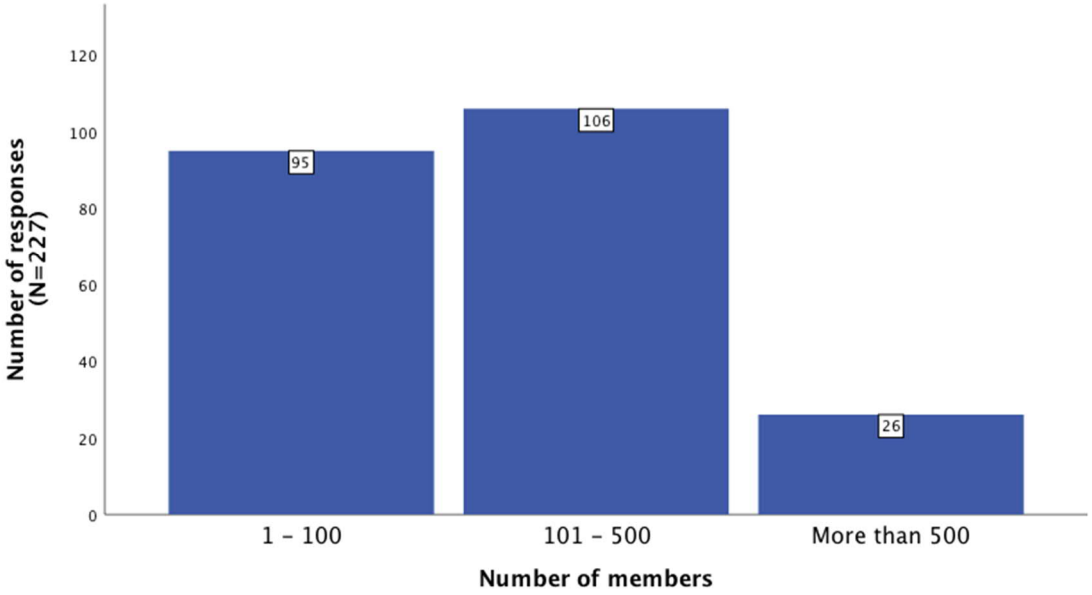

Figure 4. The graph shows the overall size distribution of associations according to the number of members.

The largest associations were found among the outdoor sports and recreation category, where 25% of associations had more than 500 members. Fishing associations in contrast, were the smallest by size, with 67.6% of respondents having 100 or less members. Figure 5 shows the associations size distribution measured by the number of members within each association type class.

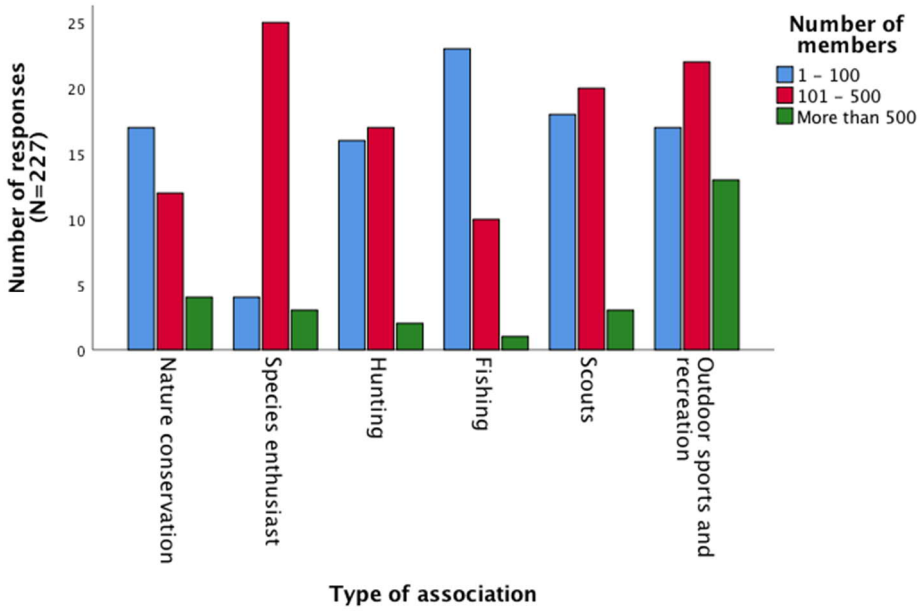

Figure 5. The graph shows associations size distribution according to number of members within each association class.

8.2 Associations' activities related to species observation and identification training

The first research question focused on nature and recreation associations' contribution to biodiversity data production. This was first evaluated by asking about associations' activities in relation to organizing species identification training for their members. From all respondents, 54.6% had organized species identification training for their members. The most active in species identification training were species enthusiast associations, of whom 93.8% answered that they had given species training to their members. Scouts and nature conservation associations were also active organizers of identification training, with 75.6% of the Scouts and 69.7% of the nature conservation associations having organized training. The least active in organizing identification training were hunting and outdoor recreation associations. Approximately 46% of hunter associations and 15% of outdoor and recreation associations had organized identification training. Figure 6 shows associations' activities to organize species identification training.

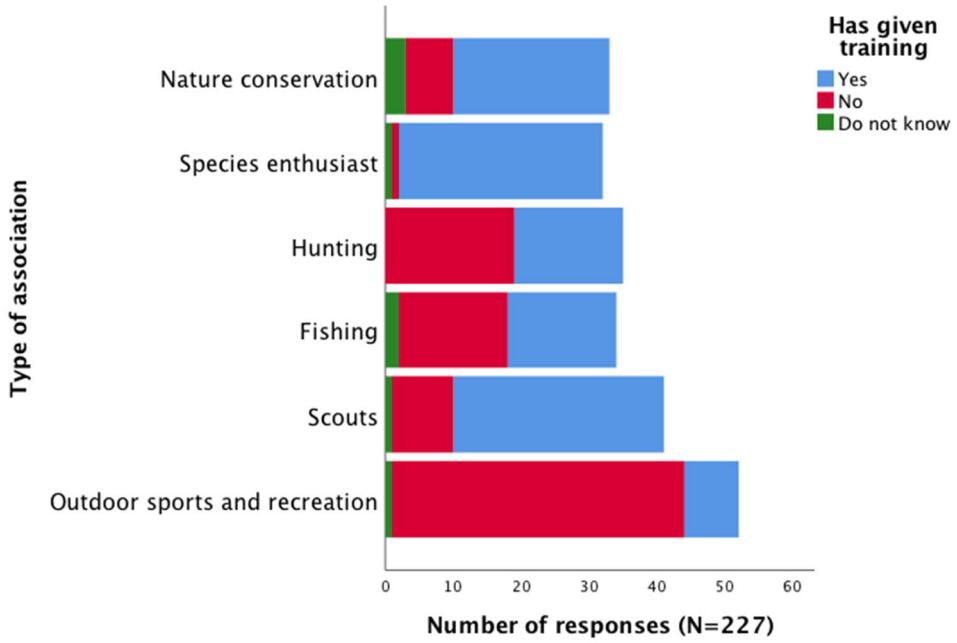

Figure 6. The graph shows different associations activity to give species identification training.

Respondents were asked which species groups the identification training had targeted, and Figure 7 shows the distribution of training given by species enthusiast associations. In total, 30.4% of the training provided dealt with birds, 17.8% plants, 15.7% mammals, 14.3% fungi, 13.3% fishes, 4.2% invertebrates, and 3.1% reptiles. Three respondents could not tell which species groups the training concerned. Of the associations that organized species training,

Scouts clearly provided the most training in identification of different species groups (see Figure 6). Moreover, the group of species enthusiast and nature conservation associations had given training in all species groups. Hunter associations gave training relating only to birds and mammals. Fishing associations gave training relating to fish and invertebrates. Associations in the outdoor sport and recreation group had given training relating to plants, birds, and fungi.

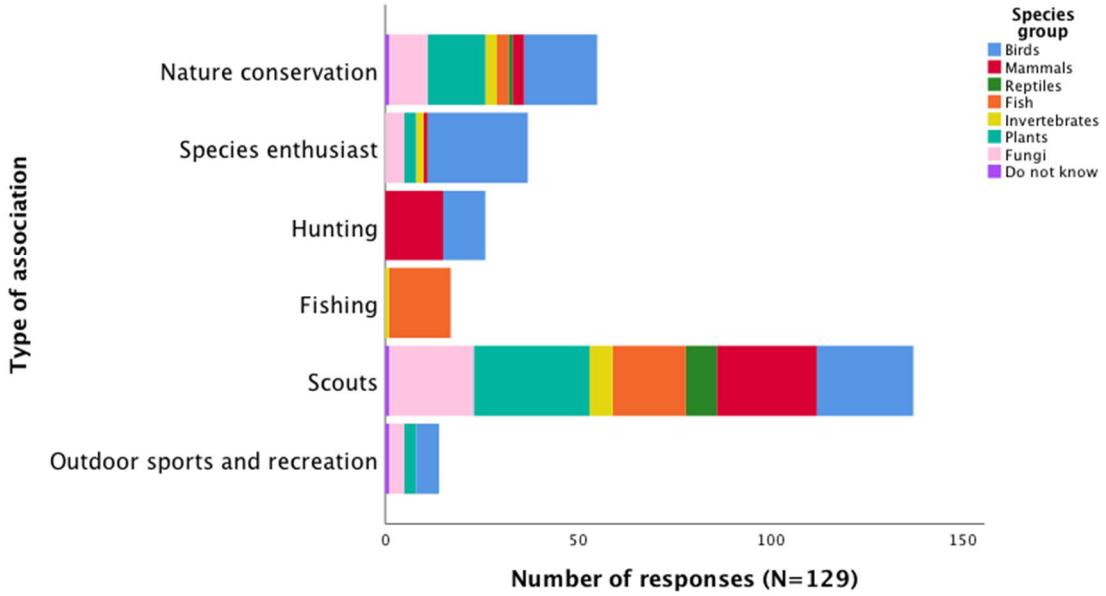

Figure 7. The distribution of given training by species groups within different associations. Answers were gathered with a multiple response question that enabled selecting all that apply. Therefore, the number of responses is bigger than number of respondents.

Figure 8 shows species observation interest among different associations when they were asked about their activity to organize species observation activities. Furthermore, associations were asked who were responsible in keeping recordings of observations and what type of recording system they used. With the aim to determine a more detailed picture about different observation types, associations were asked an open-ended question concerning observation events they had organized. All species enthusiast associations that responded to the survey answered that they have had organized species observation activities. Further, 82.9% of hunting and 84.8% of nature conservation associations had organized species observation. Of the Scout associations, 39% reported having organized species observation activities. From the comparison groups, Fishers and the outdoor sports and recreation associations showed the least interest toward species observation. Approximately 30% of the fishers and 25% of the outdoor sports and recreation associations said they have had organized species observation events.

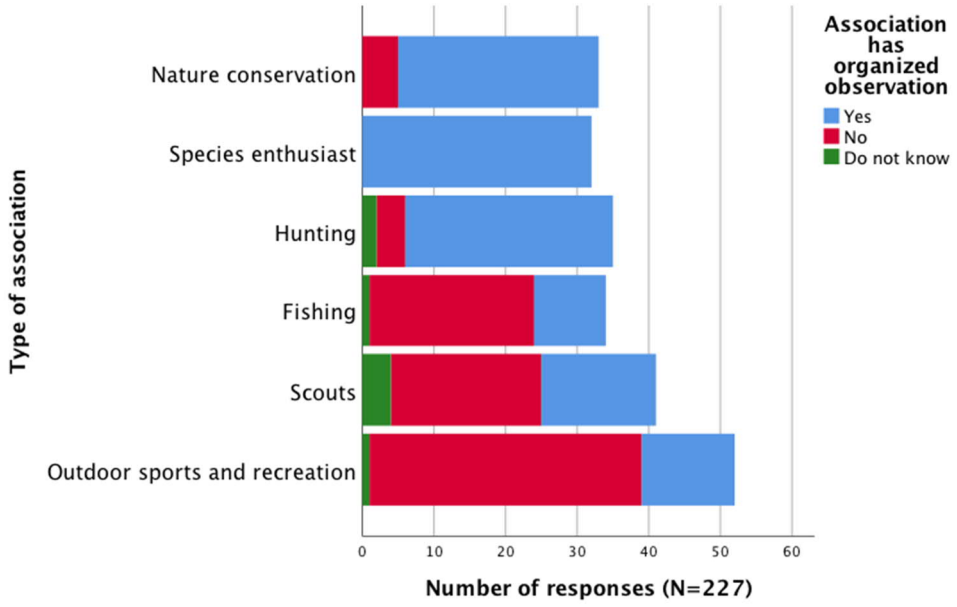

Figure 8. The graph describes the activity of different associations to organize species observation.

Figure 9 shows the species observing frequency among the associations from which hunters and species enthusiasts were the most active. Of the species enthusiast associations, 46.9% reported having multiple ongoing observation projects, whereas 40% of hunting associations said the same. Furthermore, 33.3% of the outdoor sports and recreation associations, and 27.8% of the Scouts said to observe species less than once in a year. Although, in both groups more associations organized observation events at least a couple of times in a year (66.7% of the outdoor sports and recreation associations, and 55.6% of the Scouts).

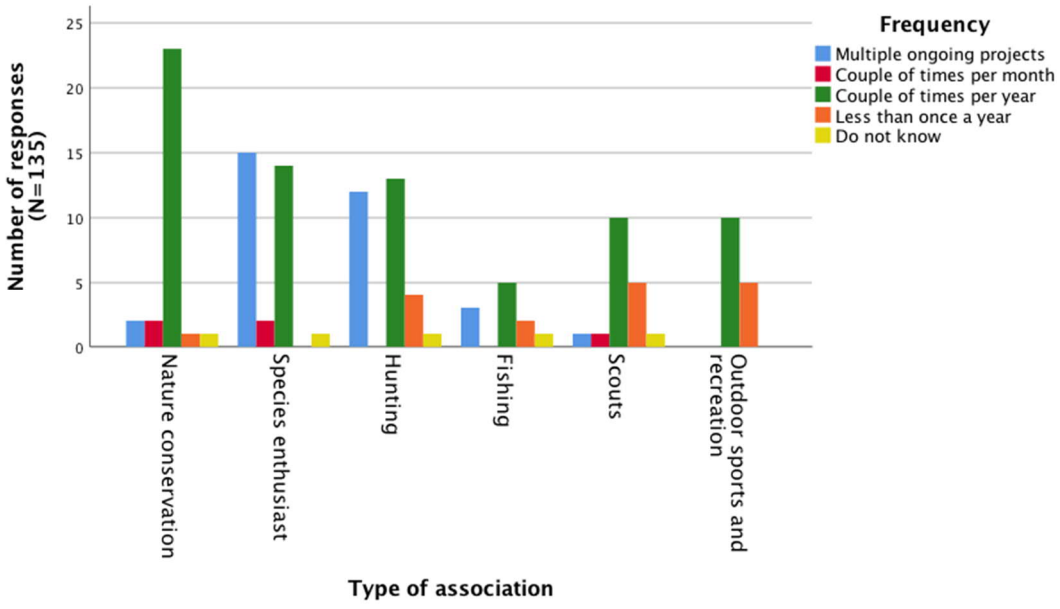

Figure 9. The graph shows different associations activity in organizing species observation events.

Figure 10 Shows the distribution of species groups observed by different associations form which can be seen that birds were the most observed species group. Of all respondents 38.9% had observed birds. Moreover, mammals (19.4%) and plants (16.2%) were among the most observed species groups. Reptiles received the least attention (2%), followed by invertebrates (4.1%). Of all respondents, 7.7% were observed fishes and 11% mushrooms. Two respondents did not know the species group they had observed. Hunting associations were entirely focused on birds and mammals, whereas fishing associations focused on fish and plants. The rest of the groups observed species more diversely.

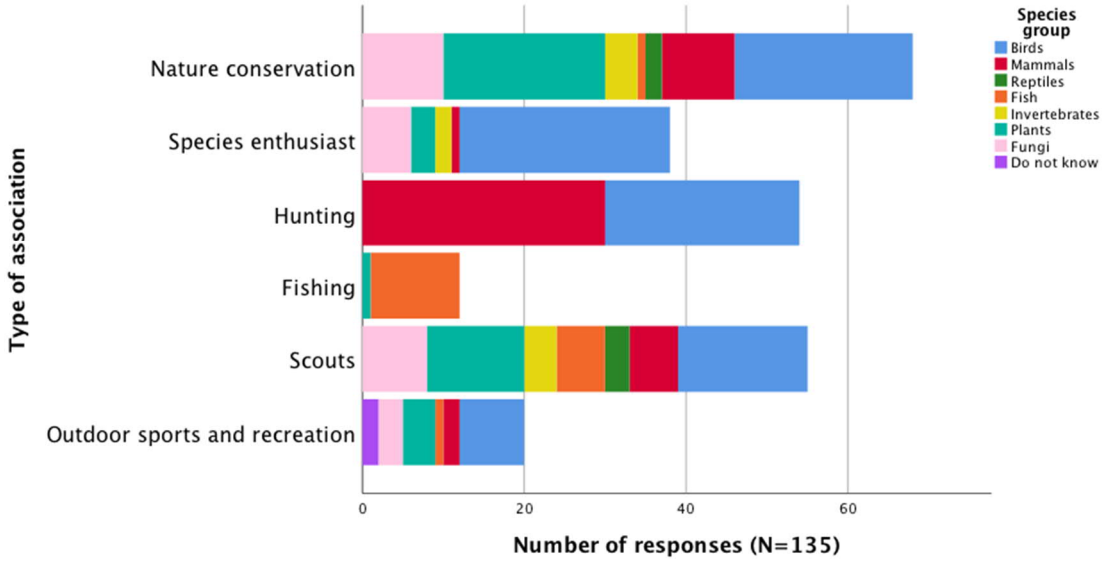

Figure 10. The graph shows the distribution of different species groups observed by different association. The number of answers is bigger than the number of respondents due to the multiple-choice question setting.

From all associations, hunters were clearly the most organized group in terms of observation recording methods. The proportion of nature conservation associations that responded to use association's representative to record observations during the events were 18.4%, whereas the proportion in species enthusiast associations was 18.2%. General recording guidance was used by 15.8% of nature conservation associations and by 43.3% of species enthusiast associations during the observation events. Participants reported recording their observations independently without coordination in 39.5% of nature conservation associations responses, and in 36.4% of species enthusiast associations. Of the nature conservation associations, 23.7% did not record observations during the events, whereas 2.3% of species enthusiast associations did not made recordings.

The Scouts were the least active in recording their observations as 42.3% of respondents said that they do not record observations during observation events. None of the respondents among the Scouts said an associations representative to be the one who records observations during the observation events. Of the Scouts, 15.4% said to have common guidelines for observation recording and 38.5% said that participants record their observations individually if they will. Outdoor sports and recreation associations were neither active in recording their observations. From that group 6.3% said to have an associations representative who is responsible for recording. Common guidelines for recording were found from 12.5% of respondents, whereas 37.5% said that recording was done independently by participants. Another 37.5% did not record observations during observation events. From fishing associations 9.1% had association's representative that recorded observations. Moreover, 27.3% used common guidelines and 45.5% made independent recordings. From fishing associations 18.2% did not record observations during the observation events. Figure 11 shows how observations recording methods wary among associations.

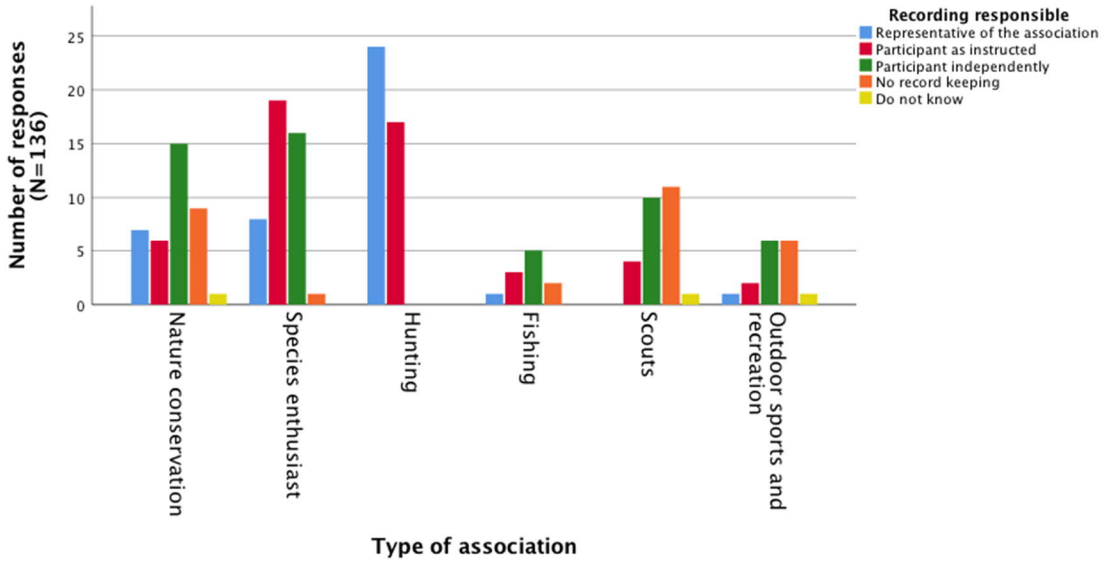

Figure 11. The graph shows the distribution of different recording methods among associations.

8.3 Association's familiarity with the FinBIF

Associations were asked about software they use in observation recording during observation events. The level and distribution of the use of observation recording software varied among associations. For those who answered to the question, Tiira was clearly the most popular software as 28.6% of all respondents had used it. From nature conservation associations 35.5%

and species enthusiast associations 55.8% had used. It was also used by hunters (3%) and outdoor sports and recreation associations (6.7%). The eBird software was used by 1.5% of all associations. An option 'another software' was selected by 20.3% of associations, mostly hunters. This is because hunters have their own software OmaRiista and Tassu that are specially developed to record observation of game and large carnivores. FinBIF's channels iNaturalist, Laji.fi and Notebook were not widely used among the study sample. Of all respondents, 10.5% had used Laji.fi or Notebook for observation recording. This software was the most popular among species enthusiast associations from which 25.6% had used them. Moreover, 6.5% of nature conservations associations had used Laji.fi or Notebook. Only two respondents said they used iNaturalist, which is 1.5% of all respondents in the question. Of all respondents, 40.6% do not use any recording software in species observation events. This is especially reflected by fishers, Scouts and outdoor sports and recreation associations. Figure 12 shows the distribution of the use of different software in observation recording among associations.

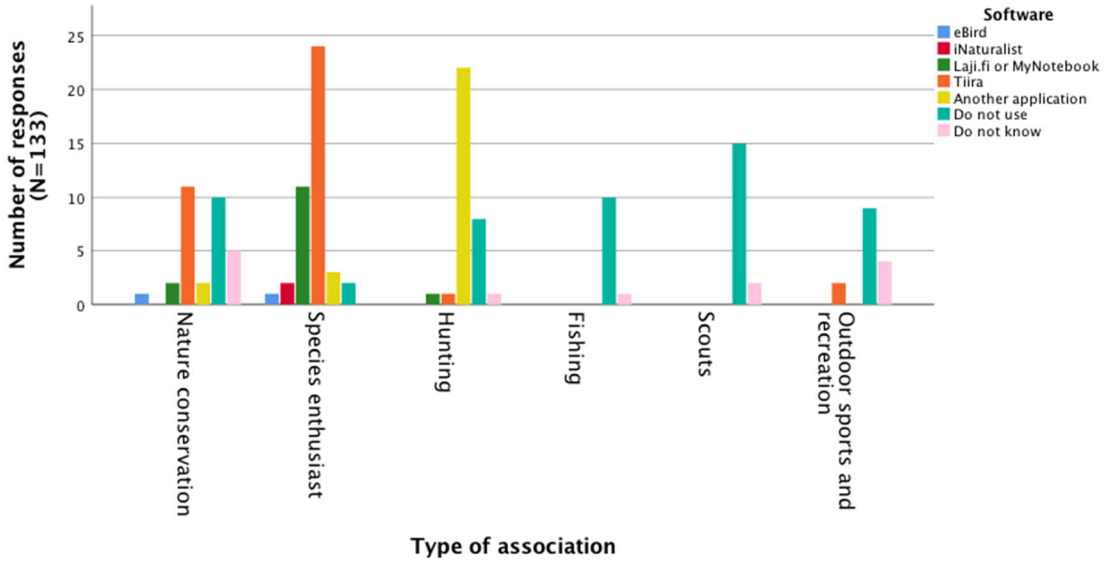

Figure 12. The graph shows distribution of different software use among associations. The question was set to be a multiple-choice question, so the number of responses is bigger than the number of respondents.

Associations were asked if they had advertised observation recording software to their members. As in the previous question concerning observation recoding software Tiira was the most often advertised. Of all respondents, 21.8% had encouraged their members to use Tiira in the context of independent species observation. Of all respondents, 8.3% had encouraged their members to use Laji.fi or Notebook in the context of independent species observation. The same proportion for iNaturalist was 1.4% and for eBird 0.5% of all respondents. Associations who advertised Laji.fi and Notebook were nature conservation associations (20%), species

enthusiast associations (21.1%), hunters (3%) and outdoor sports and recreation associations. Total 64.8% of respondents did not advertise any of the software. Figure 14 shows how different software are advertised among the associations.

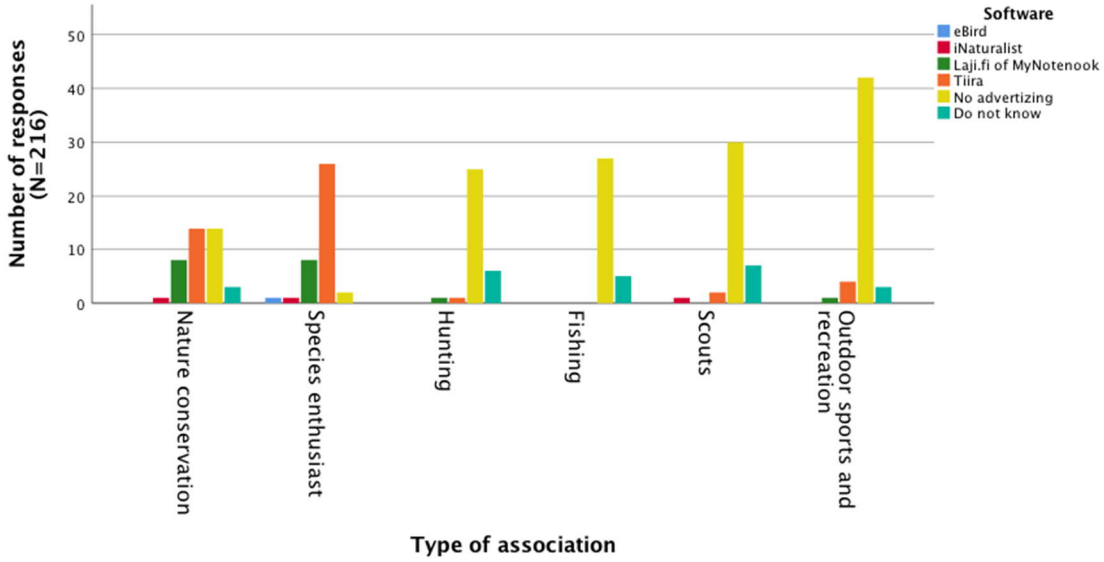

Figure 1. The graph shows the distribution of different software advertised by the associations. The question was a multiple-choice form, so the number of responses is bigger than the number of respondents.

9 DISCUSSION

9.1 Importance of the study

Biodiversity monitoring needs to invest more. Due to limited research resources, civic observation appears to be a valuable addition to the monitoring work. In Finland hunting and nature enthusiasts are well known to produce valuable data on species. However, the role of outdoor sport and recreation associations is less studies as well as the awareness of the FinBIF among different associations. The study hypothesis was that nature and species orientated associations were more actively producing species information than association that were focused on outdoor sports and recreation. Similarly, the expectation was that the FinBIF was more familiar for the first mentioned group. The study intended to enhance the understanding on how different nature and recreation associations contribute on biodiversity data production and how do they differ from each other in terms of species observing activity. Furthermore, the study measured to what extend associations had found the FinBIF services that enable data sharing. More general, the study tried to reveal how associations understand the concept of citizen science and, on the other hand, which are the nature and recreation groups that should be actively involved as users of the FinBIF and through it as producers of open biodiversity data.

9.2 Major findings

In this study, associations within the nature and recreation sector were evaluated in terms of species observation activity, data sharing methods and familiarity with the FinBIF. By a questionnaire survey, hunters and species enthusiasts were shown to be amongst the most active group to collect species data from all studied groups. The finding was in line with the study hypothesis and literature. From outdoor sports and recreation group, the Scouts stood out as being potential group to involve in citizen science-based species data production via the FinBIF software. This was the most unexpected finding and deserves the most attention in discussion. The FinBIF had not achieved high visibility and service utilization among the research sample.

Hunters are actively gathering information on game and large carnivores (Pellikka, 2007 and Ministry of the Environmente, 2017). In the study, the game triangle and snow trace calculations emerged in particular as observation activities participated by hunters. As like hunters, nature conservation and species enthusiast associations were amongst the most active in organizing species observation. The finding is in accordance with Santaoja (2013), who underlined the importance of species enthusiasts as data collectors. Nature conservation and

species enthusiast associations observed broadly different species groups however, more birds than others. This was in line with LUOMUS (2021) statement that bird monitoring is one of the most popular observation activities among volunteers, and in Finland, just over the thousand volunteers involved in it each year. The Scouts were the most interesting group what comes to the study hypothesis. Contrast to what expected the Scouts showed more interest to species observation. They were especially active in training their members species identification skills.

Tiira turned out to be the most popular software for observation recording among the study sample. According to the questionnaire responses, its popularity is due to its suitability for bird observations recording. The use of Tiira is recommended by the BirdLife Finland that is part of the world's largest environmental organization and the central organization of 30 Finnish bird associations (Birdlife.fi). Many associations that responded to the questionnaire seemed to have a focus on birds. This might explain the dominant use of Tiira. In addition to Tiira, the FinBIF related software (Laji.fi, Notebook and iNaturalist) were used the most among the species enthusiast and nature conservation associations. The observation was supported by the key informant interview (KII) with FinBIF representative who informed that from all association groups in the study, the FinBIF has collaborated mainly with species enthusiast associations. This might explain FinBIF's familiarity and use among species enthusiasts. Only one hunting association had adopted the FinBIF related software, which indicates that hunters are not either familiar with the FinBIF or for some reason resist to use it as a data sharing channel. The KII revealed that the FinBIF do not have an on-going cooperation with hunters, nor it target advertisement specifically on them. Hunters do have their own software OmaRiista and Tassu through which they share their observations with Finland Game Center and Natural Resources Institute Finland (LUKE, 2016). Of all the groups studied, the Scouts were the most inactive to record their observations. None of the respondents mentioned to use any given recording software nor did they had any internal record keeping system. This was partly explained by the view expressed in the questionnaire answers that were relied on the smaller role of species observation in the whole picture of Scout activities and the uncertainty about Scout actives own species identification skills.

9.3 Associations and FinBIF

An interview with the FinBIF representative focused on mapping associations and citizens role as producers of species information, the data quality management from the behalf of the FinBIF and communication between the FinBIF and the user groups. It was concluded that citizen produce species information in many different levels and that information is used for many

different purposes. There is no specific limitation on who can observe species. This means that any of the groups discussed in the study are potential users of the FinBIF. The FinBIF aims at a wide user base without excluding species occasionally observing citizens. It has also close cooperation with species enthusiasts and to some extend with nature conservation associations. The FinBIF has indirect cooperation with hunters, thought them are not known to use the FinBIF software for species information production. The last observation supports the study findings. The FinBIF had cooperated with the Finnish mushroom association in relation to Mushroom Atlas project. There has not been direct cooperation with fishers, Scouts, or outdoor and recreation associations but it was mentioned that the iNaturalist software has brought the missing tool to gather the observations of this type of nature hobbyists.

The FinBIF did not had an active marketing plan toward nature and outdoor recreation associations. An observation working group with 20-30 representatives from different associations acts as a contact for the organization sector in addition to a few direct contacts to species enthusiast associations. FinBIF is active in social media and communicates also by traditional means. The barrier is the limited access to closed social media groups where most of the nature enthusiasts can be found. iNaturalist's popularity is grown rapidly and its advertisement has taken place through the so-called 'jungle drum'. Older people have not been specifically considered in marketing and service development, but traditional paper observation forms are still available as FinBIF's observation recording tools.

What comes to the data sharing between different organizations and the FinBIF, it was mentioned that hunters favored software Tassu and OmaRiista do not yet share data with FinBIF. Large willingness to share data with FinBIF from several different locations and different starting points has also created both technical and ownership challenges and drawing up contracts takes time. FinBIF has close cooperation with Ministry of the Environment and there is ongoing planning to make the data available, easier to use, easy to filter by quality and to obtain the relevant information for environmental management purposes. FinBIF serves environmental administration by providing an authoritative portal through which sensitive data can be shared. For example, the lajiGIS material, which is available through the FinBIF, includes monitoring of endangered species, thus being an essential source of information for environmental management. When talking about the materials of the species information center, it must be borne in mind that the species information center does not own the materials, but shares the information contained in the materials produced by others. Civic observation works best to support decision-making when scientific information is not available. Citizen

observations can be used to better target research in the areas where the observations have been made

9.4 Limitations

The questionnaire gathered 227 respondents representing variety of different associations. As the number of associations within the nature and environmental sector is at least thousands, the size contrast between the whole population and the study sample must bear in mind. Moreover, questionnaire easily attract more those respondents who are interested about the study topic. As the questionnaire was about associations role in species data production, those respondents who are actively observing species might have been keener to respond than those who have no interest. It must be remembered that the study concerned associations, not their individual members. This is important, for example, when evaluating the use of applications. Even if the association does not use the software or advertise it, it does not yet tell us about the behavior of an individual member and citizen.

Another difficulty with the questionnaire was related to the association's variation. As the studied associations represented almost every possible form of nature and recreation hobbies, the questionnaire had to be modified general enough to be able to understand by each one. For the sake of the simplicity, there could not be too many answer options in the multiple-response questions. This meant for instance that not all possible species recording software available were included to the options but rather replaced by a general 'another recording software' option. This seemed to confuse some respondents.

The questionnaire aimed to seek information about associations willingness to share species data by asking if the association was willing to share the data from their internal recording system by a request. The question was preceded by a question about the methods and tools of which the association uses for recording the species observations. Many respondents interpreted the question as referring to their views on information sharing in general not in relation to their association practices. The problem came up while coding the data to the SPSS as many of the respondents who answered fist that they do not record species data answered further that they are willing to share data they have collected. The problem roots perhaps to the wording of the question and the fact that the questionnaire was quite long, and respondents might have lost their focus toward the end. The question was however, dropped out of the analysis in aim to avoid an error.

9.5 Future directions

The study was in accordance with earlier studies that highlighted the role of hunters in species observation. Still, the hunters did not use the FinBIF software for data sharing. Further, it should be analyzed whether this is because hunters have their own data sharing software and they do not see need for more or are they just simply not aware of the FinBIF software. Hunters do move a lot in a nature, and they might be able to observe and identify many more species than they now do and share through OmaRiista and Tassu. Therefore, by knowing what limits the use of the FinBIF software among hunters, might give tools to raise its popularity, increase usage and the amount of data shared.

The Scouts showed interest toward species observation and as an organization they want to teach children and young people skills, including species identification skills, that enable them to understand nature. It should be studied more which strengths and limitations the Scouts as an organization have in terms of species voluntary monitoring and how do they understand the concept of citizen science. As the number of kids and youth in the Scouts is big and they are curious to learn for their environment, they would be potential collectors of species data.

10 CONCLUSIONS

The study raises up two key findings: the potential of the Scouts in species data production and low number of FinBIF users among the study sample. The FinBIF is designed to support open knowledge and further it allows data sharing of citizen with different competence level. The Scouts are a well-known and well-structured organization that is active in every region in Finland. In the light of the study, it is recommended that the FinBIF should involve the Scouts to closer cooperation by informing them about the concepts of citizen science and the FinBIF. If the Scouts would adopt for example the iNaturalist app as a common tool for their nature observation activities not only the amount of data shared through the FinBIF grow but also the kids and the youth within the Scouts can learn the idea of citizen science which they can apply later. The Scouts could be also participated stronger to biodiversity monitoring work that is planned in the NBSAP.

The study has advantaged the knowledge about the FinBIF's use among different type of associations and these associations activity to organize species observation. The study filled the gap of lacking comparison between a wide range of nature and recreation associations in terms of earlier discussed activity to observe species and use the FinBIF software. Associations organize variety of activities, inform, and motivate their members in relation to their nature hobby. That is why associations should be understood as key actors when developing species monitoring. By understanding association's role in biodiversity knowledge flow from single volunteer to environmental administration, them can be included more closely to biodiversity monitoring work.

Nature and species enthusiast associations enables and coordinates hobby activities of tens of thousands of Finns. Recommendation to the Ministry of the Environment is that the new NBSAP should provide methods to promote the concepts of citizen science and the FinBIF directly to the associations within the nature and recreation sector. Connecting nature enthusiasts and existing data collection tools enables more comprehensive monitoring of biodiversity.

REFERENCES

Auvinen A., Kemppainen E., Jäppinen J., Heliölä J., Holmala K., Jantunen J., Koljonen M., Kolström T., Lumiaro R., Punttila P., Venesjärvi R., Virkkala R., Ahlroth P. 2020. Impact Assessment of the Implementation of National Strategy and Action plan for the Conservation and Sustainable use of Biodiversity in Finland (2012–2020). Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2020:36. Available at: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162392/VNTEAS_2020_36.pdf

Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. 2014. Next steps for citizen science. Science, 343(6178), 1436 – 1437. doi:10.1126/science.1251554

Bowker, G. C. 2000. Biodiversity Datadiversity, Social studies of science, 2000-10-01, Vol.30 (5), p. 643 – 683. https://doi.org/10.1177/030631200030005001

Cavalier, D., Zachary, E. 2016. The Rightful Place of Science: Citizen Science. Available at: https://www.researchgate.net/publication/305489010_The_Rightful_Place_of_Science_Citizen_Science

Chandler M. et al. 2017. Involving Citizen Scientists in Biodiversity Observation. In: Walters M., Scholes R. (eds) The GEO Handbook on Biodiversity Observation Networks. Springer, Cham. https://doi.org/10.1007/978-3-319-27288-7_9. pp 211-237

Egloff, W., Patterson, D. J., Agosti, D., & Hagedorn, G. 2014. Open exchange of scientific knowledge and European copyright: The case of biodiversity information. ZooKeys, (414), 109–135. https://doi.org/10.3897/zookeys.414.7717

Finnish Biodiversity Information Facility. 2021. [Internet site]. FinBIF in a nutshell (*Lajitietokeskus pähkinänkuoressa*). Available at: https://laji.fi/about/2915

Finnish Biodiversity Information Facility. 2021. [Internet site]. FinBIFs database (*Suomen Lajitietokeskuksen havaintojen tietovarasto*). Available at: https://laji.fi/about/803

Finnish Biodiversity Information Facility. 2021. [Internet site]. Data quality control (*Havaintotiedon laadunvalvonta*). Available at: https://laji.fi/about/772

Finnish Biodiversity Information Facility. 2021. [Internet site]. Laji.fi-portal (*Laji.fi-portaali*). Available at: https://laji.fi/about/788

Finnish Biodiversity Information Facility. 2021. [Internet site]. Observation service My Notebook (*Havaintojärjestelmä Vihko*). Available at: https://laji.fi/about/823

Finnish Biodiversity Information Facility. 2021. [Internet site]. Processing of sensitive species information in the FinBIF (*Sensitiivisen lajitiedon käsittely Suomen Lajitietokeskuksessa*). Available at: https://laji.fi/about/709

Finnish Museum of Natural History. 2021. [Internet site]. Bird watching (*Linnustoseuranta)*. Available at: https://www.luomus.fi/fi/linnustonseuranta

Finlands Scouter ry. 2021. [Internet site]. About as. Available at: https://www.partio.fi/suomen-partiolaiset/tietoa-meista/

Finlands Scouter ry. 2021. [Internet site]. Partners and supporters. Available at: https://www.partio.fi/suomen-partiolaiset/tue-tyotamme/tukijat-ja-yhteistyokumppanit/

Gardiner M., Allee L., Brown P., Losey J., Roy H., Rice Smyth R. 2012. Lessons from lady beetles: accuracy of monitoring data from US and UK citizen-science programs. Frontiers in Ecology and the Environment. Front Ecol Environ 2012; doi:10.1890/110185. Available at: http://nora.nerc.ac.uk/id/eprint/20992/1/N020992JA.pdf. Sited 24.8.2021.

Hilden, M. 2008. The utilization of natural resource information in support of policy and decision-making – End report. *(Luonnonvaratiedon hyödyntäminen politiikan ja päätöksenteon tukena – loppuraportti)*. SYKE. Available at: https://core.ac.uk/download/pdf/80070111.pdf

Hyvärinen, E., Juslén, A., Kemppainen, E., Uddström, A., Liukko, U. 2019. The 2019 Red List of Finnish Species. Ministry of the Environment & SYKE. 978-952-11-4974-0. http://hdl.handle.net/10138/299501

IBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56pages

iNaturalist. 2021. [Internet site]. iNaturalist Suomi Finland. Available at: https://inaturalist.laji.fi

Koski, P. & Mäenpää, P. 2018 Finnish exercise and sports clubs - situation, changes and future (*Suomalaiset liikunta ja urheiluseurat − tilanne, muutokset ja tulevaisuus*). University of Turku. Report conclution. isBn:978-952-263-593-8. Availale at: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161059/Suomalaiset%20liikunta-%20ja%20urheiluseurat.pdf

Kosmala M., Wiggins A., Swanson A., Simmons B. 2016. Assessing data quality in citizen science. Front Ecol Environ 2016;14(10): 551 – 560, doi:10.1002/fee.1436.

Lahti, K., Heikkinen, M., Juslén, A., Schulman, L. 2021. Tackling Data Quality Challenges in the Finnish Biodiversity Information Facility (FinBIF). Biodiversity Information Science and Standards 5: e75559. https://doi.org/10.3897/biss.5.75559

Lorimer, J. 2007. Nonhuman charisma. Environment and Planning D: Society and Space 2007, volume 25, pages 911 – 932. DOI:10.1068/d71j. Available at: https://journals-sagepub-com.libproxy.helsinki.fi/doi/pdf/10.1068/d71j

Mammalnet. 2021. [Internet site] IMammalia - Recording European mammals. Available at: https://mammalnet.net/imammalia

Mammalnet. 2021. [Internet site] How to participate? Outdoor activities enthusiast. Available at: https://mammalnet.com/outdoor-activities-enthusiast/

Marshall, MN. 2021. The key informant technique. Family Practice 1996; 13: 92-97. Available at: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.554.5499&rep=rep1&type=pdf

Ministry of the Environment. 2017. Action plan for protection of threatened species. The Finnish Environment 2/2017. Available at: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/79398/Sy_2_17.pdf?sequence=1.

Ministry of the Environment publications. 2007. Finland's Biodiversity Protection and Sustainable Use Strategy 2006–2016 (*Luonnon puolesta – ihmisen hyväksi, Suomen luonnon monimuotoisuuden suojelun ja kestävän käytön strategia 2006–2016*). SUOMEN YMPÄRISTÖ 35 | 2007. Ministry of the Environment, Department of Land Use. Available at: https://ym.fi/documents/1410903/38439968/SY35_2007-Luonnon-puolesta---ihmisen-hyvaksi-4812CA57_BFE1_403F_99DD_F386AE6AC127-25500.pdf/28047740-9518-6d3b-c66f-5b07cd4f0f68/SY35_2007-Luonnon-puolesta---ihmisen-hyvaksi-4812CA57_BFE1_403F_99DD_F386AE6AC127-25500.pdf?t=1603260617574

Molloy JC. 2011. The Open Knowledge Foundation: Open Data Means Better Science. PLoS Biol 9(12): e1001195. https://doi.org/10.1371/journal.pbio.1001195

Natural Resources Institute Finland. 2021. [Internet site] Construction of the My Fish service for recreational fishing begins (*Vapaa-ajan kalastuksen Oma kala -palvelun rakentaminen alkaa).* Available at: https://www.luke.fi/uutinen/vapaa-ajankalastuksen-oma-kala-palvelun-rakentaminen-alkaa/

Natural Recources Institute Finland. 2021. [Internet site] The implementation of the My Fish service has started (*Oma kala -asiointipalvelun toteuttaminen on käynnistynyt*).

Available at: https://www.luke.fi/uutinen/oma-kala-asiointipalvelun-toteuttaminen-on-kaynnistynyt/

Natural Resources Institute Finland. 2016. [Internet site]. Hunting (*Metsästys*). Available at: https://www.luke.fi/tietoa-luonnonvaroista/riista/metsastys/

Natural Resources Institute Finland. 2016. [Internet site]. Recreational fishing (*Vapaa-ajan kalastus*). Available at: https://www.luke.fi/tietoa-luonnonvaroista/kalat-ja-kalatalous/vapaa-ajankalastus/

Pellikka, J., Viitala, M. 2009. What do nature hobbies say about the multifunctionality of hunters? (*Mitä luontoharrastukset kertovat metsästäjien monitoimisuudesta?*) The Natural Resources Institute Finland. Available at: https://jukuri.luke.fi/bitstream/handle/10024/532860/tutkimuksia_6_2009.pdf?sequence=1&isAllowed=y

Research, Monitoring and Information Systems Expert Group 2001: Proposal for a national monitoring of the state of biodiversity. Report of the Expert Group on Research, Monitoring and Information Systems (*Tutkimus, seuranta ja tietojärjestelmät - asiantuntijaryhmä 2001*). The Finnish Environment 532. 76 p. Ministry of the Environment. Available at: https://helda.helsinki.fi/bitstream/handle/10138/40545/SY_532.pdf?sequence=1&isAllowed=y

Riistakolmiot.fi. 2021. [Internet site]. What are the Wildlife Triangles? (Mitä on kolmiolaskenta). Available at: https://www.riistakolmiot.fi/#

Santaoja, M. 2013. From love to nature - Nature lovers as nature conservation actors (Rakkaudesta luontoon - Luontoharrastajat luonnonsuojelun toimijoina, Akateeminen väitöskirja) The University of Tampere. Available at: https://trepo.tuni.fi/bitstream/handle/10024/94423/978-951-44-9216-7.pdf?sequence=1&isAllowed=y

Santaoja, Minna. 2013. Information about nature - money or love? (Tietoa luonnosta - rahasta vai rakkaudesta?). Cultural research. 30. p. 15 – 28.

Schulman, L., Lahti, K., Piirainen, E. et al. The Finnish Biodiversity Information Facility as a best-practice model for biodiversity data infrastructures. Sci Data 8, 137 (2021). https://doi.org/10.1038/s41597-021-00919-6

Scouts International. 2021. [Internet site] Scouts for SDGs. Available at: https://sdgs.scout.org

Scouts of England and Wales. 2021. [Internet site] Seek out nature. Available at: https://www.scouts.org.uk/activities/seek-out-nature

Sharman M., Mlambo M., 2012. Wicked: The Problem of Biodiversity Loss. GAIA - Ecological Perspectives for Science and Society. 21. 10.14512/gaia.21.4.10.

Shorten A., Smith J. 2017. Mixed methods research: expanding the evidence base Evidence-Based Nursing 2017; 20:74-75. Available at: http://dx.doi.org/10.1136/eb-2017-102699

Sievänen, T., Neuvonen, M. 2011. Recreational use of nature 2010 (*Luonnon virkistyskäyttö 2010*). Working Papers of the Finnish Forest Research Institute. Available at: http://www.metla.fi/julkaisut/workingpapers/2011/mwp212.pdf

Strategy for monitoring the state of the environment 2020. 2011. Ministry of the Environment reports 23 | 2011. Available at: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10138/41382/YMra23_2011_Ymparistontilan_seurannan_strategia_2020.pdf?sequence=2&isAllowed=y

United Nations, Convention on Biological Diversity. 2020. National Biodiversity Strategies and Action Plans (NBSAPs). https://www.cbd.int/nbsap/.

Vehkalahti, K. 2014. Survey study indicators and methods (*Kyselytutkimuksen mittarit ja menetelmät*). DOI: 10.31885/9789515149817

APPENDIX 1 – THE QUESTIONNAIRE FORM

Yhdistykset lajitiedon tuottajina

Luontoharrastajilla on suuri merkitys luonnon monimuotoisuuden seurannassa käytettävän lajitiedon keräämisessä. Havaintoja eliölajeista voi tehdä aina luonnossa liikuttaessa, eikä lajitiedon tuotanto rajoitu ainoastaan virallisiin lajistoseurantoihin. Havaintotietoa tarvitaan luonnon monimuotoisuuteen liittyvässä tutkimuksessa ja päätöksenteossa.

Kysely kartoittaa yhdistysten ja harrastajayhteisöjen roolia lajihavaintotiedon tuottamisessa. Kyselyn vastaukset koostetaan pro gradu -tutkielmaan. Kyselyyn vastataan anonyymisti, eikä kyselyvastauksia julkaista sellaisenaan. Kyselyyn vastaaminen kestää noin 5 - 10 minuuttia, eikä siinä kerätä henkilötietoja.

1. Yhdistyksen pääasiallista tarkoitusta kuvaa parhaiten

Merkitse vain yksi.

Luonnonsuojelu

Eliölajiin liittyvä harrastus (esimerkiksi lintu- tai hyönteisharrastus)

Metsästys

Kalastus

Sienestys

Partio

Vaellus tai retkeily

Suunnistus tai hiihto

Melonta

Veneily tai purjehdus

Muu luontoharrastus

2. Yhdistyksen jäsenmäärä

Merkitse vain yksi.

1 – 100 jäsentä

101 – 500 jäsentä

Yli 500 jäsentä

3. Onko yhdistys järjestänyt jäsenilleen eliölajien tunnistamiseen liittyvää koulutusta?

Merkitse vain yksi.

Kyllä

Ei

En osaa sanoa

4. Mikäli yhdistys on järjestänyt eliölajien tunnistamiseen liittyvää koulutusta, mihin eliöryhmiin koulutus on liittynyt?

Valitse kaikki sopivat vaihtoehdot.

Linnut

Nisäkkäät

Matelijat

Kalat

Selkärangattomat

Kasvit

Sienet

Yhdistys ei ole järjestänyt lajitunnistukseen liittyvää koulutusta

En osaa sanoa

5. Onko yhdistys järjestänyt jäsenilleen eliölajien aktiiviseen havainnointiin liittyvää toimintaa (esimerkiksi lintubongausta, hyönteisseurantaa, eläinten jälkien laskentaa, vieraslajien torjuntaa…)? Kysymyksessä huomioidaan myös toisen tahon järjestämä toiminta, johon yhdistys on aktiivisesti osallistunut

Merkitse vain yksi.

Kyllä *

Ei (jos vastaat ei, siirry kysymykseen 13)

En osaa sanoa

* Millaista lajihavainnointiin liittyvää toimintaa yhdistys on järjestänyt?

7. Kuinka usein yhdistys järjestää eliölajien havainnointiin liittyvää toimintaa?

Merkitse vain yksi soikio.

Yhdistyksellä on meneillään useita projekteja tai havainnointi on jatkuvaa

Muutama tapahtuma kuukaudessa

Muutama tapahtuma vuodessa

Harvemmin kuin kerran vuodessa

En osaa sanoa

8. Mikä eliöryhmä on ollut yhdistyksen järjestämän lajihavainnoinnin kohteena?

Valitse kaikki sopivat vaihtoehdot.

Linnut

Nisäkkäät

Matelijat

Kalat

Selkärangattomat

Kasvit

Sienet

En osaa sanoa

9. Miten yhdistyksen järjestämän lajihavainnoinnin yhteydessä tehdyt havainnot pääosin kirjataan?

Valitse kaikki sopivat vaihtoehdot.

Yhdistyksen edustaja kirjaa osallistujien tekemät havainnot

Osallistujat kirjaavat havainnot itsenäisesti yhdistyksen ohjeistuksen mukaisesti

Osallistujat kirjaavat havainnot itsenäisesti kukin omalla tavallaan

Tehtyjä havaintoja ei kirjata

En osaa sanoa

10. Onko yhdistyksen järjestämän lajihavainnoinnin aikana käytetty havaintojen kirjaamiseen jotakin seuraavista yhteiskäyttöisistä palveluista?

Valitse kaikki sopivat vaihtoehdot.

eBird

iNaturalist

Laji.fi / Vihko (Lajitietokeskuksen havaintopalvelu)

Tiira (BirdLifen lintutietopalvelu)

muu yhteiskäyttöinen palvelu

Havaintojen kirjaamisessa ei käytetä yhteiskäyttöisiä palveluja

En osaa sanoa

Voit halutessasi kertoa lyhyesti miksi yhdistys on päätynyt käyttämään tiettyä yhteiskäyttöipalvelua, tai vastaavasti miksi yhdistys ei halua käyttää yhteiskäyttöisiä palveluja lajitiedon jakamiseen.

11. Kirjataanko yhdistyksen järjestämän lajihavainnoinnin aikana tehtyjä lajihavaintoja yhdistyksen sisäiseen kirjanpitoon?

Valitse kaikki sopivat vaihtoehdot.

Paperinen havaintovihko tai yhdistyksen omat havaintolomakkeet

Yhdistyksen verkkosivut

Yhdistyksen Facebook

Yhdistyksen Instagram

Muu sisäisen kirjanpidon muoto

Yhdistyksellä ei ole sisäistä havaintokirjanpitoa

En osaa sanoa

12. Mikäli lajihavainnoinnin yhteydessä tehdyt havainnot kirjataan ainoastaan yhdistyksen sisäiseen kirjanpitoon, onko yhdistys halukas jakamaan tietoa eteenpäin pyydettäessä esimerkiksi tutkimuskäyttöön?

Merkitse vain yksi.

Kyllä*

Ei*

En osaa sanoa

*Voit halutessasi kertoa tarkemmin miksi yhdistys on valmis luovuttamaan keräämäänsä lajitietoa eteenpäin ja millä ehdoilla, tai vastaavasti miksi tietoa ei luovuteta ulkopuolisille.

13. Yhdistyksen jäsenet liikkuvat luonnossa vapaa-ajallaan ja havainnoivat eliölajeja omatoimisesti ilman, että se liittyy yhdistyksen järjestämään toimintaan. Onko yhdistys

kannustanut jäseniään jakamaan omatoimiset lajihavaintonsa jonkin seuraavan yhteiskäyttöisen palvelun kautta (esimerkiksi tiedottamalla palvelusta verkkosivuilla tai yhdistyksen toiminnan yhteydessä)?

Valitse kaikki sopivat vaihtoehdot.

eBird

iNaturalist

Laji.fi / Vihko (Lajitietokeskuksen havaintopalvelu)

Tiira (BirdLifen lintutietopalvelu)

Yhdistys ei ole erikseen kannustanut jäseniään käyttämään yhteiskäyttöisiä palveluja

En osaa sanoa

14. Onko yhdistyksellä käytössään jokin yhteinen sisäiseen käyttöön tarkoitettu havaintokirjanpito, johon jäsenet voivat ilmoittaa omatoimisia lajihavaintojaan, joita he tekevät yhdistyksen toiminnan ulkopuolella?

Valitse kaikki sopivat vaihtoehdot.

Paperinen havaintovihko tai yhdistyksen omat havaintolomakkeet

Yhdistyksen verkkosivut

Yhdistyksen Facebook

Yhdistyksen Instagram

Muu sisäisen kirjanpidon muoto

Yhdistyksellä ei ole sisäistä havaintokirjanpitoa

En osaa sanoa

15. Mikäli yhdistys ylläpitää sisäistä kirjausjärjestelmää jäsenten omia lajihavaintoja varten, luovutetaanko tietoa eteenpäin pyydettäessä esimerkiksi tutkimuskäyttöön?

Merkitse vain yksi.

Kyllä

Ei

En osaa sanoa

APPENDIX 2 – THE KEY INFORMATIVE INTERVIEW QUESTIONS

1. Kuka saa tehdä kansalaistiedettä: Tavoitellaanko lajihavaintojen ilmoittajiksi esimerkiksi tiettyjä harrastajaryhmiä, vai onko toivottavaa, että kuka tahansa luonnossa liikkuja ilmoittaisi tekemänsä havainnot riippumatta lajitunnistuskokemuksesta?
2. Onko havaintojen ilmoittajan puutteellinen lajiosaaminen tai tahallinen väärän tiedon tallettaminen noussut kertaakaan ongelmaksi Lajitietokeskuksen havaintopalvelussa? Ts. toimiiko laadunvalvonta toivotusti?
3. Millaisena näkisitte seuraavien kolmannen sektorin toimijoiden ja harrasteyhteisöjen roolin kansalaistieteeseen perustuvan lajihavaintotiedon tuottajina ja millaista yhteistyötä teette heidän kanssaan: luonnonsuojelijat, eliölajiharrastajat, metsästäjät, kalastajat, sienestäjät?
4. Millainen rooli lajihavaintojen tuottamisessa on seuraavilla harrasteyhteisöillä, joiden toiminta liittyy luonnossa liikkumiseen, mutta ei ensisijaisesti keskity eliölajeihin ja onko teillä yhteistyötä heidän kanssaan: partiolaiset, vaeltajat ja retkeilijät, suunnistajat ja hiihtäjät, melojat ja muut vesillä liikkuvat?
5. Millaista markkinointia kohdistatte erilaisille kolmannen sektorin toimijoille?
6. Pyrittekö aktivoimaan luontoharrastajia suoraan, vai heitä edustavien yhdistysten tai harrasteyhteisöjen kautta?
7. Luontoharrastajissa on paljon ikäihmisiä, onko heitä erikseen huomioitu Lajitietokeskuksen markkinoinnissa?
8. Siirtyykö seuraavien yhteiskäyttöpalveluiden data suoraan tai välikäden kautta Lajitietokeskukseen: Tiira, Oma riista, Tassu?
9. Teettekö yhteistyötä ympäristöministeriön kanssa päätöksenteossa tarvittavan lajitiedon saatavuuteen ja kulkuun liittyen?
10. Miten hyvin Lajitietokeskuksen aineistot soveltuvat mielestänne ympäristöministeriön käyttöön päätöksenteon tueksi?