

Insect Affects: A Study on the Motivations of Amateur Entomologists and Implications for Citizen Science

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Abstract

With increasing interest in citizen science, this paper discusses how amateur naturalism, especially amateur entomology, is placed within citizen science discourses. Through a case study of amateur entomology in Finland, the paper discusses amateurs' diverse motivations for engaging with nature. The paper discusses especially the affective and ethical aspects of amateur entomology and its implications for citizen science. The discussion is based on an ethnographic study of an entomologist society. The paper suggests that amateur naturalism cannot be reduced to any single definition of citizen science, but amateur entomologists enact different epistemologies as knowledge producers and active citizens. The amateurs are often motivated by an ethical 'first contract' with nature. The rich amateur culture may democratize and 're-enchant' science, provided the scientist worldview of superior data is not allowed to conceal the diversity of amateur motivations.

Keywords: amateur entomology, citizen science, entomological societies, affect, ethics, Finland

Introduction

With increasingly urban lifestyles and decreasing contact with nature, the common knowledge on nature has deteriorated to the point researchers have called 'extinction of experience' (Soga and Gaston, 2016). The lack of contact may have an impact on how we value nature. During the last years, the 'insect apocalypse' has captured public attention and may provide pathways for increased interest in amateur entomology and reconnecting with nature. The 'extinction of experience' is paralleled by a loss of expertise, especially in fields such as invertebrate taxonomy. Lester et al. (2014) have described this 'taxonomic impediment' as a worldwide phenomenon. Taxonomic data, such as

species occurrences, are the 'ammunition for conservation' (Hopkins and Freckleton, 2002). Taxonomic research has significant input from amateur researchers. Within the landscape of extinction of experience and loss of expertise, citizen science has emerged as an approach to tackle the dual problem. There are differing understandings of what citizen science encompasses, and its relationship to amateur naturalist tradition is unclear.

For citizen science to deliver the dual promise of engaging people with science and educating them on nature, it is necessary to understand the different motivations of people participating in science. This paper discusses the driving moti-



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vations of amateur entomologists, focusing primarily on the affective side of amateur entomology. Empirically the study draws on an analysis of the amateur entomology scene in Finland, and more specifically, the active amateur entomologists in local entomological society in Tampere, Western Finland. What makes the Tampere Entomological Society particularly interesting is that the society, established in 1967, functions purely on an amateur basis. While the active members of the society are well networked with professional scientists, the society's activities are not organized around institutionalized entomological research as in many other entomological societies.

The contributions of the paper are threefold. First, I provide a description of modern amateur entomology through the example of Finland and a case study of one amateur entomological society in particular. Second, I explore how amateur entomology relates to different types of citizen science. Third, I focus on amateur entomology's affective qualities and ethical dimensions and discuss their implications for citizen science.

The paper begins with a discussion of the research literature on the emergence and different understandings of citizen science and its critique. I then discuss the tradition of amateur naturalism, amateurs' role in taxonomy, and, more specifically, amateur entomology. Next, I provide further reasoning for focusing on the affective aspects of amateur entomology before presenting the materials and methods used in the study and moving on to the analysis and conclusions.

Before we continue, an etymological note. The word 'amateur' is often used in opposition to 'expert' or 'professional,' as someone less knowledgeable, 'dabbling' in science or other activity. However, the roots of the word can be traced to the Latin verb 'amare,' 'to love.' An amateur entomologist is someone passionate about insects. "Amateur" is a quality also of many professional entomologists.

Citizen science and its critique

The Oxford English Dictionary defines citizen science as "the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists." The defini-

tion does not capture the diversity of citizen science as a field (Bonney et al., 2016). It leaves out all kinds of projects where volunteers participate beyond data collection and work independently from professional scientists.

There is no single definition of citizen science that would cover the normative, epistemological, and structural differences among the citizen science approaches, and at the same time, capture the diversity of participatory research (Kasperowski and Kullenberg, 2019; Schrögel and Kolleck, 2019). There are roughly two main paradigms, one emphasizing the 'citizen' part and public participation in dialogue about science, and the second emphasizing the 'science' part, i.e., public doing science in diverse ways (Schrögel and Kolleck, 2019). Vohland et al. (2019) have called citizen science a hybrid object, belonging to the worlds of both science and civil society.

Current citizen science efforts range from individual to institutional level and from limited projects to lifelong interests (Vohland et al., 2019). The projects may be initiated by individual laypeople, civil society groups, scientific institutions, or public administration. Citizen science projects have been classified in different ways, based on the project goals (for instance, conservation, investigation, or education) and the depth of citizen participation (Acorn, 2017; Eleta et al., 2019; Schrögel and Kolleck, 2019). As Bonney et al. (2016: 3) write, "citizen science functions in a variety of disciplines, each of which has its own culture, norms, and expectations."

Kimura and Kinchy (2016) have identified seven virtues appointed to citizen science: 1) increasing scientific data, 2) increasing citizens' scientific literacy and awareness, 3) building community capacity for environmental protection, 4) building an equal relationship between scientists and citizens, 5) filling knowledge gaps and challenging official accounts, 6) driving policy change, and 7) catching polluters. These virtues cast the citizen scientists in different roles as epistemic and societal agents. In addition to advancing scientific understanding and opening new pathways for doing research, citizen science projects may combine education, community development, and conservation outcomes (Oberhauser and Prysby, 2008) with positive social and ecological

impacts (Eleta et al., 2019). Irwin (1995) writes how opening science to a broader set of knowledge and sources of inquiry is necessary for crafting sustainable environmental responses and calls for a restructuring of existing institutional knowledge structures. Strasser et al. (2019) think participatory research could transform how knowledge is produced at a deep epistemological level, which could result in a different kind of science. Similarly, Wylie et al. (2017: 403) call for Civic Science that “empowers people to question the state of things rather than simply serving the state.”

The definition of citizen science commonly adopted in natural field sciences is in line with the above dictionary definition. Silvertown (2009: 467) describes a citizen scientist as “a volunteer who collects and/or processes data as part of a scientific inquiry.” He attributes the burgeoning of citizen science projects to three factors. First, the existence of suitable technologies for disseminating information about projects and gathering data from the public, such as open biodiversity databases, have made public participation in science available for a broader public. Acorn (2017: 775) goes as far as to say that the term citizen science “was coined to accommodate the emergence of large online databases in recent decades.” Second, this was linked with the realization among professional scientists that the public represents a free source of labor and skills (Silvertown, 2009). Citizen science has also emerged as an important public policy issue as governments aim to capitalize on it (Kimura and Kinchy, 2019). Third, research funders have started to increasingly expect public outreach from grant holders, so citizen science emerged as a two-for-one opportunity.

Science and technology studies scholars have cautioned about the neoliberal turn in science, illustrated by the perception of citizen science as the provision of free labor, skills, and even funding for professional science. Vohland et al. (2019) define neoliberalism as a political ideology that prefers market solutions to government solutions on efficiency grounds and stands for the economization of everyday life and a move away from common good to individual concern. According to them, environmental sciences are particularly susceptible to neoliberal knowledge appropri-

ation. As the state outsources, for instance, biodiversity monitoring to volunteer citizens, it can be argued that citizen scientists are expected to play the role that has previously belonged to public agencies (Kimura and Kinchy, 2019). Some citizen science programs have been criticized as extractivist, treating the citizens as ‘data drones’ and not considering the different knowledges, ethics, and ways of relating with nature people have (Lorimer, 2007; Ellis and Waterton, 2004). Turnhout et al. (2014) discuss how biodiversity governance has been permeated by ‘measurementality,’ a linear understanding of the relationship between science and policy: the accumulation of data is expected to lead to its effective implementation in policymaking. Knowledge production becomes increasingly geared towards those aspects of biodiversity that are considered scientifically, politically, or economically relevant. With its technocratic, economic, and managerial discourses, measurementality shifts the focus from political action to knowledge and loses sight of the diversity of ways of knowing biodiversity (also Irwin, 1995).

Dickel et al. (2019) write how civic technoscience, such as collecting biodiversity data via large online platforms, involves the public in the technological world making and constitutes technosocial publics. Here, the role of the public is limited to either embracing the technoscientific imaginaries or engaging in critical discourses (Dickel et al., 2019). Still, Vohland et al. (2019) see the impact of citizen science as ambivalent: it can either strengthen the neoliberalization of science by providing free data, and public goods like education, or citizen science can challenge neoliberalization by promoting new forms of cooperation and learning, that may safeguard non-economized sphere and lead to sustainability.

The hybrid nature of citizen science has resulted in doubts and criticism towards the different ends of the spectrum. Citizen science is suspected of being a ‘stamp collecting’ kind of exercise rather than ‘proper’ hypothesis-driven science (Elliott and Rosenberg, 2019). The quality of the data collected by citizens is often questioned (Oberhauser and Prysby, 2008), and citizen scientists are feared to hold an advocacy position rather than a ‘properly’ disinterested scientific approach (Elliott

and Rosenberg, 2019). The authors state, however, that citizens' engagement in political advocacy does not threaten the quality of their scientific work, but, on the contrary, the value-laden perspective of citizen scientists may even increase scientific objectivity by uncovering values or assumptions in traditional scientific work and illustrating the need for different kinds of data for different purposes (Elliott and Rosenberg, 2019; Mazel-Cabasse, 2019). To fulfill the promises of citizen science, Eleta et al. (2019) call for designing citizen science projects with ethics at their core.

Decline of taxonomy, decline of amateur entomology?

Research on nature has become dominated by experimental sciences, shifting the epistemic practices in a way that sciences, where amateurs have played the most important role, have become marginalized (Strasser et al., 2019). While the decline of professional taxonomists has been widely publicized, Hopkins and Freckleton (2002) claim that the decline of amateur researchers may represent an underappreciated threat to conservation. Amateurs are particularly important in generating occurrence records of species (Elliott and Rosenberg, 2019; Hopkins and Freckleton, 2002; Pearson and Shetterly, 2006; Vohland et al., 2019), and therefore their decline may have a disproportionate impact upon the information available for conservation planning (Hopkins and Freckleton, 2002). To highlight the importance of amateurs, the latest Finnish Red List of endangered species (Hyvärinen et al., 2019) acknowledges the amateur contributions on various taxa on 42 occasions. Regarding several groups, the authors had to write that few, if any, amateurs are focusing on them. New identification literature is expected to inspire amateurs focusing on, e.g., little-known fungi or insect groups.

Amateurs have many advantages to professional scientists in providing knowledge on insects and other fauna. First, amateurs are more widely distributed than professionals, and thus their activity provides better geographic coverage (Hopkins and Freckleton, 2002). Second, amateurs are free to pursue their interests and can devote their time to recording species occurrences that

may provide valuable background information for conservation, whereas professionals may have limited time and interest for general surveys. Furthermore, Hopkins and Freckleton point out that amateurs frequently attend entomological society meetings, providing them an opportunity to share the unique body of knowledge they possess, which raises the study's standards and encourages fellow amateurs to expand their interests. Without this taxonomic expertise, there is no one capable of assessing the conservation status of taxa that are difficult to identify, and focusing conservation efforts only on easily identified taxa may lead to skewed conservation priorities (Hopkins and Freckleton, 2002). Committed, specialized volunteer naturalists may be top experts regarding the species or taxa of their interest locally, nationally, and even internationally. In some fields, they may even dominate the progress and agenda of the discipline (Pearson and Shetterly, 2006).

Citizen science is often presented as new and revolutionary by its proponents. However, two precedents are sometimes acknowledged: the amateur naturalist tradition of the 18th and 19th centuries, and the 'science for the people' movement, and the critique of science of the 1960s and 1970s (Strasser et al., 2019). However, it does not seem clear what the relationship of citizen science and amateur naturalism is, as amateur naturalism is not only a historical but a continuing contemporary tradition, taking many forms that cannot be reduced to the narrowest definitions of citizen science. The label of citizen science should not obscure or determine the meaning of practices such as amateur entomology that are significant in and of themselves (Strasser et al., 2019). Acorn (2017) perceives citizen science as an extension of traditional amateur entomology. Many amateurs possess statistical and theoretical training from a related field useful for relevant analyses (Kaplan, 2009).

In reflections on the history of citizen science, it is often pointed out that all science has civic or amateur roots (Pearson and Shetterly, 2006). Mid-19th century, all entomologists were still amateurs. Through the professionalization of science from the early to late 20th century, amateurs were marginalized (Kaplan, 2009). Still,

amateur entomologists continue contributing to the field, and Kaplan (2009: 328) writes that “entomology advances through the efforts of its many amateur practitioners.” The first entomological societies came about in England in the mid-18th century to share knowledge on *Lepidoptera* (butterflies and moths) (Kaplan, 2009). In 1999, the Directory of Entomological Societies listed 514 entomological associations worldwide (Pearson and Shetterly, 2006). 194 of them were interested in general entomology; the rest had more focused missions. 107 general entomological associations were primarily for professionals, 85 for both professionals and amateurs, and 2 expressly for amateurs. A more recent listing arrived at 285 entomological societies worldwide (Ameixa et al., 2017). The lists are likely to be non-comprehensive, as it is challenging to find information on all the local and regional societies in different language areas. The numbers point to a decline, but locally the amateur entomologist societies may even be growing.

Insect imaginaries and ethical citizen science

Insects have intrigued people as they have played a prominent role in our perception of life (Hogue, 2009). Insects are the most numerous group of animals, making up over half of all known species (Footit and Adler, 2009). The field of entomology is diverse, and pest control has been one key driver of entomological research. Smith and Kennedy (2009) distinguish between basic and applied entomology, the applied fields including economic, agricultural, medical, and veterinary entomology. Cultural entomology is a field that studies the role of insects in language, literature, music, folklore, religion, art, and recreation (Hogue, 2009; Raffles, 2010). Insects have even modeled for the development of architecture and artificial intelligence (Parikka, 2010).

However, especially in the West, the typical attitude towards insects has been that of aversion. From an anthropocentric perspective, insects are perceived to be on the bottom of a species hierarchy as the ‘ultimate other’ (Knight and Barnett, 2008; Sleigh, 2006). The multiplicity, ‘monstrosity,’ i.e., the physical difference from humans, autonomy, and parasitism are insect

characters that are perceived as being outside the normal boundaries of aesthetics and satisfactions (Lemelin and Fine, 2013) and a threat to the idea of bounded, personal subjectivity (Hillman, 1997), associated with illness and death. Therefore, amateur entomology has remained in the recreational fringe (Lemelin and Fine, 2013), outside the leisure commonplace, unlike, for example, bird-watching.

Entomologists have mostly stayed out of the environmental debates of the last decades (Smith and Kennedy, 2009). Concern over pollinator decline rose in the wake of the IPBES report in 2016, stating that over three-quarters of main global food crops rely on insect pollination (IPBES, 2016). In 2017, the ‘insect apocalypse’ became headlines after a German study discovered a 75 percent decline in insect biomass in protected areas (Hallmann et al., 2017). The extinction of insects has become an emblem of the current ecological crisis. It poses new challenges to the field of entomology, and according to Smith and Kennedy (2009), calls for a modification of entomologists’ self-image towards ‘entomological statesmanship.

The ‘insect apocalypse’ has captured the public’s imagination and may provide opportunities for engaging the public in entomological citizen science. The citizen science initiatives should, however, consider the diverse motivations of amateur entomologists, and technoscientific projects should also be made useful for the naturalists’ purposes (Acorn, 2017; Vohland et al., 2019). Citizen science projects may conflict with the amateurs’ existing data gathering habits (Acorn, 2017). There may be intrinsic conflicts, as while some amateurs are motivated by the possibility of participating in science, the primary motivation for many citizens and amateur naturalists is “to care for nature, to be outdoors, and to do something they perceive as enjoyable and meaningful” (Vohland et al., 2019: 4). For those interested in ecology and conservation, the measure of success in citizen science projects is the degree to which the data is used for positive environmental changes (Acorn, 2017; Dosemagen and Parker, 2019). Ellis and Waterton (2005) have called this a reciprocal ‘first contract’ between amateurs and nature: nature provides the amateurs wonder and

knowledge, and the amateurs, for their part, make sure that data extracted from nature is appropriately used toward preservation.

Nevertheless, the data does not speak for itself; it is put to various uses. The biodiversity knowledge-gathering efforts, including citizen science programs, do not self-evidently aim at conservation. Furthermore, there is no way of knowing to what uses data might be put, once it is stored in databases, now emphasizing open access. Conservation-oriented citizens may not be motivated to participate in science for the sake of science.

Amateurs contributing to research provide not only their cognitive capabilities but also a unique set of perceptive and affective qualities (Strasser et al., 2019). Amateurs deeply familiar with local entomological fauna add a layer of lived experience to their scientific knowledge, enriching it and making it more relevant for many purposes. Mazel-Cabasse (2019) points out how our capacity to use emotions in response to disasters such as ecological crises is a too often disregarded competence. Studying the affective aspects of epistemic cultures may allow crafting more nuanced responses to environmental disasters and advocating for a more grounded science. For Wylie et al. (2017: 414), STS may offer a form of grounded research “to robustly ask the question of how we wish to construct our collective futures.”

(N)ethnography and affect

The empirical material for this study has been collected by ethnographic observation of Finnish amateur entomologists, both offline and online. Ethnographic observation aims to understand a particular culture or society in its terms (e.g., Madden, 2010). To discover the practices of an epistemic culture, Knorr-Cetina (2007: 364) calls for “a working familiarity with the frames of meaning within which people enact their lives.” My interest in amateur entomology has continued since 2002. I joined the Tampere Entomological Society, started receiving the society’s annual journal, *Diamina*, and its email list. The publications and emails form part of the research material. I have participated in the society’s monthly meetings as an observer, and notes from seven meetings are included in the research material. I am not an

entomologist of any kind myself; my interest is in the amateur culture and environmental agency. The study materials contain six semi-structured interviews with amateur entomologists, further six interviews with professionals from environmental administration and natural history museums, and informal personal communications with the entomologists. The interviews were recorded and transcribed verbatim. Excerpts from the data have been translated from Finnish by the author.

Netnographic research considers the virtual world as ‘the field’ and applies ethnographic observation on the internet (Kosinski et al., 2015; Kozinets, 2010; Reid and Duffy, 2018). I followed the virtual presence of the amateur entomologists, tracing the actors, activities, histories of the societies, and memberships. I mapped the Finnish entomological scene via the web pages and social media groups of the societies and other electronic media content. The emergence of social media has also affected amateur naturalism. Through popular social media groups, people who do not participate in the traditional, specialized naturalist societies have found ways to share their enthusiasm for nature and ask for peer support with species identification. For the study, I followed one such group in particular, the ‘Suomen ötökät – Bugs of Finland’ group on Facebook. The group was established in 2013 and now has over 19,500 members. The broader netnographic observation allowed to set the findings from the local society into a broader context.

While ethnographic analysis aims at describing the study subject on its terms, I will address the affective aspects of amateur entomology. This is not something the amateurs themselves emphasize, and therefore the choice requires consideration of research ethics. My aim is not to present amateur entomology as ‘irrational’ or anything of the like but, on the contrary, to discuss how affects and emotions are fundamental in naturalist epistemologies. There are still deep epistemological divides, as in the natural sciences it is often not considered appropriate or relevant to discuss topics such as emotions in research. As citizen scientists, the amateurs balance between the natural scientific epistemologies and those of pleasure, leisure, and care, as I will discuss below.

This balancing act is crucial to take into account in designing citizen science.

Geographer Jamie Lorimer (2007, 2008) has studied the significance of affect in UK biodiversity conservation and conceptualized nonhuman charisma to draw attention to the importance of affects. Focusing on charisma allows us to see differences and potentials for agency in nonhuman nature. The concept of affect has been employed differently in various research traditions, some emphasizing the corporeality and intensity of affects, others holding affects and emotions as synonymous (Taira, 2007). Following Deleuze and Guattari (1987), research on affects often distinguishes between affect, feeling, and emotion. For Anderson (2006), affectivity is corporeal, pre-conscious, immediate flow between a human body and another body. Physical feelings are momentary expressions of affects in the body—immediate assessments of the affect. Finally, Anderson (2006) takes emotions as qualitative classifications of affects, bringing affects to the world of meanings for conscious interpretation.

In studying flying squirrel surveyors, Nygren and Jokinen (2013) emphasize the diversity and personal strengths of the surveyors, which makes it impossible to standardize the affective knowledge practices fully. Similarly, entomologists tune into the characteristics of the observed species and become trained in observing them. Affects are not independent of the subject - they are influenced by the person's knowledge, skills, emotions, interests, and motivations. However, affects are not purely subjective either: cultural norms and conventions influence what sort of things each of us invests in and what gives meaning to life. Grossberg (1997) views affects as building capacity for action and tuning in to what matters.

Conceptualizing affects as bodily intensities sets limits to how they can be studied. A shortcoming of this study is that I have not observed the entomologists' affects firsthand on the field, but instead ex-post accounts and expressions of them in the society meetings. Similar to Peltola and Tuomisaari (2015), I have analyzed expressions of affects in observation and interview data. More precisely, I looked for expressions of different

types of nonhuman charisma (Lorimer, 2007). Studying affects requires attentiveness from the researcher – I had to let myself be affected by the amateur entomologists. In addition to the choice of words, I paid attention to the amateur entomologists' interpersonal exchanges, tone of voice, and facial and body language, as expressions of emotions resulting from affects, drawing primarily on Anderson's (2006) conceptualization of affect. The study contributes an empirical case of how to employ the concepts of nonhuman charisma in studying affects in field sciences, and emphasizing affects I argue for diversified epistemologies.

The Finnish amateur entomology scene

Tampere Entomological Society, which is in focus here, was established in 1967. Before, it functioned as a specialized club under a local naturalist society (Santaaja, 2021). The Society currently has over 160 members, comprising mainly local amateur entomologists but including also some professional 'corresponding' members nationally. The society is run by a board, elected yearly. The board's tasks are divided between a chairperson, secretary, treasurer, museum coordinator, journal editor, and scientific coordinator. The society aims to circulate the chairs not to burden the same persons and to get new people involved. However, the chairperson has remained unchanged for 15 years. A milestone was reached in the society's monthly meeting in April 2021, as the first woman ever was appointed as a member of the board. One (male) attendee in the online meeting noted: "Things are changing as 4 of the 18 attendees here are women, so perhaps it is time to end the era of all-male panels".

Amateur naturalism has a long history in Finland and elsewhere, going back to the 18th century. In Finland, there are seven active entomological societies. Considering the size of the country, with a population of ca. 5,5 million, it is safe to say there is a lively entomological tradition.

The oldest Finnish entomological society is the Helsinki Entomological Society, founded in 1919. At the time, the language of science in Finland was mainly Swedish. In the bilingual society, communications were held both in Swedish and in Finnish. A Finnish-speaking society, the Ento-

mological Society of Finland was established in 1935. The society aims to provide a platform for amateur as well as professional entomologists. The Helsinki-based societies collaborate closely and organize, for instance, their monthly meetings partly together. The membership practice of the Helsinki Entomological Society remains somewhat exclusive, as a new member is required to have a recommendation from two previous members before acceptance. The election to membership is a common practice among entomological societies with professional members (Kaplan, 2009), but as an amateur society, the Tampere Entomological Society, for one, accepts anyone willing to join. The new members are formally accepted in the society's meeting.

The third oldest entomological society in Finland is the Entomological Club of the Turku Zoological and Botanical Society, established in 1948. The society is closely connected to biology students and researchers at the University of Turku, but it aims to bring together both amateur and professional naturalists.

The above-mentioned societies are generalist entomological societies. The largest entomological society is the Finnish Lepidopterological Society, with its ca. 1100 members, established in 1955. The society brings together butterfly and moth enthusiasts from beginners to professional researchers and has a couple of local clubs in different parts of the country. In 2010, the Lepidopterological Society, with the Helsinki Entomological Society and the Entomological Society of Finland, established Hyönteistarvike Tibiale Ltd, a company selling entomological equipment and literature.

The sixth society, the Insect Club Cupido, was established in 1989. Organizationally, it is placed under the local Hämeenlinna nature conservation association, which is part of The Finnish Association for Nature Conservation (Suomen Luonnonsuojeluliitto). Finally, the seventh Finnish entomological society is the Oulu Entomological Club that functions in close collaboration with the Finnish Lepidopterological Society and the Zoological Museum of the University of Oulu. The club is not a formally registered association but an informal collective of amateur and professional entomologists, biology students, and photog-

raphers. The roots of the club go back decades to the former Friends of Nature Oulu. The club became reactivated in 2014 by some active entomologists based in Northern Finland.

Lepidoptera (butterflies and moths) and Coleoptera (beetles) have traditionally been popular subjects of entomological observation, but more recently also Odonata (dragonflies) have interested larger numbers of people (Kaplan, 2009). The latest newcomer to the Finnish entomological scene was the Finnish Dragonfly Society, established in 2006. The interest in dragonflies was rising in the wake of the book *Finnish dragonflies* (Karjalainen, 2002), and the dragonfly enthusiasts organized themselves into a society. However, it was soon realized that the administrative duties in running a registered association took time from the actual study of the dragonflies, and in 2016 the association was disbanded. Interest in dragonflies seems to be still on the rise, and activities are continued without the association.

The activities of Tampere Entomological Society, like the other societies, follow a seasonal cycle also described by Kaplan (2009). From autumn until spring, the emphasis of activities is indoors. The Tampere society holds monthly meetings at the local natural history museum, typically attended by 15-20 people. At the museum, the amateurs have access to the entomological collections for referencing their observations. In the meetings, the members or invited experts give presentations on certain taxa or entomological fauna of a specific geographic area. Photos and specimens are identified together, and the members inform their fellow entomologists of their findings (also Hopkins and Freckleton, 2002). The Tampere society has also organized identification meetings, where the members learn to identify species with the help of a microscope aided by more experienced peers. The individual entomologists commonly travel abroad, combining leisure and entomological observation, and images from these trips are shared in the societies' monthly meetings. The entomologists describe the meetings as 'colloquial'; afterward, the younger entomologists may go for a beer together.

Summer, then, is a time of intensive fieldwork, and meetings are on hold. Some entomologists

prefer to venture alone, whereas others go with a friend or a group of peers. Some of the entomological societies organize field trips aimed at beginner entomologists and the public at large. For entomologists, there are several criteria for choosing the destination for a field trip. It may be individual interest to see a particular species, or there may be external demand for knowledge on insects in a given area. The experienced amateurs of the Tampere Entomological Society collaborate closely with conservation professionals and environmental administration and carry out commissioned studies. I will get back to this collaboration more closely below.

In addition to monthly meetings and fieldwork, the entomologists keep written records of their findings. These are often published in the societies' journals and possibly nowhere else. For this reason, the societies' publications are a valuable information source, for instance, for compiling the red list of endangered species (Hyvärinen et al., 2019). The Helsinki Entomological Society published a series, *Notulae Entomologicae*, from 1921 until 1989. From 1990, the Society, together with the Entomological Society of Finland, the Finnish Lepidopterological Society, and the Entomological Club of the Turku Zoological and Botanical Society published the peer-reviewed scientific series *Entomologica Fennica*, with four issues annually. In 2019, *Entomologica Fennica* was terminated, and papers falling within the journal's scope are submitted to *Annales Zoologici Fennici*, an international peer-reviewed journal published by the Finnish Zoological and Botanical Publishing Board.

Additionally, the societies publish their journals for the members. The Finnish Lepidopterological Society has published *Baptria* journal quarterly since 1976. The journal covers all aspects of entomology focused on butterflies and moths, from the dispersion, behavior, identification, and conservation to issues related to amateur lepidopterology in general. The Tampere Entomological Society has published its *Diamina* journal annually since 1992. The journal publishes articles in various formats, from field reports to shorter notifications, annual reviews of larger butterflies in the region, and essays on aspects of amateur entomology. In addition to entomological articles,

the journal publishes texts that can be characterized as cultural entomology. For instance, a member of the society wrote on butterfly-themed stamps worldwide (Koivikko, 2019). Finally, the Entomological Club of the Turku Zoological and Botanical Society has published a web-based journal called *w-album* since 2004. The journal reports studies on local entomological fauna and is published irregularly, depending on the availability of articles from the society members.

The entomological societies are networked nationally and internationally. The Helsinki Entomological Society used to organize national entomological days to bring together amateur and professional entomologists, but recently the collaboration has taken other forms. The Finnish Lepidopterological Society organizes Entomological Weekends annually. The entomologists had a volunteer-run internet discussion forum and a database for entomological observations. However, these have recently been integrated into the Finnish Biodiversity Information Facility (FinBIF, laji.fi), coordinated by the Finnish Natural History Museum in Helsinki.

The Helsinki Entomological Society has organized meetings of Nordic entomologists. The Nordic societies take turns in organizing the meetings, and now also the Baltic countries belong to the network. Furthermore, the entomological societies exchange their publications internationally: for instance, in the meetings of the Tampere Entomological Society, Swedish, Danish, and Spanish entomological journals were circulated. While many amateur entomologists are not multilingual, the use of scientific names for the species works as a lingua franca. I will return to the issue of Latin names shortly.

The interest in dragonflies discussed above exemplifies the significance of new identification literature available in one's language (Lemelin and Fine, 2013). Pearson and Shetterly (2006) write how popular field guides, with quality photography, encourage more professionals and amateurs to go to the field and study organisms in greater depth. The publication of field guides accelerates the development of skills. Pearson and Shetterly describe how, with a field guide in hand, an enthusiastic amateur may gather reliable information, expanding the data set to the point

that the field guide may become obsolete. Lack of reliable literature and identification guides useful for the amateurs have been identified as one of the major barriers to amateur entomology (Lester et al., 2014), but the situation has recently improved. Many of the recent Finnish entomological books have been authored by experienced amateur entomologists, highlighting the fuzzy boundary between amateurs and professionals (Meyer, 2005). For instance, two active members of the Tampere society authored the book *Suomen vesiperhoset - Trichoptera of Finland* on caddisfly (Salokannel and Mattila, 2018).

Another development making amateur entomology more accessible than before is the internet and social media. Naturalists' social media groups are also used for recruiting participants to citizen science projects, such as the Bumblebee Watch or the Finnish mushroom atlas. While social media and the internet may create new citizen scientists, it takes time before the new enthusiasts grow into expert amateurs. Interestingly, while there are only a few women in the entomological societies as active members, in the social media groups such as "The Bugs of Finland," women are actively posting images of insects and asking for help in identification. Taking photographs and sharing them on the internet seems to motivate many beginner entomologists. Social media may provide equal space for participation, independent of time and place, and perhaps in being somewhat 'faceless' also a space with less emphasis on gender or expert hierarchies. The gender balance in the entomological societies seems to be also changing, as the Tampere example attests. Many female society members are trained biologists, working, for instance, in conservation, and have joined the society both for professional development and personal interest.

An amateur entomologist career

Köhler (1989) has presented 'the typical career path' of an amateur entomologist based on a study of German amateur entomologists. According to him, the path begins with collecting specimens, as the amateur naturalist mimics imagined professional scientists. As the amateur becomes more knowledgeable, they want to develop their

identification skills, so they find their way to the entomological societies. As the skills and knowledge increase and the amateurs can mentor younger naturalists, they are further motivated to continue on the career path. Amateur entomology may be 'omnivorous' initially, but a more experienced entomologist usually chooses an area of specialization. Finally, they may end up in a leading role in the society and receive esteem by giving lectures, publishing, and participating in scientific and/or conservation work. According to Köhler (1989), entomologists are also motivated by finding a new species and having it named after them. Factors further maintaining the naturalist career include enchantment by natural diversity, the practices and openness of the entomological society, and friendships formed in conjunction with entomological activities. While Köhler's (1989) career path is structured along with the production of scientific knowledge, it points to the importance of affects in maintaining the career.

The typical career path applies to Finnish amateur entomologists, at least to the more experienced ones and the key persons in entomological societies. For example, the chairperson of the Tampere society, Tero Piirainen, disclosed how his entomological career started as a young boy. Like many entomologists, Piirainen started with butterflies but expanded his activities to cover other insect groups. Piirainen has a professional career in the IT sector. As an amateur entomologist, he works as an expert, for instance, in the national expert group for Diptera, alongside professional entomologists. The group aims to support the conservation, amateur observation, and research on Finnish Diptera species and maintains the checklist of the Diptera of Finland. Piirainen has visited schools to talk about bugs to children, and having unparalleled taxonomic expertise, he has taught identification skills for university biology students. The distinction between amateurs and professionals seems somewhat redundant for the entomologists; the distinguishing factor is expertise, regardless of professional or institutional status. Professionals may 'moonlight' as amateurs or become one as they retire, and it is not unheard of that an amateur would move into a professional entomologist career. Ellis and

Waterton (2005: 677) have described this as an implicit 'ladder of esteem,' which is "an incentive to learn, to gain more advanced knowledge of species and their attributes. It appears to be an important ordering device within naturalist communities, dictating patterns of interaction and learning."

While some entomological societies have youth programs (Kaplan, 2009), the Tampere society has chosen a different approach. Although there are concerns about the continuity of the society with the aging of active members and new aspiring entomologists are warmly welcomed, becoming integrated into the semi-scientific society might not be straightforward. "We cannot run a children's program; it would not serve our purposes then," explained an interviewed entomologist. One practice beginning entomologists may find intimidating is the use of Latin species names, as one interviewed entomologists remembered:

I remember when I started to attend, it was totally astounding when there are a thousand larger butterflies and more than a thousand smaller moths and three thousand beetles, and people talk using scientific names just like that, and everybody knows right away, oh yes, that butterfly lives in that and that village. [I28]

I thought the use of Latin names for species could be interpreted as a sign of scientism (Haack, 2009), a worldview emphasizing science as the best source for human knowledge and willingness to affiliate with it, "mimicking imagined professional scientists" (Köhler, 1989). But the scientific coordinator of Tampere Entomological Society, Juha Salokannel, demonstrated with a series of three questions in the Society's meeting that the amateur entomologists are not using Latin names out of snobbery:

(i) "How many of you are familiar with the species *Phigalia pilosaria*?" Everybody in the meeting raised their hand (except me); (ii) "How many of you know the name of the species in Finnish?" No hands; (iii) "And how many of you would be able to translate what the name of the species means?" Still no hands; the entomologists looked at one another, puzzled. The species in question has a Finnish name, 'sulkamittari,' but the Latin 'pilosaria' was more familiar to the entomologists.

Most of the amateur entomologists do not know Latin beyond the species names. The use of Latin names has been unavoidable, as, at the time when the more experienced entomologists started, even the domestic species did not have common names. In the 1980s, Finnish names were used for some of the most common butterfly species. Learning the Latin names is instead a sign of the amateurs' devotion. The Finnish species names have recently started to take over due to new photography-oriented amateur entomologists and new identification literature. The chair of Tampere Entomological Society, Tero Piirainen has participated in a working group developing the Finnish nomenclature for Diptera species. According to him, the Finnish naming proceeds in bursts, often in connection to book projects.

The Latin names may give the species – and thus the amateurs - a certain scientific charisma. Common species have Finnish names, and therefore, a species that is now called by its Latin name may be recently discovered and, as such, of particular interest to the entomologists. This kind of scientific charisma does not, however, attract all naturalists:

When you for example ask someone, "What is this spider?" and you hear the scientific name, the interest just vanishes. So it's just some random thing; it doesn't even have a Finnish name. [I6]

For some, the Finnish species names and the aesthetics and cultural history inscribed in them are an essential part of the amateur naturalist endeavor. The interviewee described how they could not get the same kind of feel for a species if they could not talk about it in their language. Creativity and innovation have an important motivating role for some amateur entomologists. Creativity may be related to the names or the aesthetics of the insects. The chair of Tampere society also draws insects, and his scientifically accurate, detailed drawings are visible in the society's *Diamina* journal and illustrations at the local natural history museum.

Proceeding on the 'career path' offers the amateurs opportunities for creativity related to capturing and identifying insects. I was told of an instance where an amateur wrote to the ento-

mologists' discussion forum that they had identified over a hundred beetle species from an area in half an hour using only a plastic bucket. They then left the fellow entomologists guessing how this was possible before revealing the method: some ant species have a "waste management site" where they take the inedible parts of their prey; the entomologist had taken such a waste pile with the bucket and identified the beetle species from the discarded backplates. As citizen scientists, the amateurs are not only following the scientific methods but developing new ones, rewarded by acknowledgment among peers.

While Köhler's (1989) amateur career path seems to apply to modern amateur entomology, it is also limited and dated. The amateur entomologists' motivations are not captured by a desire to climb a ladder of esteem. The career path may take many shapes, and the entomologists are increasingly motivated by environmental concern, often featuring 'entomological statesmanship' called for by Smith and Kennedy (2009). The amateurs are pushed to maneuver and "to take on enough of capital-S Science to gain legitimacy among credentialed scientists" (Wylie et al., 2017: 411) and environmental authorities. In the society meetings, the affective side of entomology and the role of species' charisma can be expressed.

Affects in amateur entomology

Lorimer's (2007) concept of nonhuman charisma points to the importance of affects in research and conservation. Lorimer distinguished three kinds of nonhuman charisma: ecological, aesthetic, and corporeal. Ecological charisma is based on ethology, the study of animal behavior. The physiology of the human body sets limits to our perception of nature and the detectability of species. We most easily detect those species whose spatial and temporal rhythms are compatible with ours. As visual animals, we easily detect large colorful butterflies during daylight, but to study moths means tuning the daily rhythms to match those of the nocturnal insects. Species requiring extra effort may be charismatic to some entomologists if there is a potential for discoveries.

Insects attain ecological charisma also from their status as a species, for instance, being endan-

gered or previously undetected in a given area. Ecological charisma is relational and depends on the identification skills and interests of an amateur. An amateur reported on the results of a local study in the entomologists' email list:

In addition to finding interesting species in the area, one wouldn't believe we would find SUCH interesting species and even so many different species. No endangered larger butterflies were found, but "locally fun species."

'Locally fun species,' less frequently seen in the region, may have ecological charisma regardless of not being endangered. Also common species may be ecologically charismatic. One amateur entomologist, who had been studying beetles in an area, described the catching efforts in an entomologist meeting: "We didn't get anything really good—just ordinary earth stompers," referring to beetles commonly known to live in the area. Talk of 'earth stompers' indicates an affinity towards the insects, an ethical notion of sharing the Earth with other "stompers." A 'really good' species would have been a species previously unknown in the area and with a possible endangered status that could have served as ammunition for conservation.

For the amateur naturalists, the ecological charisma of insects seems to be primarily charisma of the species—not of insect individuals. Insects may gain individual ecological charisma as entomologists sometimes take larvae home to grow into adult insects to determine the species and half-jokingly name them. Occasionally for some entomologists, the insects may become momentarily personified through the use of personal prepositions: "S/he perhaps takes cover that way by imitating a hymenopteran." Even though the insect's behavior is understood to be instinctive, the amateur emphasizes with its lifeworld, indicating a profoundly ethical perspective.

The second type of nonhuman charisma defined by Lorimer (2007) is aesthetic, which can be further specified into 'cute' and 'feral' charisma. We often find species with recognizable faces, especially large mammals such as the panda bear, charismatic. 'Monstrous' insects radically differing from an anthropocentric aesthetic norm have feral charisma. Entomologists studied by Lorimer

(2007) were critical towards cuddly charisma and admired instead organisms that appear wild and chaotic. Feral charisma entails the complexity, autonomy, and specific kind of beauty of the other. Different kinds of aesthetic charisma may play a role at different stages of an amateur entomologist's career, as highlighted in an interview:

I suppose in principle people are interested in butterflies for the same reason as the rest of nature: they are aesthetically pleasing . . . look nice. But when one starts to get interested in other insects, I suppose it's more like an interest in biological diversity in general and so insects basically just because they are so big a part of this diversity . . . and quite an exciting part of it. [I1]

The different types of nonhuman charisma order the amateur and professional naturalists and place them on different stages of the career path. Interest in pretty butterflies is typically considered an activity for beginning entomologists. The Tampere Entomological Society has consciously employed the aesthetic charisma of insects in recruiting new aficionados: the society regularly exhibits its activities at a gardening fair, and for this, they have put together showy collections of tropical butterflies to attract visitors. In an expert context, the amateurs avoid referring to cuddly-type aesthetic charisma, but amongst themselves, they may easily call species "pretty." Appreciation of feral charisma is connected to understanding the ecological value of the species. In a society meeting, the entomologists jokingly referred to a rare species as "small and ugly, so we shouldn't show a picture of it to the environmental authorities," indicating that the authorities might not understand the feral charisma and thus the conservation value of the species.

The third form of nonhuman charisma is corporeal charisma, which Lorimer (2007) again divides into epiphanies and jouissance. By epiphanies or moments of enlightenment, Lorimer (2007) depicts encounters that in the narratives of amateurs have taken place in childhood and have had an emotional effect on them. The encounter may be unique or may occur periodically, such as bird migration. Many of the interviewed entomologists described some kind of epiphanies—moments when the miraculous world of insects

revealed itself to them, and the spark for amateur entomology was lit. These epiphanies often seem to be social: another person, such as a more experienced entomologist, initiated the new entomologist's career. An interviewee told how he tried to inspire his children into naturalist activities by taking them to natural history museums. However, as it happened, he was himself blown away by the insect world.

Others have to travel to the other side of the world to experience something marvelous. But one only has to look into the grass or turn a leaf, and there's a marvelous world. [I28]

The other kind of corporeal nonhuman charisma, jouissance, means emotional and intellectual satisfaction and a feeling of manageability that comes from, for example, identifying a species. There were likely moments of jouissance, as the amateur entomologists in Tampere found an aquatic butterfly species previously unknown to science in 1998. The species was named *Oxyethira tamperensis*, and 20 years later, the place where it was found was protected. The insect is just a couple of millimeters long, with hairy wings, so its charisma is rather ecological, related to its scientific and conservation status, than aesthetic. Similarly, in the entomologists' meeting, one of the entomologists said modestly: "I have one small species here." A red cardboard box with a tiny copper-winged insect pinned in it was passed around. As it soon turned out, the species was a previously unknown species to Finland. The understatement of "one small species" highlighted its ecological charisma and the jouissance of the find.

The amateur entomologists themselves possess a kind of feral charisma that they cultivate with jouissance. The entomologists may describe themselves as researcher types and independent thinkers with an excellent memory, placing themselves proudly in the recreational fringe (Lemelin and Fine, 2013). As an interviewee mentioned half-jokingly, some of them may have neurological diagnoses, "but you don't have to be more odd than that" [I28]. The entomologist society provides a refuge for the members, many of whom may be alienated from modern society and its disregard of the environment. At the same time, the expert

roles taken by the society members may legitimate their choice of fringe recreation.

According to Lorimer (2007), the charisma of species provides an acceptable forum for expressing the human-nonhuman attachment behind amateur naturalism and nature conservation. Charisma acts as a counterbalance to reductionist discourses and practices of conservation biology that emphasize, for example, molecular biology methods in identifying species. Yet, the expert amateurs also adopt technoscientific methods of identification when necessary. There is a full spectrum of different types of nonhuman charisma at play in amateur entomology, employed and expressed differently in diverse contexts. Feral charisma builds on respecting the complexity, autonomy, and specific kind of beauty of the other, and Lorimer holds it a fundamentally ethical relationship.

Between neoliberal technoscience and ethical nature contract

The members of Tampere Entomological Society collaborate with professional researchers and environmental administration nationally, regionally, and locally. Nationally, the amateurs collaborate with The Finnish Natural History Museum and its efforts in collecting data on biodiversity in the Finnish Biodiversity Information facility. Some of them have participated in the 18 working groups set by the Ministry of the Environment to compile the Finnish Red List of Endangered Species, the latest issued in 2019 (Hyvärinen et al., 2019). The working groups consisted of 170 species experts, including researchers in nature conservation and administration, conservators and researchers in natural history museums, staff in research institutes, and experienced amateurs.

Regionally, the Entomological Society holds annual meetings with environmental authorities to determine their knowledge needs and how the society members can respond to them. The local entomologists have participated in compiling the regional biodiversity program and in setting species conservation priorities. The entomologists monitor endangered species in the region, report to the authorities, and organize restoration and maintenance of habitats of endangered species,

such as the rattle grasshopper (*Psophus stridulus*). As the regional environmental authority does not have resources for this (personnel or specialized expertise), the amateur entomologists are commissioned to do the work. The volunteers are compensated for costs, but besides that, the work is done on a voluntary basis.

At least two different, opposite readings of the situation are possible. We could take the tasks performed by the amateurs to be indicative of neoliberalism, where citizens are expected to voluntarily take up tasks that previously belonged to public agencies (Vohland et al., 2019; Kimura and Kinchy, 2019). However, the amateurs do not perceive themselves as exploited neoliberal subjects in top-down citizen science. They are actively involved in determining the forms and content of collaboration, conscious of their expertise and experience. The amateur entomologists see the environmental administration and professional conservationists as necessary allies, with whom they have a functional division of labor. The expert amateurs are emphatic of the situation of environmental administrators, with budget cuts limiting the scope of their work, but at the same time aware of the institutional power the environmental officials wield. In a mutual alliance, the amateur entomologists provide the professionals with 'ammunition for conservation' with their data. Simultaneously, they express their puzzlement in "how little the environmental officials seem to know" [I29], pointing to the limits of academic training compared with practical experience (Cornwell and Campbell, 2011). Also the ethical commitment of the amateurs may set the bar high for professional science that is also concerned with careers and organizational regulations.

Locally, the entomologists collaborate with municipalities, especially with the city of Tampere. As the city grows, so does the demand for surveys on flora and fauna in areas planned for construction. One such area of interest is Lake Lidesjärvi, located near the city center of Tampere. The lake and its surroundings are an important nature and recreation area, but it has been targeted for different types of development over the years due to its location. In 2001 the entomological society surveyed the insect fauna in the area. The study

yielded over 1200 insect species (Piirainen and Salokannel, 2019). In 2003, together with other local conservationist and naturalist societies, the entomological society made an initiative to the city to establish the lake as a nature conservation area. The city council did not respond to the initiative but instead continued to plan the area's development into a recreational park for families. For this, the entomological society was commissioned again during summer 2018 to study the insects in the area. This time the emphasis was on butterflies. Overall, 650 species have been found in the area, including five endangered species and two species possibly previously unknown to science. In its report to the city, the society made detailed recommendations for trees and areas to be left untouched to provide habitat for insect diversity also in the future. It seems the message of the naturalist societies is finally being heard among the local decision-makers, as the newly elected mayor of the city has proposed the lake to be conserved.

In the local case, the amateur entomologists participate as scientific experts on entomological fauna. But their role is dual, as they also participate as active citizens, carrying out community-driven citizen science together with residents and other local naturalist societies, such as the botanical and bird associations. For them, the use of data becomes a form of civic empowerment (Kasperowski and Hillman, 2018). The dual role requires some maneuvering (Wylie et al., 2017), as the preferred self-image of the entomologists is "an expert-type amateur society that affects decision making by providing knowledge", as an interviewee put it. The entomologists aim to steer clear from roles that could be considered openly 'political'; they would prefer the data to speak for itself and lead to desired outcomes for nature. Highlighting the scientific character of the entomological society is, however, a double-edged sword. The expert image may exclude some aspiring entomologists and make amateur entomology less accessible for a broader public. The chair of the society did not consider it problematic, though:

The general opinion is not that there is too much emphasis on science. It is a conscious

choice, and we are not planning to give up on it. It is not considered a problem, either, if we simultaneously close some doors in practice. There are other forums for easier, more popular, or more entertaining amateur entomology, such as groups on social media, and I think we live currently nicely side by side with them.

The members of the entomological society do not contribute equally to the knowledge requests (Strasser et al., 2019). People responsible for various studies ask the other society members to provide data on the species and locations of interest. For example, in the Lake Iidesjärvi entomological study, 12 members of the society took part. According to the yearly report of the society, in 2018, altogether 20 members of the society participated in the commissioned research activities – most of them in one study out of the four carried out by the Society that year. The entomologists cannot respond to all the knowledge needs and calls for participation to leave time for fieldwork driven by personal interests. While some amateur entomologists are motivated by the production of scientific knowledge and participation in conservation, their interests are more diverse. An account by Rasimus (2019) on the finding of a rare species *Tipula (Pterelachisus) crassicornis* exemplifies how amateur interests may not be bound by pre-defined knowledge needs or scientific disciplines. The account begins:

May 22nd was a hot day in Pirkanmaa region. In the early evening, I had taken two Malaise traps to Orivesi and decided to drop by Siikakangas in Ruovesi to see whether there would be insects' evening swarming in the air. I chose a familiar observation spot in an old-growth pine forest by the shore of Kilpilampi pond at the Siikaneva bog. As the evening sun was still shining low at around 22:15, I managed to net two rather large, dark-colored crane flies, one male, and one female, which I freshly deposited in 70% ethanol.

The account provides the reader with information on where and how the mentioned insects may be found, but the writing style distinguishes it from scientific disciplinary accounts. The observer is not faded out but is an active agent in the story. The text explains how the species was con-

firmed under a microscope the next day and was revealed to be a species previously observed only in Eastern Finland. Moreover, for 120 years, the species was not encountered at all, which made the discovery in Ruovesi, Western Finland, particularly interesting. The text continues as a detective story, taking the protagonist to the Natural History Museum in Helsinki, where old samples of the species are kept. The samples turn out to contain little information but are accompanied by a number that takes the entomologist to the collector's notebooks kept in the museum collections. The detailed fieldnotes take the amateur to entomological field excursions "on the summery roads and blossoming meadows of the 19th century Northern Karelia" and the text recounts the finding of *Tipula (Pterelachisus) crassicornis* by Emil Ivar Grönvik in 1865. The text opens up one among the myriad scientific processes at work (Cornwell and Campbell, 2011). The example shows how experts develop intimate relationships with objects of expertise and learn to observe, imagine and understand them (Knorr-Cetina, 2007). This kind of transdisciplinary accounts may make science more relatable, accessible, and lively.

In addition to pragmatic time use, there may be other reasons amateurs might be reluctant to carry out commissioned surveys or donate their data. Historically, there has been a long-standing 'vital contract' between professionals and amateur naturalists based on reciprocity (Ellis and Waterton, 2005). The amateurs have donated their observations, data, and knowledge to the professionals freely and willingly, with the expectation that the records will contribute to the advancement of a wider good and the accumulation of scientific knowledge. The vital contract has become complicated by other actors entering the field of ecological knowledge production. Consultants may approach amateurs for their specific knowledge, and through them, the question of monetary compensation enters the equation. The amateurs may be pushed to consider why they would give their data for free to someone who benefits from it financially. Another issue is that the surveys made for land use planning do not primarily aim at conservation. The data is used for enabling rather than constraining urban development, which always results in some loss

of biodiversity. The amateurs might not want to participate in "rubber-stamping" land use in an area with their data.

In addition to the 'vital contract' between amateurs and professionals, the 'first contract' between amateurs and nature binds the amateur entomologists ethically (Ellis and Waterton, 2005). The first contract obliges the amateurs to not only act as scientific experts but to take on more political and activist roles and function as 'entomological statesmen' defending biodiversity. In an interview, after emphasizing the expert roles of amateur entomologists, one of the amateurs evaluated the importance of amateur naturalism, highlighting the dualism of the activity:

It is essential that things are good at home and that work is not of the silliest kind, but amateur naturalism is maybe, after all, the most important thing in the world, and one cannot use time better than that. [13]

A widely discussed and somewhat controversial aspect of amateur entomology, which I take to illustrate ethical entomological conduct, is killing and collecting insects (Lemelin and Fine, 2013). Amateur entomologists perceive catching insects as part of regular scientific practice. Only the largest and visually distinctive insects can be identified accurately in the field or afterward from photos without capturing them. Most of the insects are so small that a researcher has to capture some individuals to identify the species using microscope or DNA identification methods. Entomology guidebooks have had relatively straightforward instructions on killing methods as an essential part of entomology, but recently field guides take an apologetic tone towards collecting (Pearson and Shetterly, 2006). According to an interviewed entomologist, these sections are for "more sensitive people." Especially among the younger entomologist generation, the thinking seems to be that insects should not be killed without reason, even though the amateurs may struggle to put these ethics into words as the practice of collecting is so established:

I don't know how you can explain it, but most amateur entomologists also think that we won't kill anything without grounds. [...] We use a lot

of traps that don't have poison, so the butterflies are kept alive and . . . Even if it doesn't matter that much, but it's just like . . . [13]

I take the quote to indicate the first contract between amateur and nature, a reflective empathy towards insects (Aaltola, 2018) – a combination of affective other-directedness and rational deliberation. There seems to be an expanding group of entomologists interested in certain insect groups and who do not collect specimens but rather document their observations by taking photos. There is a difference between collecting insects like stamps, and collecting them for scientific purposes, to provide 'ammunition' for conservation (Hopkins and Freckleton, 2002). This difference is not evident to beginner entomologists, and killing insects is frequently problematized, for instance, in the popular social media group "Bugs of Finland." The amateurs accept the killing of insects pragmatically, but a stamp-collecting type of undiscriminating collecting is no longer looked upon favorably. The difference has to be communicated to aspiring entomologists, and it also invites citizen science projects to consider how to account for the first contract and ethics in their methodology.

Discussion: Catering for diversity

Amateur entomologists participate in citizen science in various ways, but amateur entomology cannot be reduced to any narrow or single understanding of citizen science. Amateurs provide data for national databases, research projects, and regional conservation, but they are not limited to data providers even in that role. They participate in analyzing and reporting the data alongside professional researchers. The amateur entomologists go beyond participation – they decide and design themselves the studies they carry out and the various public outreach activities they participate in. The experienced amateurs train the future professionals on university taxonomy courses, turning the recent roles of amateurs and experts upside down. In these activities, the amateur entomologists' use of data is a form of civic empowerment (Kasperowski and Hillman, 2018). At least the amateur elites can move between scales and contexts

to realize their expertise for effective citizen science (Kimura and Kinchy, 2019).

The adoption of scientific standards has a boundary-bridging role (Ottinger, 2010). The amateur entomologists are part of the epistemic culture of natural sciences; they have interiorized the processes of scientific knowledge creation (Knorr-Cetina, 2007). Nevertheless, they are only partly scientists – they are also much more. In this paper, I have aimed to shed light on the rich culture of amateur entomology. Amateur naturalists develop intimate relationships with the insects they study, and they are linked to them "through libidinal sequences of wantings" (Knorr-Cetina, 2007: 371). These libidinal wantings may be connected to the diversity, beauty, and autonomy of insects, but also to the colloquial amateur-expert entomological society and the possibility to proceed on one's amateur entomologist career and become an acknowledged expert, able to help others on their path. These libidinal wantings portray amateur entomology both as citizen science, leisure, and civic action. However, for many amateur entomologists, I have argued, the primary libidinal wanting is connected to the so-called first contract between amateurs and nature. The intimate relationship of having access to nature and being obliged to care for it is fragile. The ethical first contract is constantly in danger of being dismissed or ridiculed by capital-S Science with its epistemic practices. The scientific standards themselves require democratizing and diversifying (e.g., Ottinger, 2010), as the perception of scientific worldview being superior in every context is flawed (Irwin, 1995).

As epistemic subjects, amateur entomologists encompass several kinds (Kasperowski and Hillman, 2018). They participate in epistemic cultures on par with professional scientists, but they may hold multiple agencies, as illustrated by the example of knowledge production and conservation concerning Lake Iidesjärvi in Tampere, Finland. The agency of amateur entomologists may rotate between different agencies, depending on what is at stake in a given situation (Knorr-Cetina, 2007). The 'entomological statesmanship' enacted by amateur entomologists is not only scientific knowledge production. At best, amateur entomology has an opportunity

to democratize science and help imagine more sustainable science, bringing the first contract to bear on epistemic practices. Here, however, I fear the amateurs are somewhat in danger also from themselves in reinforcing the norm that only those with data have a voice (Wylie et al., 2017). It may then fall on STS analyses to show the diverse values of amateur entomology for science and the amateurs themselves.

Strasser et al. (2019) have called for a better understanding of the epistemologies of participatory research in order to better assess the politics of citizen science. Contemporary discourses on participatory research are challenging the current regime of knowledge production, based on the separation of institutionalized professional expertise and the lay public as the consumer of scientific knowledge. Citizen science programs should be organized in a way that does not bring additional burden to the amateurs. While they bring their specialized expertise to bear, citizen science projects should make visible the affective side of amateur entomology. If the fundamentally ethical first contract between amateurs and

nature is not respected by initiatives aiming to tap into the amateur knowledges, the amateurs are faced with choices that might result in withdrawal from participation.

Citizen science seems to be somewhat uncomfortably positioned between a neoliberal need for innovation and measurementality and a need to find new sustainable ways of living. Environmental field sciences have adopted a relatively narrow definition of citizen science, treating citizens as data sources. The urgency to find novel ways of responding to environmental crises points to community-driven science being able to question the current state of affairs. There are signs of growing interest in amateur entomology. However, one should not be too quick to channel these emerging amateurs into citizen science programs with limited scope. As Turnhout et al. (2013: 592) have written, "the diversity of life needs to be fostered by a diversity of relations with and ways of knowing biodiversity." Amateur entomology is a holistic and diverse engagement with nature, and it should be cultivated as such.

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