CITIZEN SCIENCE:
THEORY AND PRACTICE

Hunters and Gatherers – Understanding Swedish Hunters' Voluntary Reporting of Hunting Data as Social Interaction

RESEARCH ARTICLES

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ABSTRACT

Biodiversity research and governance are increasingly reliant on data collected by volunteers, including through citizen science. This begs the question of how data contribution is made sense of by volunteers, and how this understanding relates to their willingness to contribute with data. In this study, we focus on the case of hunters reporting harvest data to the Swedish Association for Hunting and Wildlife Management (SAHWM). We use mixed methods to analyse survey responses from 2,358 hunters in Sweden. We employ symbolic interactionism as a lens to analyse what meanings hunters give to the act of submitting data to the SAHWM and how this meaning is shaped by social interaction. To understand how these meanings may connect to the willingness of hunters to contribute data, we also draw on self-determination theory to work with the concepts of intrinsic and extrinsic motivation. We find that hunters tend to perceive data submission as meaningful if it contributes to better wildlife management, but also that they pay attention to how other actors may use and interpret harvest data. We observe that hunters see the submitted data as a basis for discussion on how wildlife management and hunting practices ought to be carried out and perceive the SAHWM as a voice for the hunting community. We conclude that viewing data submission as social interaction provides deeper insight into the meanings that volunteers give to data submission, and thereby when and why it makes sense for them to contribute data.

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INTRODUCTION

In the face of climate change and biodiversity loss, there is an ever-increasing demand for knowledge about the state of the environment (McKinley et al. 2017). Knowledge on species abundance and distribution often depends on big data sets, covering large geographical areas and long periods of time. Volunteers can collect large amounts of data, which would be unattainable for research institutions or state agencies alone (Silvertown 2009). Such voluntary data contribution, often termed citizen science (McKinley et al. 2017), comes with further potential. This includes the possibility for increased public awareness and engagement in environmental matters and for more inclusive and democratic science (Wagenknecht et al. 2021; Bryn et al. 2023; Moon et al. 2024). Its potential for inclusive knowledge production may be particularly important, in the context of environmental governance, if the knowledge citizen science produces and the management decisions based on this knowledge are perceived as trustworthy and legitimate by the public (Bonney et al. 2021).

If the abovementioned potential of citizen science is to be realised, it is important to understand how and why people engage in voluntary data reporting. There is a growing body of literature on what connects volunteers to various citizen science programmes. These studies point to the importance of intrinsic motivation (West and Pateman 2016; August et al. 2019; Schumann et al. 2024), that is, people engage in citizen science because they perceive it to be valuable in and of itself rather than because of external pressure or rewards. Two dimensions are particularly salient, namely learning (Domroese and Johnson 2017; Maund et al. 2020; Waldo et al. 2025) and contributing to the benefit of science, conservation, or management (Cherry 2018; Maund et al. 2020; Verploegen et al. 2021; Van Buskirk et al. 2024). Social dimensions of engaging in citizen science also matters, specifically socialising with other volunteers (Eriksson et al. 2023) and obtaining feedback in the context of data submission (Tiago et al. 2017; Cherry 2018; Van Buskirk et al. 2024; Waldo et al. 2025).

Most citizen science follows a contributory model, with members of the public submitting data to initiatives or organisations (Hecker et al. 2018). Yet, our understanding of voluntary data submission as a specific—and key—element of citizen science remains limited. In this article, we explore what makes people perceive data submission as meaningful, including how they make sense of and understand this process. We argue that this sense-making happens in interaction with others, for example, scientists, authorities, and other members of the public. Drawing on symbolic interactionism (Blumer 1969), we ask what can be seen when viewing data submission as social interaction—that is, as part of ongoing communication between participants in a process, and as something that is continuously interpreted and given meaning by those partaking in that interaction. We apply this lens to the citizen science activity conducted by hunters (Cretois et al. 2020) in the form of voluntary reporting of harvest data. This is a type of citizen science in which volunteers are asked to submit data from an activity (in this case, hunting) they would do regardless of the citizen science project. In this sense, our case is similar to, for example, birdwatchers reporting their sightings—one of the most prevalent forms of contributary citizen science to date—or fishers submitting data on bycatch, and it contrasts with citizen science projects that engage people in activities that are performed solely for the sake of the project. By viewing data submission as interactive process, we ask: What meaning is given to the act of submitting voluntary data by the hunters, how is this meaning shaped by social interaction, and how does this influence the willingness to report?

THEORY

A symbolic interactionism perspective highlights the interactive nature of data submission: Even if a hunter is alone while submitting, they may do this on behalf of a group (e.g., their hunting team)—most likely as a response to a request for data (from, for example, a hunting association)—and they may expect some form of feedback on their submission. Symbolic interactionism holds that people base their actions on their definition of the situation (Blumer 1969, p. 66) in which the act occurs, and this includes a definition of the self and the other(s) with whom they are interacting. This definition is fluid and depends on one's experience of interactions in previous situations and the meaning-making that occurred. From a symbolic interactionism perspective, meaning is thus always socially constructed. In our analysis, we use this theoretical lens to study meanings that hunters seem to give to the act of data submission. In addition, we explore how hunters perceive others involved in reporting data, which, as we will see, includes other hunters, hunting associations, authorities, and other data users, and how this perception is shaped by and shapes their definition of data submission. Following symbolic interactionism theory, we also explore how hunters' own identities are negotiated in social interaction. This includes hunters viewing themselves through the eyes of others, that is, they "take each other into account" (Blumer 1969, p. 108). In addition, we use the concept of trust to explore how various perceptions of others, and of one's own identity, relate to the willingness or motivation to submit data. From a symbolic interactionism

perspective, trust is connected to expectations of conduct of oneself as well as of other(s) and to the joint definition of a particular situation, with all parties acting in a way that is comprehensible to each other (Garfinkel 1963; Heslin 1968).

Earlier work on why people engage in voluntary data submission in citizen science typically departs from the individual's perspective and focuses on people's intrinsic motivation (e.g., Johansson et al. 2022; Smith et al. 2025; Waldo et al. 2025)—driven by the basic needs of autonomy, competence development, and relatedness to others—in association with interest, enjoyment, and inherent satisfaction. To be able to connect to such earlier studies, we draw on self-determination theory (SDT; Ryan and Deci 2000), which views motivation as a continuum ranging from fully autonomously regulated (i.e., intrinsic motivation) to different levels of externally controlled motivation (e.g., regulated by social pressure, norms, or financial incentives). We applied SDT to get an overview of the extent to which data submission by hunters is driven by autonomously regulated processes.

CASE DESCRIPTION

We use the case of hunters submitting data to the Swedish Association of Hunting and Wildlife Management (SAHWM; in Swedish: Svenska Jägareförbundet) to investigate voluntary data submission as social interaction. Submitting wildlife harvest data by hunters to the SAHWM has a long tradition in Sweden, with some data series going back to 1939 (Bergqvist, Liljebäck, and Elmhagen 2019). For many of the game species, such data sets are an important basis for management, since they can reflect population trends over long periods of time (Cretois et al. 2020; Lindström and Bergqvist 2022). The data is used in local, regional, and national game management to influence hunting-related policies and for research (e.g., Andrén and Liberg 2024; Bergqvist, Kindberg, and Elmhagen 2024).

About 271,500 people paid for a Swedish state hunting permit for the hunting year of 2025/2026 (Naturvårdsverket 2026). Most active hunters in Sweden are a member of either the SAHWM (~145,000 in 2026) or The National Hunters´ Association (In Swedish: Jägarnas Riksförbund; ~29,000); in addition to these, there is a handful of smaller hunting organisations. The two larger organisations have different profiles, with the SAHWM representing a more data-driven and science-based approach and with long-standing collaboration with several universities. The SAHWM also has a contract with the Swedish Environmental Protection Agency (SEPA) to collect and compile harvest data, and to use this data to estimate the total harvest of the species in question (Lindström and Bergqvist 2022).

In Sweden, the right to hunt belongs exclusively to the landowner. It is common for landowners, whether they are hunters themselves or not, to lease hunting rights, usually to several hunters that join together and form a hunting team. Hunts themselves can be team-based, for example when concerning moose or red deer, but can also be individual when concerning small game such as grouse and hares. Usually, each team assigns a so-called rapporteur: a member who is responsible for collecting and submitting harvest data for the whole team. The SAHWM has 14 offices across the county, and regional representatives (i.e., hunting consultants) who act as contacts for hunting teams in their region. Currently, more than 8,000 hunting teams report to the SAHWM each year (Bergqvist, Liljebäck, and Elmhagen 2025), and harvest reports cover large parts of Sweden and concern a multitude of species.

In Sweden, it is mandatory to report harvest of some game species, such as moose and red deer. For most other species, however, reporting of harvest is voluntary. In this study, we investigate the willingness of hunters to submit voluntary harvest data. We see this as a form of citizen science (Cretois et al. 2020), where hunters put in (unpaid, since there is no monetary compensation involved) time and effort to provide data that increases knowledge of Swedish wildlife populations. See ENETwild Consortium (2025) for how Sweden's hunting data collection system compares with those in other European countries.

METHODS

The study is based on a transdisciplinary collaboration between the SAHWM and academic researchers interested in understanding voluntary submission of data. To investigate this, we used a survey-based mixed methods approach (Creswell 2014).

QUESTIONNAIRE DESIGN AND DISTRIBUTION

To be able to submit harvest data, hunters are provided with an account in Viltdata, the database holding all harvest data collected by the SAHWM, (https://www.viltdata.se/). All hunters can register in Viltdata (i.e., a SAHWM membership is not required), but most commonly, it is a designated rapporteur who gathers harvest data from their hunting team. We sent a questionnaire to all those who were, at the time of the first send-out, registered in Viltdata, had logged in and had approved of new European Union General Data Protection Regulation (EU GDPR) conditions set by the SAHWM in May 2022. As a result, the questionnaire was sent to 6,294 hunters of the around 20,000 registered users of Viltdata, and 2,358 respondents completed the survey (response rate 37%).

The questionnaire (Supplemental file 1: Appendix I) contained 38 questions (in Swedish), two of which were mandatory. This included item-based questions about the rapporteur and their team, hunting habits, submission practices, associated motivations, contact with the SAHWM, and trust in relevant actors. For the questions about trust, we included items informed by salient-value-similarity theory (Cvetkovich and Winter 2003), adapting a set of questions used in a related study (Johansson et al. 2020). For the questions about motivation, we drew on self-determination theory (Ryan and Deci 2000) to cover different levels of autonomously motivated behaviour. The questionnaire concluded with two open-ended questions: one about what the respondent thought could increase or decrease voluntary data submission to the SAHWM, and one asking for final comments. The questionnaire was designed in the online survey tool Netigate (https://www.netigate.net/) and distributed by email via the Viltdata system in September 2022, with reminders after eight and nineteen days.

BACKGROUND DATA

Our respondents were mostly older (>51 years: 70%) and had hunted for many years (>20 years: 82%) (see Supplemental file 1: Appendix I for the full breakdown of the questions and responses). Most were also experienced in reporting harvest data (>3 years: 80%) and did so by themselves (81%) for their hunting team (typically 6–20 members). They gathered this data through hunting apps (39%; particularly viltdata.se), speaking to team members (28%), and by email or SMS (18%). Most of the respondents were members of the SAHWM (82%), which is a higher proportion compared with the total population of Swedish hunters with an active hunting license (of which 53% are SAHWM members); however, when comparing these numbers it is important to note that the survey was not sent to all Swedish hunters, but to those who were registered as rapporteurs in viltdata.se. Most respondents reported for teams in the south (44%) or middle (36%) of Sweden (Figure 1a). These numbers are representative of the geographical distribution of hunters in Sweden. Because almost all teams hunted moose (95%), which is subject to mandatory reporting, submitting harvest data will have been a familiar procedure. Other species (e.g., roe deer, wild boar) or groups (e.g., small game including hare, fox, and badger) were also important hunting targets (Figure 1b), and their reporting (except for red deer) is voluntary.

When asking respondents whether, and if so to what extent, they submitted their voluntary harvest data, we encountered the full range from none, to a small or large part, to all of the species that were harvested (Figure 1c). Submission was almost exclusively through viltdata.se—not seen by many as a difficult platform (12%)—and typically done once a year (Figure 1d); that is, less frequent than the mandatory reporting of moose or red deer (typically one to more than three times per year).

Our respondents told us that they have extensive contact with hunting team members—many times per month—particularly during the hunting season (Figure 2b). Contact with either hunting consultants or other SAHWM staff, however, was mostly absent, or at best a few times a year. Levels of trust in other hunting members (on average 4.0, on a scale of 1–5) and in the SAHWM (3.8) were high, while trust in hunting-related authorities was at a somewhat lower level (2.9) (Figure 2a).

QUANTITATIVE DATA ANALYSIS

All quantitative survey data were handled and statistically analysed in SAS version 9.4. We used data of 2,358 hunting team rapporteurs. Because only two survey questions were mandatory, some analyses were performed on a lower number of responses.

We employed proportional odds models (PROC LOGISTICS within SAS) to analyse the reporting of hunting data (or lack thereof) by rapporteurs in relation to two theoretical concepts: social trust and motivation, as assessed by related composite measures and treated as indices. These indices were then included as predictor variables in our models to test whether they would explain variation in hunting data submission. We also tested for the potential moderating effects of participant age (3–4 classes), SAHWM membership (2), years hunting (4), reporting moose through viltdata.se (2) and region (3), but found only the last to be statistically significant.

We chose logistic regression over ordinary least-square regression because of the ordinal nature of our measure of voluntary harvest data submission (based on count data in 4 classes: none; a small part; the largest part; all that is shot). To avoid model fitting problems, we turned this measure into binary (submit/submit not; submit part/all) response variables. This allowed for the predictive accuracies of all models to be good (concordance probabilities > 0.7).

Social trust

We created three social trust indices and used those in our statistical models. They were based on Likert-scale questions in which participants were asked to assess their trust towards three entities: the SAHWM (6 items; 5 were used), authorities involved in the management of wildlife (e.g., environmental protection agency, county administrative boards [6 items]), and their own hunting team members (4 items) (See Figure 2a). We used factor analysis (PROC FACTOR) to condense multiple items into three separate trust indicators (i.e., trust in

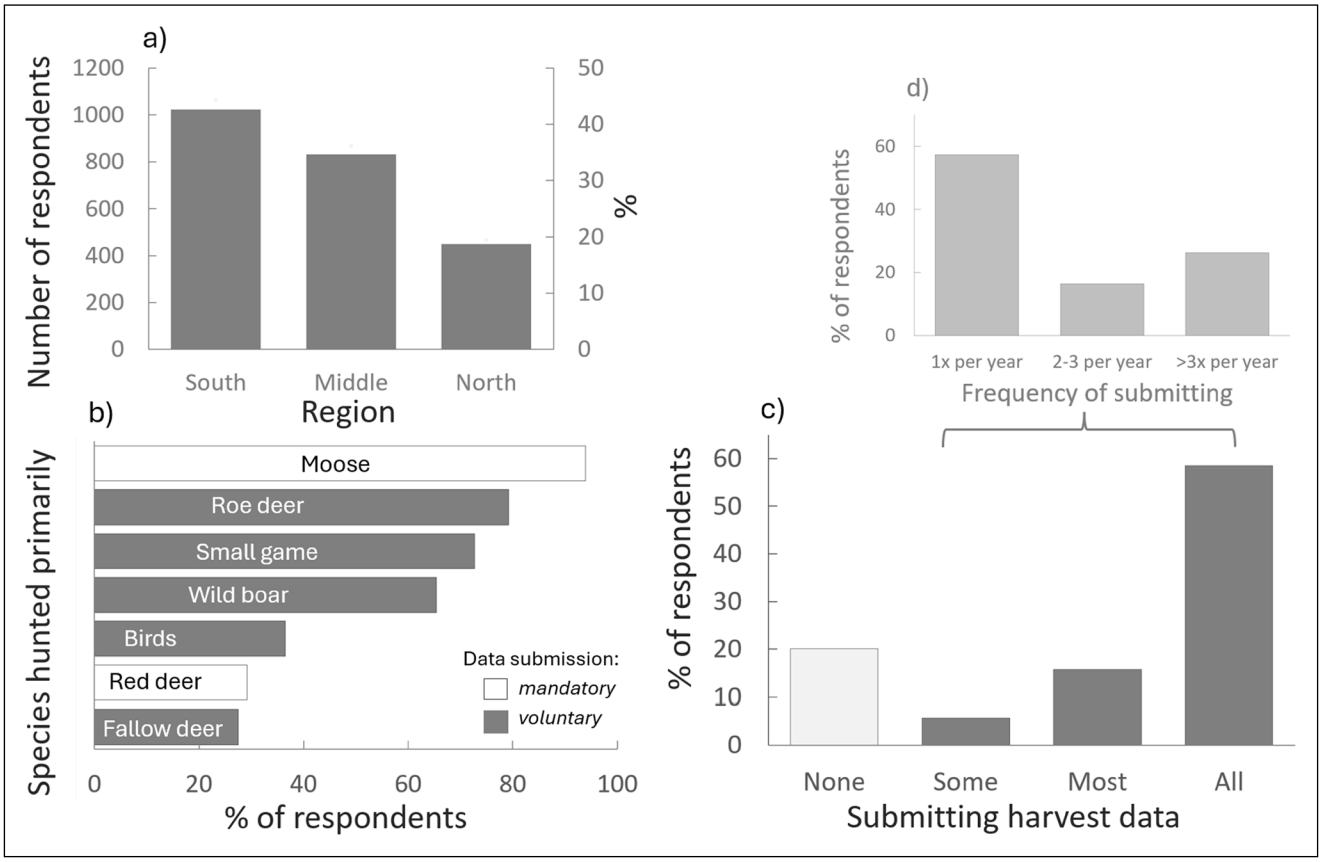


Figure 1 Background data as provided by hunting team rapporteurs responding to our survey: **a)** geographical distribution of teams across Sweden (number and %); **b)** the most important species hunted by the team; **c)** the extent to which rapporteurs submit voluntary harvest data; and **d)** frequency of data submission of such data (as % of those that did submit some, most, or all that was shot).

the SAHWM, relevant authorities, and their own hunting team); Kaiser's measure of sampling adequacy values (0.85, 0.87, and 0.74, respectively) confirmed the data's suitability to do so. Items within each of the three social trust indices showed good to excellent inter-reliability (Cronbach's alpha: 0.88, 0.90, and 0.83, respectively), suggesting that each measured the same respective underlying construct.

Given the potential importance of personal contact, we also investigated whether contact with hunting consultants or (other) SAHWM representative influenced hunting data submission. Factor analysis revealed two tight clusters (four items concerning contact with the SAHWM or other hunting consultants versus two items about (other) SAHWM personnel), but too few items underpinning the second factor and difficult-to-interpret axes loadings rendered this approach unsuitable. We therefore aggregated responses to questions about frequency of contact manually instead (Figure 2b), creating two "contact variables" (e.g., with hunting consultants and SAHWM personnel, respectively) with six levels each (ranging from "never" to "many times per month"). Because of few observations in the high-contact classes, we simplified both into 3-level categorical variables for subsequent statistical analysis.

Motivation

Participants who indicated to report voluntary harvest data were asked further questions about their motivations for doing so. We ordinated ten such items using PROC FACTOR and retained the two factors with eigenvalues >1, which explained 72.0% and 28.0% of the variance. The first factor was our index of autonomously regulated motivation to submit (based on 6 items; Figure 3a), and the second factor was our index of extrinsically driven motivation (based on 4 items; Figure 3b). Kaiser's measure of sampling adequacy was high (0.85), suggesting that items shared enough variance to form distinct, reliable factors. Cronbach's alpha values revealed good (0.86, intrinsic) to acceptable (0.68, extrinsic) internal consistency.

THEMATIC ANALYSIS

As a first step, the survey's free-text responses were carefully read, coded, and categorised based on generalised themes of what respondents said might affect submission willingness/behaviour. The first round of thematic coding was primarily data driven and resulted in five themes: purpose/usefulness of data; technology; information and knowledge; carrots and sticks; and social

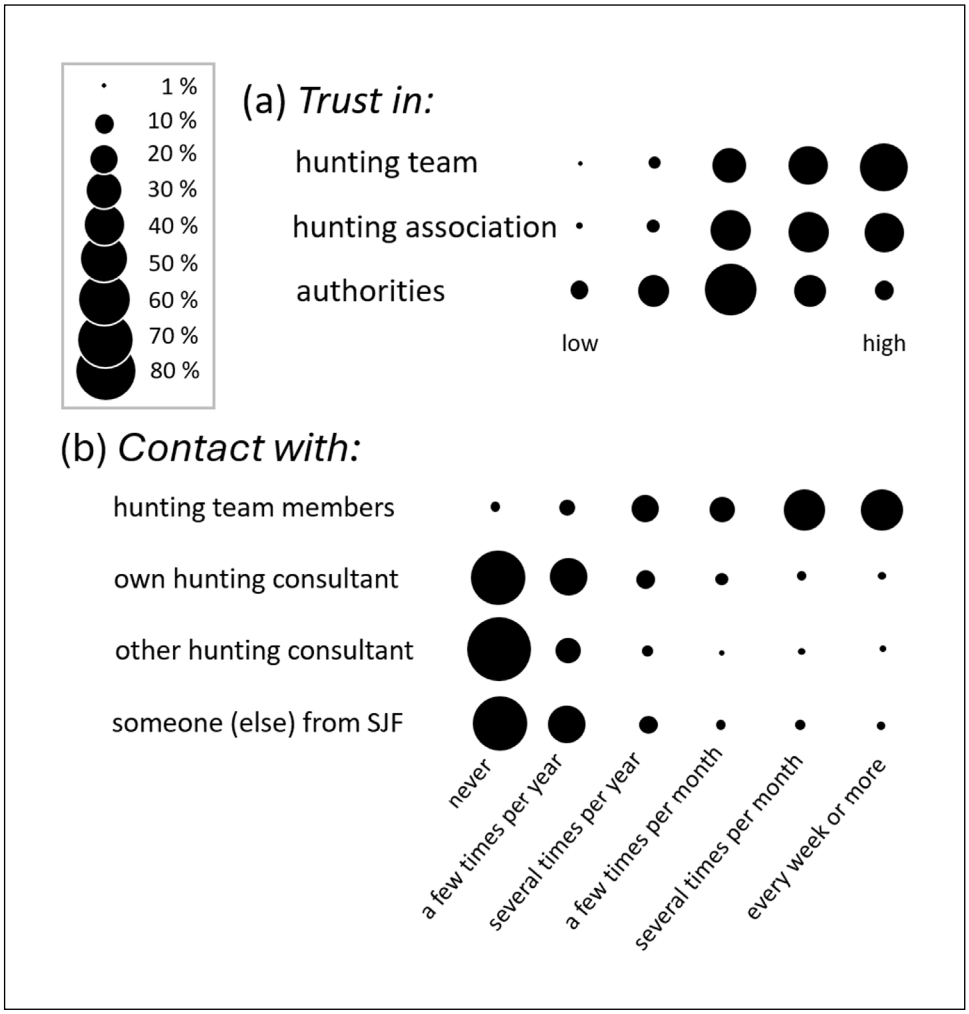


Figure 2 Distribution of survey responses across all hunting team rapporteurs concerning **a)** level of trust (in their hunting team members, the focal hunting organisation (SAHWM) and hunting-related authorities) and **b)** frequency of contact (with their team members, allocated hunting consultant, other hunting consultants or someone else from the SAHWM). Trust measures are based on aggregate data across 4–5 survey questions, whereas contact data are based on single questions concerning the hunting season.

structures. As our next step, we looked closer at each of these categories and the responses coded under them, analysing each theme from the perspective of symbolic interactionism (Blumer 1969). The analysis was then theoretically guided by the questions: what meaning do the respondents seem to give to data submission; how do they describe the relationship and interaction with organisations collecting and/or using the data; and how do they talk about themselves in the context of data submission?

RESULTS

In this section, we explore which factors influence hunters' self-reported submission behaviour and what meanings hunters give to data submission. Our analysis shows how these meanings are shaped by interaction with other data users.

STATISTICAL ANALYSIS

Part of the variation in rapporteurs' self-reported data submission behaviour could statistically be attributed to trust in the SAHWM ($\chi_1^2 = 29.8$, $p < 0.0001$; Figure 4). Trust in managing authorities or rapporteurs' own group members did not play a role here ($p > 0.2$). In addition to trust in the SAHWM increasing data submission, contact with notably a hunting consultant ($\chi_1^2 = 17.4$, $p < 0.0001$), but also with the SAHWM more broadly ($\chi_1^2 = 8.0$, $p < 0.005$), appeared to play additional roles. Moreover, it mattered where in Sweden participants had their hunting group ($\chi_1^2 = 85.6$, $p < 0.0001$), with submission of hunting data being most prevalent in the south and least in the north.

For those that did submit harvest data (in addition to what is required by law), the probability that a hunting team reported all that was shot (rather than only part) increased with our index of autonomous motivation ($\chi_1^2 = 121.0$, $p < 0.0001$) and again depended on region ($\chi_1^2 = 21.0$,

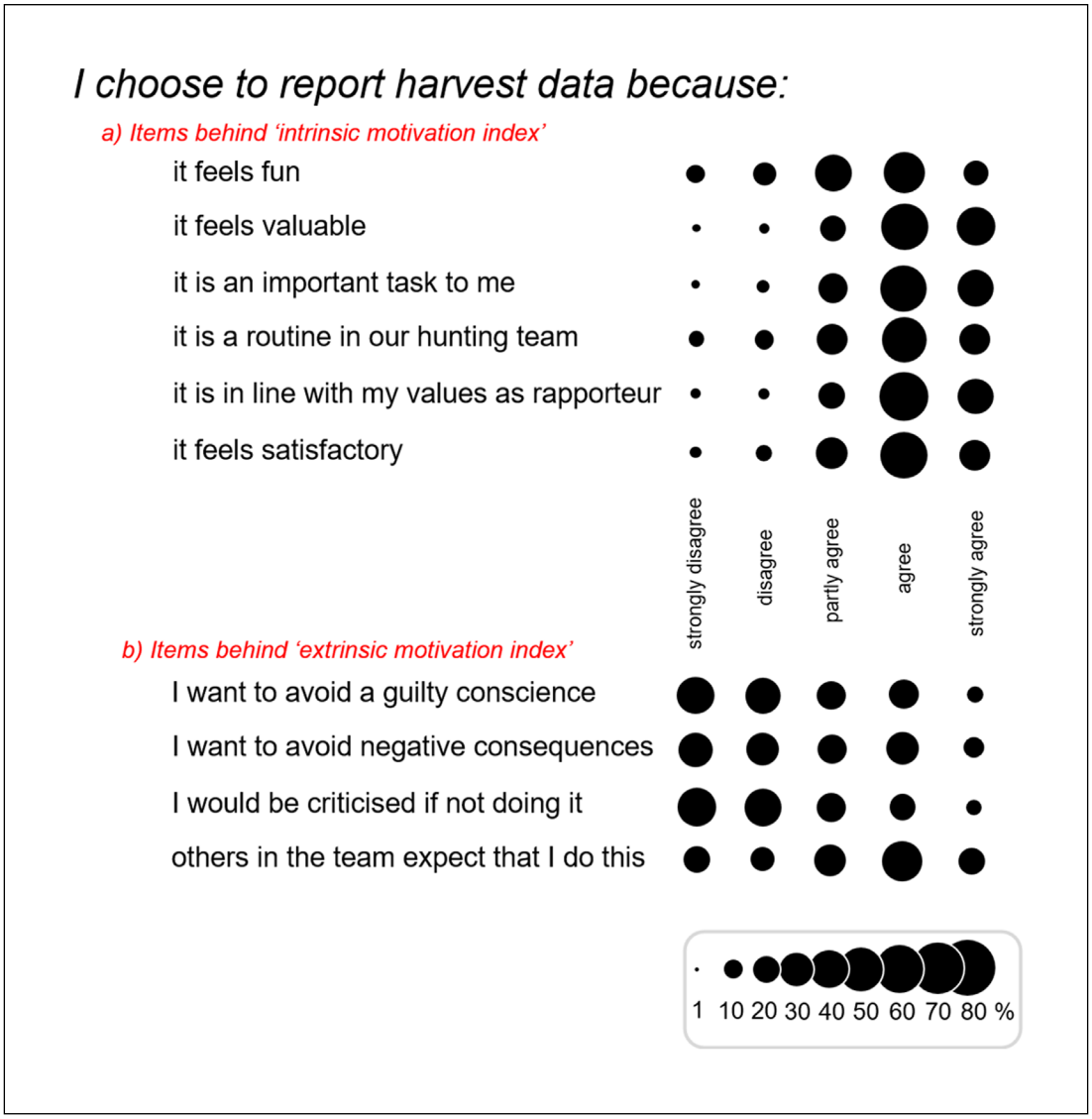


Figure 3 Distribution of survey responses across those rapporteurs that informed us to submit (part, most, or all) voluntary hunting data, concerning items aggregated to our index of autonomously regulated **(a)** and extrinsic **(b)** motivation, respectively.

$p < 0.0001$; i.e., somewhat lower in northern Sweden; Figure 5), but was unrelated to our index of extrinsic motivation ($p > 0.2$). Although many rapporteurs (45%) agreed with the statement that they report voluntary data out of habit when submitting obligatory harvest data, it was not a statistically significant term in the model.

THEMATIC ANALYSIS

Our thematic analysis identified that hunters see data submission as a way to (i) contribute to wildlife management, (ii) engage in dialogue with other data users and (iii) influence the image of hunters.

Data submission to contribute to wildlife management

Hunters seem to understand submission of hunting data as a way of contributing to "better" wildlife management. As one respondent put it, submitting hunting data is done in "the knowledge that reporting contributes to 'something bigger' (better wildlife management)". There was considerable heterogeneity in what was seen as "better" or "good" wildlife management among the respondents, but maintaining sustainable populations of game species was a recurring topic. For many, good management meant balancing impacts of wildlife on, for example, crops: "... it is important to report [harvest data] to keep the game populations at a manageable level." Others emphasised care, which in Sweden typically involves habitat management to provide food and shelter for wildlife as well as supplementary winter feeding: "[submitting is good] so that we can more easily care for our wildlife."

Multiple comments highlighted the importance of hunters seeing a clear connection between the submitted

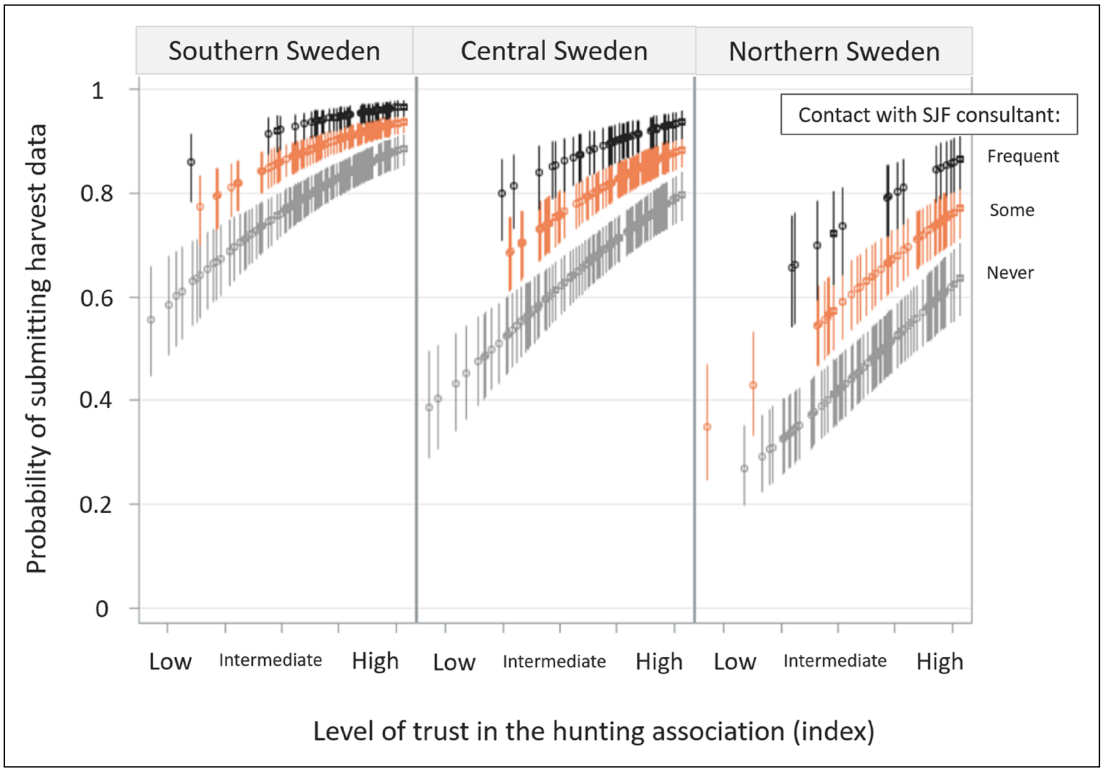


Figure 4 Modelled estimates of the probability of hunting team rapporteurs to voluntary submit harvest data of game (other than species for which reporting is mandatory) to the SAHWM as a function of the level of trust in this hunting association and frequency of contact with (their SAHWM or other) consultants, for the three different parts of the country. Error bars represent 95% confidence limits.

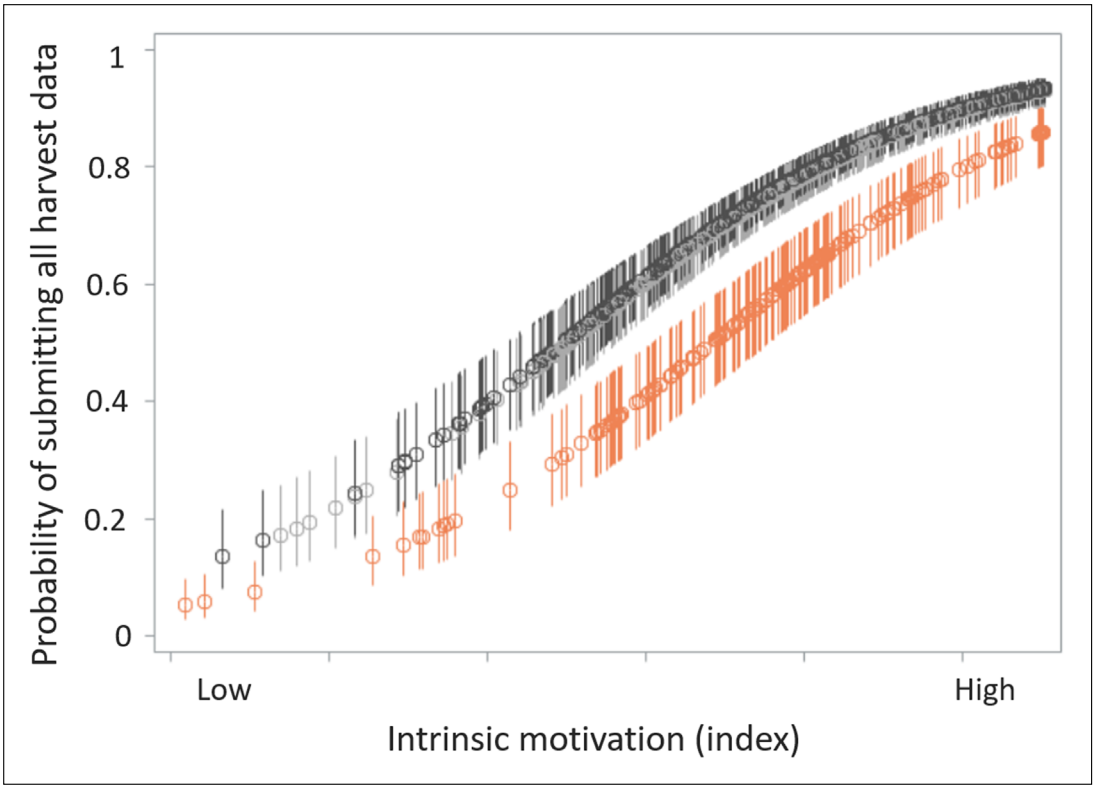


Figure 5 Modelled estimates of the probability of hunting team rapporteurs to submit data of all game (other than species for which reporting is mandatory) shot to the SAHWM, rather than only part, as a function of our index of autonomously regulated motivation to report, and for the three different parts of the country (south = grey; central = black, north = muted coral). Error bars represent 95% confidence limits.

data and decisions about wildlife management and hunting, for example, "that it is clearly visible that reporting contributes to good wildlife research and decisions made by the authorities." Such responses indicate that the hunters did not take it for granted that their submitted data would contribute to better wildlife management. They considered how the data was being used in the wildlife management system and formed perceptions of how others may interpret and understand the data: "Seems like the state authorities interpret the reported data differently from us who hunt. That can contribute to decreased submissions." Perceiving that their harvest data is not being used led some respondents question the very purpose of such data submission: "[reporting] must feel meaningful! Today, many feel that there is no use in reporting as both surveys and reports are ignored by [the managing authorities]".

This consideration of how others perceive and use the submitted data meant that trust was an important aspect. While Figure 4 draws attention to trust in the hunting association itself, free-text responses were most often about the importance of trust or distrust in managing authorities. For example, one extreme position (see Figure 2a) was: "Nothing is done with the statistics, the state authorities do their own thing; hunters have zero trust in state authorities and why then should we help them...." Another set of comments, talking about the feeling of being monitored, could be understood in terms of (mis)trust reciprocity, i.e. hunters perceiving that they are not trusted by the authorities, leading to low trust on the part of the hunters: "[reporting would increase with] an understanding of how the statistics are used. Many are still sceptical to everything being surveyed by big brother."

Data submission to engage in dialogue on hunting with other data users

When respondents talked about how the data may be useful for hunters, this wasn't so much about them using harvest data to plan their own activities, as they believed that "... most hunting teams know about population sizes (...). It's part of the nature of hunting to have such awareness." Or, in cruder phrasing: "Why should we do this [report harvest] and what's in it for me because I monitor my population myself and how much I can shoot on my land." Instead, the usefulness of data submission was about creating a basis for dialogue, with for example managing authorities, for the benefit of the hunting community. Hunters understood reporting as part of a conversation with other actors (other hunters, their organisations, managing authorities, and citizens in general) about hunting and wildlife management: "Create an understanding of how important wildlife monitoring is. That brings substance to the discussions [the representation of] the hunting community has with the Swedish Environmental Protection Agency and the local county administration boards." Understanding reporting in this way was connected to perceived others who lack hunters' (experience-based) knowledge and understanding of what is going on "in the forest" and need to be "shown" facts (e.g., harvest statistics). This was also exemplified by comments about the importance of showing others, with the help of harvest data, that hunting practices are sustainable: "If we are to be allowed to keep hunting all the species as we do today, we should have statistics in our backpacks to show the possibilities for continued hunting." Indeed, the risk of not being allowed to hunt certain species if hunters do not report their harvest seemed to be the most common worry among the respondents. This seemed to be about fear that managing authorities could misinterpret a drop in harvest reports as a drop in population levels, potentially leading to hunting restrictions.

Data submission to negotiate the image of hunters

The free-text responses indicated that some respondents saw data submission as a way of negotiating the image of hunters. As one respondent put it, submission rates would increase if hunters understood "how important reporting is for showing the relevance of hunters when it comes to wildlife management and environmental monitoring." Here, reporting formed part of a dialogue with other actors about the role of hunters and their relationship with nature and wildlife: "[by reporting] we can show that the shooting of game does not decrease wildlife populations." Submitting harvest data thus became a way of portraying hunters as people who hunt responsibly and play an important part in the monitoring and management of wildlife (see also Figure 3a—rapporteur). However, there was another side to this. Comments indicated that the perception of how others see and relate to hunters mattered for the willingness to engage in data submission. Hunters expected to be seen and treated as legitimate by, for example, managing authorities. According to respondents, perceptions of *not* being listened to, taken seriously, or seen as knowledgeable about wildlife and hunting matters might reduce the willingness to submit data: "[Reporting would increase if] authorities show a greater respect for hunters' opinions and knowledge."

DISCUSSION

Voluntary engagement is the very foundation of citizen science. Understanding why people choose to engage in

voluntary data collection and submission is therefore vital for citizen science to live up to its potential (West and Pateman 2016; Fraisl et al. 2026). We approach this issue by suggesting that voluntary data submission is interactive and is continuously interpreted and given meaning by the actors involved through social interaction (i.e., symbolic interactionism; Blumer 1969). This perspective allowed us to explore when and how it makes sense for voluntary data contributors to spend their time and energy on sharing data. We see that volunteers' autonomously regulated motivation, trust in and contact with the primary data-collecting organisation, and the region where volunteers are active are connected to self-reported submission behaviour. We find that volunteers see data submission as a way of contributing to on-the-ground management, as a basis for dialogue with other data users, and as influencing how others perceive the volunteers' community. These findings help us understand what makes volunteers perceive data submission as valuable and how the relationship with the primary data recipient shapes the willingness to report.

Our focal case is—like most other programmes—an example of contributory citizen science, with members of the public submitting data to initiatives or organisations (Pocock et al. 2017; Hecker et al. 2018). Yet, our volunteers did not perceive data submission as one-way communication. They did not simply submit data as a response to a request to do so; they also meant something with their submission. When deciding whether to submit or not, they were attentive to who would be receiving the data and how these people or organisations would interpret and use that data. This resonates strongly with one of the key insights of the ENETwild Consortium report (2025), a review in which hunting data collecting practices across 18 European countries are compared to investigate the potential for harmonisation or even standardisation, namely that data submission has "deeply rooted sociological dynamics" and can be "both a social signal and a bargaining chip" (pp. 14–15). The volunteers in our study also saw the submitted data as a basis for discussion about how things really are and what should be done. It is argued that citizen science projects can provide an important framework for dialogue between citizens and the scientific community (e.g., Wagenknecht et al. 2021). Our study shows that volunteers see data submission as an opportunity for dialogue on wildlife management, hunting, and hunters. The fact that harvest data arises from activities volunteers care strongly about, and carry out regardless of any citizen science project, lowers the threshold of sharing them and strengthens interest in how the data is being understood and used by others. Thus, a key finding of our study is that data submission *is* a form of social interaction where the perspectives of the receiver(s) of the data are taken into account when submitting data.

We find that volunteers see data submission as a way of contributing to something that is important to them. This is in line with several previous studies that find that the will to contribute (e.g., to research, conservation, or management) plays an important role in people's decision to participate in citizen science projects (Cherry 2018; Maund et al. 2020; Van Buskirk et al. 2024; Waldo et al. 2025). Our study shows that volunteers do not just contribute to something that is of interest to them but also because of other expectations, including that they believe their data is being used and in ways that make sense to them. We thus concur with Verploegen, Ganzevoort, and Van den Born (2021), who found that birdwatchers reported their sightings in part because they expected these to be used for nature conservation and academic research. While the birdwatchers assumed this to happen, our hunters actively appraised whether their data was used based on management decisions taken. The SAHWM's public commission to compile hunting statistics may raise hunters' expectations of harvest data being used in particular ways. Either way, an important dimension of data submission is thus how volunteers believe their data is being used. Perceiving that other actors such as managing authorities interpret data differently from volunteers, or seemingly ignore it, may lead to mistrust towards the authorities and decreased willingness to submit data (e.g., Shapiro et al. 2023; von Essen et al. 2025; ENETwild Consortium 2025). Several respondents indeed indicated this. However, our statistical analysis did not show a connection between trust in managing authorities and self-reported submission behaviour, whereas trust in the hunting organisation clearly did matter. Since the data in our case is submitted to the SAHWM, and they represent hunting interest in many decision-making processes (Bergqvist, Kindberg and Elmhagen 2024), it may be the volunteers' perception of the primary recipient of the data and how they use and interpret it that shapes the willingness of volunteers to submit data. This is further supported by the finding that contact with the hunting organisation related to increased willingness to submit data, despite that such contact was mostly rather infrequent (Figure 2b). This suggests that feeling connected with the primary data recipient matters for the willingness of volunteers to engage in data submission.

An additional meaning of data submission for volunteers is showing others who they are, be it a responsible and

knowledgeable hunter (our data; von Essen et al. 2025), a dedicated birdwatcher (Cherry 2018; Peterson, Van der Wal and Kasperowski 2025), or a beekeeper, contributing to science with their expertise (Bieszczad, Fochler, and Brodschneider 2023). When this fails, that is, when the other does not seem to perceive (or treat) the submitter as responsible, knowledgeable, and legitimate, this may interfere with the basic needs driving autonomously regulated motivation (e.g., relatedness) and may negatively affect willingness to submit. This finding may be most relevant for citizen science participants, such as hunters, farmers, fishers and birdwatchers, who have a clear identity connected to the research or data collection topic. Here, data submission may become part of a collective identity, as something you just do as, for example, a hunter or a birdwatcher. Our study shows that incorporation of data submission—over and above data recording—into the collective identity of such groups depends also on relationships with other actors, as volunteers are sensitive to how they (as a group) are viewed, portrayed, and treated by other societal actors.

The observed regional differences in the willingness to submit data (i.e., higher in the south of Sweden and lower in the north) are likely to be connected to differences in social structure among the volunteers as well as environmental variations such as species composition in the different regions. Moose hunts are known to have a strong influence on the organisation of hunting in Sweden (Dressel et al. 2018; see also Figure 1b), and although we did not find submitting data from moose hunts to influence data submission of other species, there may still be organisational effects at play. In the southern and to some extent central parts of Sweden, other ungulates such as roe and fallow deer (which are voluntary to report) compete for food with moose (Dressel et al. 2018), which may create an incentive for hunters interested in moose management to submit harvest data on non-mandatory species. Another aspect of differences in species composition is that the ungulate species are hunted in teams, whereas many of the non-mandatory species that occur in the north are taken by individual hunters, making it more difficult for the rapporteur to get harvest data from their hunting team members. In addition, differences in social structure in terms of land ownership affect the way that hunters submit their data. Large forest companies own much of the land in the north of Sweden, and many of these have their own systems for how hunters should submit harvest data on non-mandatory species. It may be that hunters who must submit data to the forest company do not see a reason to also submit to the hunting organisation's database (viltdata.se).

CONCLUSIONS

Recruiting and, more so, retaining participants in citizen science projects can be challenging. It is important, therefore, to understand what it is that drives participants to join and commit. We investigated a central aspect in citizen science, namely the voluntary submission of data, and did so by viewing this as social interaction. More specifically, we asked what meaning volunteers give to data submission in what remains the dominant model of participation in the field: contributary citizen science. For this, we turned our attention to a group of people who are interested in and knowledgeable on a particular issue, namely hunters that gather and submit harvest data for their team in response to a request from the largest hunting association in Sweden. We find that data submission has multiple meanings for these volunteers: to contribute to on-the-ground management, to engage in discussion with other data users, and to influence how others view their community. Furthermore, we see that these meanings are shaped by interaction with others who may submit, talk about, compile, or use the data, and that trust in and feeling related to the primary recipient of the data influence the willingness to engage in data submission. Exploring the meanings that participants in citizen science projects give to their participation and how these are shaped by social interaction provides insights into when and why people may choose to contribute to such projects, as well as how other citizen science ideals, such as creating engagement and inclusive knowledge production, can be achieved.

DATA ACCESSIBILITY STATEMENT

A summary of all quantitative data is included as Appendix I.

SUPPLEMENTARY FILE

The supplementary file for this article can be found as follows:

- **Appendix I.** Survey questions and summarised responses. DOI: https://doi.org/10.5334/cstp.1036.s1

ETHICS AND CONSENT

This study follows the ethical guidelines of ALLEA, the European Code of Conduct for Research Integrity (ALLEA 2023) and, specifically, the Swedish Ethical Review

Authority. According to the guidelines, no ethical review was required. We ensured good practice as requested by our home institution (https://www.uhr.se/en/start/laws-and-regulations/Laws-and-regulations/act-on-responsibility-for-good-research-practice/). The survey was distributed by the SAHWM, who sought legal advice regarding GDPR. All respondents gave consent in two steps: first, upon logging in to viltdata.se, they consented to their contact details being used for disseminating surveys for research purposes (not limited to our study). Second, when receiving and following the link to the survey, respondents were informed about the study, and that by submitting their answers they gave consent to these being used in the described study. Individual answers could not be traced in the survey system, which ensured anonymity.

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COMPETING INTERESTS

René van der Wal serves as an editor for *Citizen Science: Theory and Practice*, although he was not involved in any way in the review of this submission.

AUTHOR CONTRIBUTIONS

Hanna Bergeå, Bodil Elmhagen, Maria Johansson, Emily Montgomerie and René van der Wal conceived the ideas and designed the methodology; Göran Bergqvist and Bodil Elmhagen disseminated the survey; Emily Montgomerie and René van der Wal conducted the analyses and led the writing; and all authors contributed critically to drafts and gave final approval for publication.

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