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Exploring the potential of an online platform for citizen science-based ecological monitoring of plant- and wildlife on the high-Arctic Archipelago Svalbard

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Photo on cover: Svalbard reindeer (*Rangifer tarandus platyrhyncus*).
Photo: Ann E. Lennert.

Photo on the inside: participant describing an observation in a focus group arranged by team members of SVALUR with guides in Longyearbyen, 22nd of October 2021.
Photo: Ann E. Lennert.

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2 Abstract

Citizen science is increasingly used to include in ecological monitoring over the past three decades. Web-based applications or smart phones enable citizens to record observations or experiences at larger temporal and spatial scale and provide opportunities for a larger number of citizens to participate in mapping observations. Citizen science can also be used to record, or map observed and experienced ecological changes.

The purpose of this thesis is to understand how a warming climate affects plants- and wildlife in the high-Arctic Archipelago of Svalbard through the eyes of citizens that are residing or visiting the islands. To examine the kind of ecological phenomena that citizens are observing on Svalbard, I used a dedicated digital platform to register local observations and experiences on how plant- and wildlife species are impacted by climate change. Residents and visitors were invited to share their knowledge and observations about how the environment is changing in Svalbard including nine categories, where my focus was primarily on plant- and wildlife.

The online PPGIS survey had an overall response rate of 11% for mapping all kinds of environmental changes, wherein 21 of the respondents mapped 75 observations on plants- and wildlife covering most of the archipelago. The observations were divided into six categories: invertebrates, vegetation, marine mammals, terrestrial mammals, birds, and other. The experienced changes in plants- and wildlife were compared to existing ecological monitoring by using five ecological phenomena: spatial distribution, abundance, behaviour, phenology, and impacts of abnormal events. I assess how and in what way citizen science as an approach, using an online citizen science platform, can contribute to and complement traditional ecological monitoring. I found two-thirds of the observations to focus on presence of the species or the abundance. Most were observations of charismatic species without references to any potential causal mechanisms of change. I found that citizen science is most likely to contribute to the monitoring of species ecology by expanding the spatial scale of plant- and wildlife observations. However, the limited amount of data in this thesis makes it difficult to conclude on the full potential and possibilities of using citizen science in ecological monitoring.

3 Introduction

The biodiversity unique to the Arctic is changing in a rapid pace due to the warming of the atmosphere, which is on average three times as high in the Arctic as the rest of the world (AMAP, 2021). Scientific monitoring of the ecology of different species is expensive and therefore both spatially and temporally limited (Pedersen, Arneberg, et al., 2021) as well as biased in terms of the species monitored, the habitat in which they reside, or the geography (Ancin Murguzur & Hausner, 2020; Virkkala, Abdi, Luoto, & Metcalfe, 2019). Citizen science approaches has been suggested as complementary tools to better understand the biodiversity changes taking place in the Arctic. Such approaches could be particularly useful for the remote locations in the Arctic where residents are living year around, while scientists mainly have the possibility to visit for short periods to conduct fieldwork (Frigerio, Richter, Per, Pruse, & Vohland, 2021).

Oxford English Dictionary (2022) defines citizen science as "scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions". Citizen science spans widely and includes initiatives in both natural- and social sciences and the humanities aiming at gathering information and/or addressing public concern (Predavec et al., 2016; Vohland et al., 2021b). Projects monitoring biodiversity are among the most common citizen science projects in natural sciences (Frigerio et al., 2021). There are many examples of monitoring projects using data gathered through citizen science platforms, such as monitoring of koala populations (Dissanayake, Stevenson, Allavena, & Henning, 2019), monitoring of mosquitos in Germany (Pernat, Kampen, Jeschke, & Werner, 2021), and monitoring of monarch butterflies in western North America (Schultz, Brown, Pelton, & Crone, 2017). The engagement with local knowledge has given citizen science a wider recognition as an approach to complement traditional ecology, and have increased the involvement of non-scientists in science, monitoring and support to management measures (Tengö, Austin, Danielsen, & Fernández-Llamazares, 2021). Thus, people who live and visits an area over longer time can experience and acquire local knowledge about that area which can be an important addition to the scientific knowledge (Vohland et al., 2021b).

The advantage of including citizens in monitoring programs can be many. The possibility to cover a greater spatial and temporal scale with volunteers collecting data through observations or simple data measurements in field is one argument for including citizens in monitoring

(Frigerio et al., 2021). Working with citizens and non-professionals can increase the capacity to better monitor trends and changes in the environment (Conrad & Hilchey, 2011). In addition, Peter, Diekötter, and Kremer (2019) found evidence that participants in citizen science projects focusing on biodiversity can increase their knowledge and skills.

There are many different approaches to citizen science (Haklay et al., 2021) including, but not limited to, qualitative interviews, focus groups, questionnaires, cultural domain analysis, community workshops, participatory mapping, and the Delphi technique (Mukherjee et al., 2015; Newing, 2010; Reed et al., 2018). The recent increase in popularity of citizen science approaches can be seen in relation to the advantages given by technological progress with smartphones and web-based solutions (Johnson, Druckenmiller, Danielsen, & Pulsifer, 2021). The use of digital tools has increased the range and possibilities to co-create knowledge with citizens with possibilities to increase both temporal and spatial scales (Johnson et al., 2021).

One large-scale citizen initiative that is currently using a digital platform is the Circumpolar Local Environmental Observer (CLEO) hosted by the Arctic Monitoring and Assessment Program of the Arctic Council. CLEO is collecting observations about unusual animal, environment, and weather events through a network of people, local observers, and topic experts (Arctic Council, 2022). This initiative has support from many arctic societies, including some indigenous communities, and is claimed to increase awareness of vulnerabilities to the impacts caused by climate change (Arctic Council, 2022; Bengtsson, Lydersen, & Kovacs, 2022).

In this thesis I am focusing on ecological phenomena in a high-Arctic Archipelago, Svalbard, using a digital platform to engage participants in monitoring of environmental change. The online platform for citizen science was inspired by previous studies on public participatory geographical information system (PPGIS) which has been using Web 2.0 communication technologies (Darwish & Lakhtaria, 2011) to gather location-specific information from the general public and stakeholders (Brown, Hausner, & Lægreid, 2015; Fagerholm et al., 2021). In monitoring this can be used to gather observations, stories and experiences from the people who resides in and visits an area. The use of digital tools is challenging for some with poor internet access and weak technological skills and can exclude people from participating (Vohland et al., 2021b). Considerations about recruitment to the platform is thus crucial when designing a citizen science project that is collecting observations and experiences about ecological changes. PPGIS collects spatially explicit information from citizens by dropping

markers in a map and by attaching attributes to the marker (for example a location where people have observed or experienced changes or development that are impacting the ecology of species). In addition to the mapping component, the PPGIS could also include a questionnaire to gather additional information such as cultural background, familiarity with the landscape or demographic information.

Svalbard is remote, and residents and visitors can contribute to valuable insight and knowledge about the changes in plant- and wildlife which remain unavailable to short-term visitors. This suggests that people that are living on or have visited Svalbard could have experienced ecological changes or other climate related natural phenomena that are unrecorded per today (Frigerio et al., 2021; Predavec et al., 2016). Svalbard as a study system is interesting since a larger portion of the people that have moved there in later years only spend a few years at the archipelago as residents before they move on, and the community has moved from a male-dominated to a family-dominated community (Stortingsforhandlinger. Meld. St. 32, 2015-2016). With a high turn-over in terms of residents and the rapid changes happening there it is interesting to document which changes in plants- and wildlife the residents and visitors are experiencing.

Citizen science has an enormous potential for increasing the general understanding of the changes impacting local plant – and wildlife on Svalbard. The high Arctic islands is home for many monitoring projects, for instance on wildlife (Descamps et al., 2017) and vegetation (Ravolainen et al., 2020). The amount of monitoring on invertebrates is not that extensive Taylor et al. (2020), but there are monitoring on many of the environmental changes impacting plants- and wildlife, such as permafrost (Albaric et al., 2021; Berteaux et al., 2016). Environmental Monitoring of Svalbard and Jan Mayen (MOSJ) is gathering and providing overviews of the state of the environment of Svalbard and Jan Mayen. The last assessments of the monitoring systems and the state of the terrestrial and marine environment was made in 2014 (Fauchald et al., 2014; Ims, Alsos, Fuglei, Pedersen, & Yoccoz, 2014). The existing monitoring network in Svalbard allows comparing the knowledge gathered through a PPGIS survey with existing scientific data, making it possible to assess whether and how local knowledge on plants- and wildlife can complement and contribute to the existing monitoring on the archipelago. With the rapid changes Svalbard is experiencing (Hanssen-Bauer et al., 2019) it is important to obtain adequate knowledge about how a warming climate will affect the ecosystems (Frigerio et al., 2021; Tengö et al., 2021), where logistical and financial limitations may constraint the amount of monitoring (Peacock et al., 2020).

In this thesis I have used an online PPGIS survey where residents and visitors of Svalbard registers their own observations and experience related to climate and environmental change in Svalbard. This is the first time a dedicated PPGIS platform to map people's experiences of environmental and climate change is used in the Arctic where the entire community of 2166 inhabitants over the age of 16 are invited to participate on a digital platform through personal invitations.

To examine the potential of contributing to ecological monitoring and to assess which qualities a digital citizen science platform could bring to better understand changes in the plant and wildlife ecology relating to Arctic warming, I used the concept of ecological phenomenon, which "specify causal links between anthropogenic drivers of change and indicators of ecosystem function and structure, based on peer review literature" (Pedersen, Arneberg, et al., 2021). The formulation of phenomena is a central part of Panel-based Assessments of Ecosystem Condition (PAEC) (Pedersen, Jepsen, et al., 2021).

The objectives of this thesis are:

- To gather local observations and experiences of changes in plant- and wildlife shared by respondents to an online PPGIS survey and assess whether and how this knowledge can complement and contribute to existing ecological monitoring on plants- and wildlife in Svalbard by using the concept of ecological phenomena.
- Discuss the advantages and disadvantages of using an online PPGIS survey in a citizen science project and discuss how the methodology could be improved.

4 Methods

4.1 Study system

The High-Arctic Archipelago of Svalbard is located north of the mainland of Norway between 74° and 81° N and 10° and 35°E and is under Norwegian sovereignty (Jensen, 2020). The archipelago has a long history of trappers and miners visiting and working in Svalbard for centuries, whereas in the past decade research and tourism have become the main activity (Stortingsforhandlinger. Meld. St. 32, 2015-2016). The Svalbard Treaty makes sure that all citizens from the nations who has signed the treaty have full access to settle on the archipelago and have the same rights as Norwegians (Jensen, 2020). This have led to a society of high diversity, with residents with 54 different nationalities (Norwegian Tax Administration, 2021). The later years the number of tourists visiting the archipelago has increased noticeably, with almost a doubling from 2009 to 2018, from 53 000 to 90 000 (Kavan & Anděrová, 2020). In a visitor survey conducted by Visit Svalbard in 2021, 63 % of visitors answer they are choosing Svalbard to experience undisturbed Arctic nature, while 58 % states they want to experience the wildlife (Visit Svalbard, 2021).

The plant- and wildlife in Svalbard is unique with short food webs with strong links between terrestrial and marine systems (Jónsdóttir, 2005). When the glaciers that had covered most of the archipelago retrieved after the last ice age there was little soil and vegetation in the landscape which are discussed to be a reason for the low species diversity (Jónsdóttir, 2005). The species present in Svalbard are living under high-arctic conditions with extreme cold temperatures, strong winds, little precipitation, polar night and midnight sun (Aronsson et al., 2021) and are influenced both from the cold, arctic water from the East Spitsbergen Current and the warm, Atlantic water from the West Spitsbergen Current (Descamps et al., 2017). All this have resulted in highly specialised species adapted to survive these conditions and species who migrate to utilize the rich resources that are available in the Arctic in the summer months (Aronsson et al., 2021).

4.2 Maptionnaire

To gather observations and experiences from residents and visitors of Svalbard a web-based platform was created using the software Maptionnaire (https://maptionnaire.com/). Maptionnaire provides a user-friendly platform where the developer easily can customize the survey to fit the needs of the project. The design of the survey was done in collaboration with

the Belmont Forum project “SVALUR” as it included many more features than what was the focus of my thesis. My focus was the plant-and wildlife observations which I compared to scientific knowledge about the same species.

I created a template to design the survey in Microsoft Word (see appendix 1) to define what was needed of information from the participants and the observations and experiences they wanted to share with us. There was a wish to keep the survey as short and simple as possible give respondents time to express their experiences for each of the features. Fewer features to map would also retain more participants, who might easily lose motivation if the mapping part takes too long time (Brown & Fagerholm, 2015).

The first part of the survey consists of three different pathways: one for permanent residents, one for former residents, and one for visitors. Based on the respondent’s answers they were presented with different questions that are more relevant to them. Residents could enter the personal code they received in the mail (see 4.3.1 Invitation letters) and they were thereafter asked how long they have lived in Svalbard. Residents that did not receive the invitation letter and former residents were asked the same questions about how long they have lived in Svalbard in addition to how they learned about the survey. Visitors were asked how they learned about the survey, how often and long they have visited Svalbard, and if they have spent nights in Longyearbyen, Barentsburg, Ny-Ålesund, or outside these areas. After these questions, all were presented with the privacy policy of the study and had to agree to the terms to continue to the next part of the survey for the mapping (see 4.2.2 Privacy policy).

The respondents were asked to map changes and happenings related to nine distinct categories: “weather”, “ice and snow”, “land/landscape”, “sea and ocean”, “freshwater”, “plants and animals”, “buildings and infrastructure”, “littering and pollution”, and “other”. The first six categories were chosen based on the SVALUR team’s analyses of monitoring programs in Svalbard and by reviewing the categories used by Circumpolar Local Environmental Observer (CLEO) (Arctic Council, 2022). The three last categories were added after discussions in the SVALUR team where it was a wish to make it easier and more relatable for people when mapping. The categories were added to encourage people to map more and trigger their memories towards a broader diversity of observations. After choosing a category and placing a point on the map, a pop-up window opened where the respondents could write their observation, when they did the observation, and upload files or pictures if they wanted to do so. In this project it was chosen to have the settings that did not allow participants to go back and edit observations after they had delivered the survey, but nothing

stopped them from entering the survey multiple times.

Brown and Fagerholm (2015) shows that demographic variables can influence what the participants are mapping. To be able to see if the respondents to the PPGIS survey are representative for the population in Svalbard, demographic data were gathered in a questionnaire in the end of the survey. The demographic questions included questions about their gender, age, level of education, and income. They were also asked to cross out different statements that applied to them, as well as to state their level of agreement to statements designed to estimate their place attachment to Svalbard. By knowing more about who is participating in the survey it is possible to take measures to ensure that underrepresented groups also are represented (Brown & Fagerholm, 2015). Looking on which groups are underrepresented it is possible to aim the recruitment towards those groups to lift up more voices and opinions (Brown et al., 2018)

4.2.1 Webpage

After the template was created, it was translated to English and Russian. Maptionnaire allows the creator of a survey great freedom in how a webpage will end up looking. It is possible to add maps, pictures, videos, files, and more. For the pages with questions, I chose among pictures provided by Ann Eileen Lennert (UiT) to use in the background to create a more aesthetically pleasing experience. For the mapping component, I used a base map from Svalbard. The base map was retrieved from the Norwegian Polar Institute (NPI) 12.04.2021 using the same base map as in the service TopoSvalbard (Norwegian Polar Institute, 2021) which is used widely by residents, researchers, and visitors. Providing a base map that the respondents already are familiar with makes it easier for the respondents to navigate and orientate themselves on the map which increases accuracy when mapping (Newing, 2010).

To explain how the platform is working, I created an instruction video that was added to the website where the different functions were explained. This was done by recording the screen as I explained the different functions, and adding the sound to the video in a free, video editing app.

After the survey was completely transferred to the webpage I filled in the translation for English and Russian. The webpage was assessed and reviewed by SVALUR team members, and after fixing errors and changing some details in wording and aesthetics, the webpage was launched on October 11th, 2021, and made accessible on http://mpt.link/svalbard.

4.2.2 Privacy policy

Projects that at any point handles personal information must report the project to NSD – Norwegian centre for research data (NSD - Norsk senter for forskningsdata, 2021). The approval from NSD ensures that we follow the current EU General Data Protection Regulation (GDPR) rules and regulations on privacy policy (Personopplysningsloven, 2016). The application was sent on July 26th 2021 and approved on August 2nd 2021 (see appendix 3 for the application). Included in the application were a draft of the survey, information about how we planned to gather and store personal data, and the information about how we would manage and store their data and their rights as participants (see appendix 2).

To be able to participate in the survey the respondents had to agree to the declaration of consent, where they confirmed to have read and understood the information about the project and their rights. They also agreed to participate in the project and confirmed that they understood that the information about them and the information they shared will be stored until the project is completed. It also included a condition that they agreed to that the pictures and documents they shared could be used further for non-commercial purposes including social media, and that pictures of a third person required consent.

4.3 Recruitment

4.3.1 Invitation letters

The main form for recruitment to the survey consisted of invitation letters (appendix 5) and postcards (appendix 6) sent out to permanent residents in Svalbard. The letters were chosen based on previous experience that people tend to respond to a higher extent to letters with university heading compared to a postcard, email, or other forms of communication over the internet (V. Hausner, personal communication, 2021).

The addresses of residents were provided by the Norwegian Tax Administration through an application (see appendix 4) to get access to data from the Norwegian population register (Norwegian Tax Administration, 2021). The application was sent on September 10th and was approved on October 11th, 2021, after continuous attempts to contact the Norwegian Tax Administration and get an update on the application.

The letters contained information about the project, contact information, and a 4-digit personal code that was assigned to people at random. By using these personal codes, we can easily say something about the response rate of the people receiving the invitation by post

without asking people to enter personal data into the survey. A draft of the letter was created using the invitation letters from Kystbarometeret (https://kystbarometeret.com/) as a template. A list of random generated 4-digit codes was generated in Microsoft Excel using =INDEX(UNIQUE(RANDARRAY(25^2; 1; 1000; 9999; TRUE)); SEQUENCE(25)) repeated and checked for duplicates until there were enough unique codes, as the Excel software used here could not generate all at once. When the data from the Norwegian Tax Administration arrived, the names and addresses were transferred to a separate excel workbook and all were assigned a unique code. The letters were completed with names, addresses, and codes using the Microsoft Word function "Start Mail Merge" – "Step-by-step Mail merge wizard". The letters were saved as a PDF and printed, folded, and put into envelopes with windows so the address on the letter was visible.

The data on the Norwegian citizens living in Svalbard was provided by TietoEVRY (2021) on October 13th. TietoEVRY was in the beginning only able to provide the data for the Norwegian citizens in Svalbard (n=1395). I contacted the Norwegian Tax Administration in Svalbard on October 25th when I was in Longyearbyen and after talking with the Norwegian Tax Office's employee in Longyearbyen, she contacted TietoEVRY and was able to talk them through how to get the data for the permanent residents without a Norwegian social security number and we got the rest of the data forwarded November 5th (n=771), leaving us with information about 2166 residents in Svalbard from the age 16 and older. The data was transferred and stored in accordance with the EU's GDPR regulations (Personopplysningsloven, 2016).

The first round of letters was sent from Tromsø on October 14th, 2021. For the second reminder, we chose to use postcards instead of letters to reduce the amount of work required when folding and putting letters into envelopes manually. UiT did not have a template for postcards, so I created them myself using Microsoft Word. It was also decided that there should be a lottery among the participants to increase the response rate. Information about this was included in the second round of invitation letters sent on November 11th, and the second reminders for both the first round, sent on November 12th, and the second round, sent on November 29th. To be qualified to win the gift card with value 5 000 NOK they had to complete the entire survey and participate before December 6th, 2021. After the deadline a random participant was drawn out from the list of participators using the unique ID-code to name and be able to contact the winner.

4.3.2 Fieldwork in Longyearbyen

Ann Eileen Lennert and I visited Longyearbyen October 22nd – 27th 2021. The main goal for our visit was to arrange workshops for residents in Longyearbyen. Having a digital survey can exclude some groups in the society, such as elder people without the same skills using digital tools and people with limited or no internet connection at home (Brown & Fagerholm, 2015). Therefore, it was our goal to facilitate for people to be able to participate even though they did not wish or manage to do so online. A workshop can also increase the quality and quantity of observations as it can facilitate a discussion among participants that can help trigger memories (Newing, 2010).

With Longyearbyen Library we arranged two workshops, October 23rd, and October 26th. In preparation for the workshops, we had provided maps over Svalbard and small post-it notes so people could also map without using a computer. The survey questions were also adapted to a paper version that was printed along with the privacy policy information and consent form. The mapping categories were also printed out and made available for the participants to encourage them to map more. We shared information about the workshops in the Facebook group "Ros & Info Longyearbyen", and the library also shared the event on their Facebook page and in the same group. There were also made cards with information about SVALUR and the workshops that we handed out to people we talked with during our stay. Despite the prework, no participants showed up for the workshops.

We met up with SVALUR colleges that also had their fieldwork in Longyearbyen at the same time, mostly working with focus groups and interviews. We talked with a reporter from the local newspaper *Svalbardposten* (https://svalbardposten.no/) and there is an article there pending publishing about the project. In addition, I contacted Ishavsmuseet Aarvak to ask for permission to use their network to spread information about the survey and was invited to write about the project in their member magazine *Isflaket* (https://www.ishavsmuseet.no/polarmagasin/), which I did and sent them a small article that they wanted to include in the fourth issue for 2021.

As researchers coming from outside the community it was important for us to talk to people and be visible (Newing, 2010). By talking with people over dinner, coffee, and in meetings we were able to spread information about the survey, answer questions, and listen to what they had to say about the survey and project. This way we could easily exclude misunderstandings and further explain how this project also could benefit and be of interest to them. Mainly the response was positive, and many of those I talked with were interested in

answering the survey and asking friends and colleagues to do the same.

I was in contact with an employee at Store Norske Spitsbergen Kullkompani AS (https://www.snsk.no/) about sending out information about the survey to employees and former employees there. Privacy policy regulations made it difficult to get the email list ourselves as we first asked for, but after talking with him I was able to send an email with information about the survey and my contact information to him, which then was forwarded to a list of current employees through him.

4.3.3 Recruitment over social media

Relevant pages and groups on Facebook were identified through a search using relevant keywords and "Svalbard", pages and groups already known to the team, and pages and groups recommended by people we talked with. There is also an Instagram and Facebook profile for SVALUR, administrated by Ann Eileen Lennert (UiT), which actively reaches out to an increasing audience. In the Facebook groups I published information about the survey and invited people to participate.

Before publishing in the groups and pages on Facebook I reached out to either the pages or the administrators of the group and asked permission to publish about the project. This was due to that many of the groups have guidelines and rules about what is allowed to be published and not due to a high number of members. The groups and pages where there were published about the project was:

- "Svalbard Spitzbergen Longyearbyen - Travel Tips - Pictures"
- "Porten til Ishavet"
- "Svalbard Botanisk Forening"
- "Arktisk Forening"
- "Svalbard Marine Mammals & extraordinary sightings"
- "Longyearbyen Jeger- og Fiskerforening"
- "Ros & Info Longyearbyen"

The groups "Svalbard i bilder" and "Gamle Svalbard" were also contacted, but they did either say they did not want us to publish about the project or did not answer the request sent.

4.4 Analyses

4.4.1 Organization of data

The analyses were conducted in R Studio (version 3.6.3) (R Core Team, 2020), QGIS

(version 3.10.9) (QGIS.org, 2022), and Microsoft Excel. The dataset from Maptionnaire was downloaded on December 7th, 2021. Fagerholm et al. (2021) write "before the data enter the exploration phase, PPGIS data need to be cleaned by detecting, correcting, or removing inaccurate spatial records, and organized for subsequent data analysis. Such data manipulation may include value (re)classification, data (re)ordering, data queries, and removal of outliers". This was also the case in this dataset downloaded from Maptionnaire which was chaotically organized and included observations from the entire project while I am only using the observations related to plants and wildlife.

From the dataset, I identified the observations related to plants and wildlife in Microsoft Excel. This limitation to plant – and wildlife was necessary as there is not sufficient time to investigate all aspects that could have been done with the limited time available in a master thesis. I gathered the observations related to these topics and divided them into six categories based on the work in Taylor et al. (2020) where they use the taxonomic groups vegetation, invertebrates, mammals, and birds. Taylor et al. (2020) only looks on terrestrial biodiversity, so for this project the category "mammals" were divided into "terrestrial mammals" and "marine mammals". For the categories marine mammals and terrestrial mammals, I decided to divide the observations into subcategories since there were a higher number of observations in those. Based in the observations I chose the subcategories rodents, foxes, and reindeers for terrestrial mammals, and whales, polar bears, walruses, and seals for marine mammals in addition to a general subcategory for both. The category with "other" was included since there was an observation that was related to plants and wildlife, but not directly linked to any of the other categories listed as it was an observation of lack of sightings of any wildlife.

The dataset had information about all respondents who had entered the webpage, including the ones who had not mapped anything. I used the respondent ID given automatically from Maptionnaire to divide the mapping respondents from the ones who had just entered the webpage, using the "ifelse" function in R Studio to extract the ones who had mapped something in general, and the ones who had mapped something related to plants and wildlife. The information on the respondents is presented both for all the mapping respondents for the entire survey, and one for only the respondents mapping observations related to plants and wildlife.

4.4.2 Respondents

In total 554 residents from our list did not receive either the invitation letter, the postcard, or both. Some letters and postcards were delivered in return with notes from the post office that

the address was unknown, the person had moved, was dead, or just with the stamp “return”. Of 2166 letters and postcards sent, 473 letters and 279 postcards were returned, with a total of 554 recipients. This leaves 1612 possible recipients of the invitation to participate in the project. This number is based on the letters and postcards that were delivered back from Posten Norge and the post service at UiT and it can therefore be uncertain if all the letters and postcards that were not delivered where delivered back to sender. There was also one individual who took contact and wanted to information about them to be removed from our list, a wish that were followed.

The mapping behaviour of the respondents is shown in table 1, created after model from Brown et al. (2018). By looking on the mapping behaviour it is possible to assess the effort put into the survey among the respondents. Brown (2017) supports using mapping effort to assess spatial data quality gathered in a PPGIS survey. The number of respondents is the number of all visiting the web page through http://mpt.link/svalbard, while the number of mapping respondents are those who have used time to map something in the survey. The ones who have completed the post-mapping survey are those who have delivered the survey when completed it, while those who have not delivered the survey have exited in various places. All data used in this thesis from the survey origins from respondents who have agreed to the information and consent in the beginning of the survey.

To find how many had finished the entire survey I looked up how many had delivered the survey and had a submitted time listed in the dataset. The mean number of locations mapped per respondent was calculated by dividing the total number of observations by the number of mapping respondents. The median number of observations was found using R, counting the occurrence of each respondent ID, and thereby measuring how many observations each respondent had. To be able to tell how long time each respondent had used I formatted the submitted time and start time in Excel as date and time and divided them into two columns: one for date and one for time. I was then able to subtract the submitted time with the start time, and by that find out how long time the respondents used on the survey. In R I used the lubridate library to format the times and calculate the mean time used, excluding the respondents who did not complete and deliver the survey. The time used is calculated using only the respondents who delivered their survey, as it is not possible to identify how much time people used before exiting the survey.

The demographic data for the respondents were mainly read of from Microsoft Excel, using the “Analyse data” tool that presents the data in PivotTable’s summarizing the data with

counts of occurrences in the different questions. The total number of respondents on plants- and wildlife is not enough to say something about the respondents in general. To get a better picture on who is participating in the survey I compared the data from the respondents on plants- and wildlife and all the respondents to the survey regardless of what they have mapped of observations. The answers are presented in percentage to give easier comparability between plant and wildlife respondents and all respondents. Since some did not complete the entire survey, the dataset is incomplete, and the data presented are calculated using the data available (see appendix 8). For instance, age was calculated by adding together the ages and dividing on the number of respondents who answered that question. Where the data are presented in percentage it shows those who had answered that question. The education level is presented as less than bachelor's degree, and bachelor's degree or postgraduate. The mode income was found by looking on the number of occurrences of the different income categories. The results are presented in Table 2.

4.4.3 Ecological phenomena

To be able to systematically evaluate what kind of information it is possible to gather through an online PPGIS survey, the observations were divided depending on the ecological phenomena the observations were describing. An ecological phenomenon is the expected change in an indicator used in monitoring (Pedersen, Arneberg, et al., 2021). In this thesis I am building on the work by Pedersen, Jepsen, et al. (2021), simplifying and narrowing down the phenomena they have used to fit the data on plants- and wildlife. In the report they have 24 indicators and phenomena in the High-Arctic covering 7 ecosystem characteristics: primary productivity, biomass distribution among trophic levels, functional groups within trophic levels, functionally important species and biophysical structures, landscape-ecological patterns, biological diversity, and abiotic factors. Reviewing the phenomena that can be related to the plants- and wildlife observations, I created 3 general phenomena based on their work that are relevant for this thesis: abundance, phenology, and abnormal events.

The phenomenon of abundance includes the increase and decrease in abundance in either a specific species or more general in a species group. Also, pure observations of species or species groups will in this case be included here as this study is the first to try this approach in Svalbard and due to the pilot nature of the work it is valuable to include not only observations of change but also any observations. The phenomenon of phenology address how respondents observe the different species and species groups seasonal timing. The phenomena of abnormal events are meant to gather the more sudden shifts in the environment and climate that affects

the environment and the species present. These are rarer events that can be caused by changes in abiotic factors that can result in sudden shifts in plants- and wildlife, such as change in permafrost and rain-on-snow events.

In addition, after looking on the observations I chose to add the phenomena of spatial distribution and behaviour to better cover the data for this thesis. The spatial distribution phenomenon is meant to include how species and species groups have changed their spatial distribution resulting from different causes. This is not directly related to the phenomena from Pedersen, Jepsen, et al. (2021), but many monitoring initiatives are focusing on how the species distribution are changing. Harris, Gámez, Gadsden, and Malhotra (2022) discuss how the rapid changing conditions in the Anthropocene are causing species to shift faster than it might be possible to capture by the traditional monitoring efforts. The phenomenon of changing behaviour is added to include the observations of changed behaviour in animals and birds, which can be interesting on looking on to better understand how species react and if they are able to adapt to a changing climate (Singh & Kaumanns, 2005).

4.4.4 Comparing the knowledge systems

By using these ecological phenomena, I evaluated the information value of the PPGIS results in comparison with results from one of the recent, comprehensive assessments of scientific monitoring in Svalbard using the following sources:

- A review from Taylor et al. (2020) synthesising the findings of individual papers in the special issue *Terrestrial Biodiversity in a Rapidly changing Arctic* to create a synopsis of the individual papers' findings organized in the taxonomic groups: vegetation, invertebrates, mammals, and birds.
- An assessment of MOSJ – The state of the terrestrial environment in Svalbard (Ims et al., 2014)
- An assessment of MOSJ – The state of the marine environment on around Svalbard and Jan Mayen (Fauchald et al., 2014), chapters on marine mammals and seabirds
- The web pages of Environmental Monitoring of Svalbard and Jan Mayen (MOSJ) and the Norwegian Polar Institute (NPI) to supplement with more recent monitoring

There is more monitoring happening in Svalbard than what is reported on MOSJ webpage and in the evaluations, but it is not possible to include everything. These sources were chosen since they are easily accessible and are summarizing much of the existing literature. The comparison between the local knowledge shared through the survey were done qualitatively,

where I tried to assess estimated how and whether local knowledge can increase our understanding of the ecological changes in plant- and wildlife in Svalbard.

4.4.5 Kernel density estimation

To visualize how the observations are dispersed in Svalbard, I used Heatmap (Kernel Density Estimation) in QGIS. The Kernel Density Estimation creates a continuous surface where points are transformed to a raster layer, making it possible to calculate the density of features in a neighbourhood around those features (Silverman, 1986; Zhang, 2022). This way I could visualize how the observations are distributed in relation to each other. The parameters to fill out are the radius and pixel size, where the radius decides how close the points can be before they are considered neighbours and the pixel size decides the output raster size.

Using Nearest Neighbour Analysis, a QGIS vector analysis, I was able to find the mean distance between the points, using that as the radius for the kernel density estimation. The goal of the kernel density estimation was to better visualize the distribution, but with a high radius as the mean distance showed to be, I decided to try to use the median distance instead since some of the observations are located far from the others creating a high mean. The median was found using ArcGIS calculating the distance to the nearest point. The table was exported into Microsoft Excel, where the median distance was calculated. Using the median distance as the radius (in meters) and a pixel size X and Y of 5,00, the kernel density estimation created a good visualization of the distribution of the observations shown in figure 2.

4.5 Ethical considerations

A principle in citizen science projects is that they know what they are participating in and what they are contributing to (Tauginienė, Hummer, Albert, Cigarini, & Vohland, 2021). By following this principle many of the ethical considerations may be easier to navigate (Tauginienė et al., 2021). Local ecological knowledge is owned by the locals, and results should in some way go back to the community (Tauginienė et al., 2021). Engaging citizens in scientific work at different stages can help bridge the gap between the public and scientists by making scientific knowledge more accessible for the public (Conrad & Hilchey, 2011; Vohland et al., 2021a). This can also enhance the education and increase the awareness and engagement in the topic of the project (Frigerio et al., 2021). The knowledge gathered through the methods used by SVALUR is planned and already started to be communicated back to the

community. This is not a part of this thesis, but more can be read about this on https://arcticsustainability.com/2020/07/09/svalur/.

5 Results

5.1 Respondents

A total of 212 accessed our webpage, 92 mapped at least one feature, whereas 78 also finished the survey. Among those who visited the webpage, there were 178 residents, 26 visitors, and 8 former residents, where 154 residents used their unique ID-code. The response rate, after removing the letters that were returned, was 9,6 % of those who used their unique ID-code in the survey, while the rate based on the number of residents answering in total was 11 %.

There is no way of knowing if some of the residents who answered without receiving the invitation got the letter or postcard after they had participated since the invitations were sent out on different dates.

Table 1: Comparison of mapping behaviour of plant- and wildlife respondents and all mapping respondents following the reporting standard of (Brown et al., 2018). The number of respondents is the number of all visiting the web page through http://mpt.link/svalbard, while the number of mapping respondents are those who have used time to map at least one feature. Plant- and wildlife respondents have mapped at least one feature of that category. I also report the number of participants that have completed the post-mapping survey, compared to those who never reached this final stage of the survey.

Mapping behaviour	**Plants and Wildlife respondents**	**All respondents**
Number of respondents	-	212
Number of mapping respondents (% of the number of respondents)	21 (10 %)	92 (43 %)
Number completing the post-mapping survey (% of mapping respondents)	19 (90 %)	78 (85 %)
Number of locations mapped	256	461
Mean (median) observations mapped	12 (6)	5 (2)
Mean (median) time used (hh:mm:ss)	01:13:26 (00:17:39)	00:29:48 (00:12:09)

For the entire survey there was 461 observations shared, divided into the categories weather (33), ice and snow (178), land/landscape (36), ocean and sea (40), freshwater (9), buildings and infrastructure (28), littering and pollution (51), plants and animals (75), and other (11).

The mean for plants- and wildlife respondents is 1 hour, 13 minutes and 26 seconds. This mean is artificially high, derived from one respondent spending over 14 hours in the survey. Therefore, I also report the median time, which for plants- and wildlife respondents is 17 minutes and 39 seconds. The mean and median for all respondents are lower, respectively 29 minutes and 48 seconds and 12 minutes and 9 seconds.

The 21 respondents who has mapped at least one feature on plants- and wildlife have together mapped 55,5 % of all the observations in the entire survey, even though they were only 23 % of the mapping respondents. The mean number of observations mapped among the plants- and wildlife respondents were 12, with a median of 6, compared to a mean of 5 and median of 2 for all respondents.

The demographic data of the plants- and wildlife respondents compared to all mapping respondents is reported in table 2. Here we can see that the survey has recruited people who have lived in Svalbard for different length of time. But it is also noticeable that there is a relatively high proportion of the respondents who have higher education with a bachelor's degree or higher. It is also worth noting the gender proportion, which is unequally distributed towards males, with 68 % of the plants and wildlife respondents and 62 % of all respondents being male. Only 4-5 % of the respondents were visitors.

The kernel density estimation in figure 1 shows how the observations are distributed in relation to each other. Using the mean (8257.89 meters) as radius in the kernel density estimation gave a poor visualization of the results, leading to the choice to use the median distance (2782.38 meters) as the radius. This was done since the locations are covering an extensive area, leading a few locations far away from the others increasing the mean noticeable. As expected, there is a hotspot of observations related to Longyearbyen where most people lives and travels to. Otherwise, the observations are spread over large parts of the archipelago, with most observations on the island of Spitsbergen.

Table 2: Demographic data of respondents based on responses in the survey. Some participants left the survey before completing the entire survey, so the data presented are based on those who answered each question. To get the exact numbers, see appendix 8.

Demographic data	**Plants and Wildlife respondents**	**All mapping respondents**
Resident of the study area (in %)		
Resident	95 %	96%
Former resident	-	-
Visitor	5 %	4 %
Years lived in Svalbard (residents only)		
Less than 6 months	0 %	6 %
1-2 years	21 %	17 %
3-5 years	21 %	23 %
6-10 years	21 %	18 %
11-20 years	26 %	21 %
More than 20 years	11 %	15 %
Gender		
Female	32 %	38 %
Male	68 %	62 %
Other	-	-
Age in years (mean/median)	40/39	42/43
Education (%)		
Less than bachelor's degree	11 %	20 %
Bachelor's degree or postgraduate	89 %	80 %
Mode income in NOK	541 000 to 660 000 / 791 000 to 920 000	541 000 to 660 000

Figure 1: Distribution of the observations in relation to each other showing the highest density of observations around Longyearbyen.

5.2 Plants- and wildlife

The 21 respondents have reported 75 observations on plants- and wildlife, which I have divided on the 6 categories: birds, invertebrates, marine mammals, vegetation, terrestrial mammals, and other. The number of observations per category is shown in figure 2, with 10 observations related to birds, 1 to invertebrates, 36 to marine mammals, 21 to terrestrial mammals, 6 to vegetation, and 1 observation in the category other.

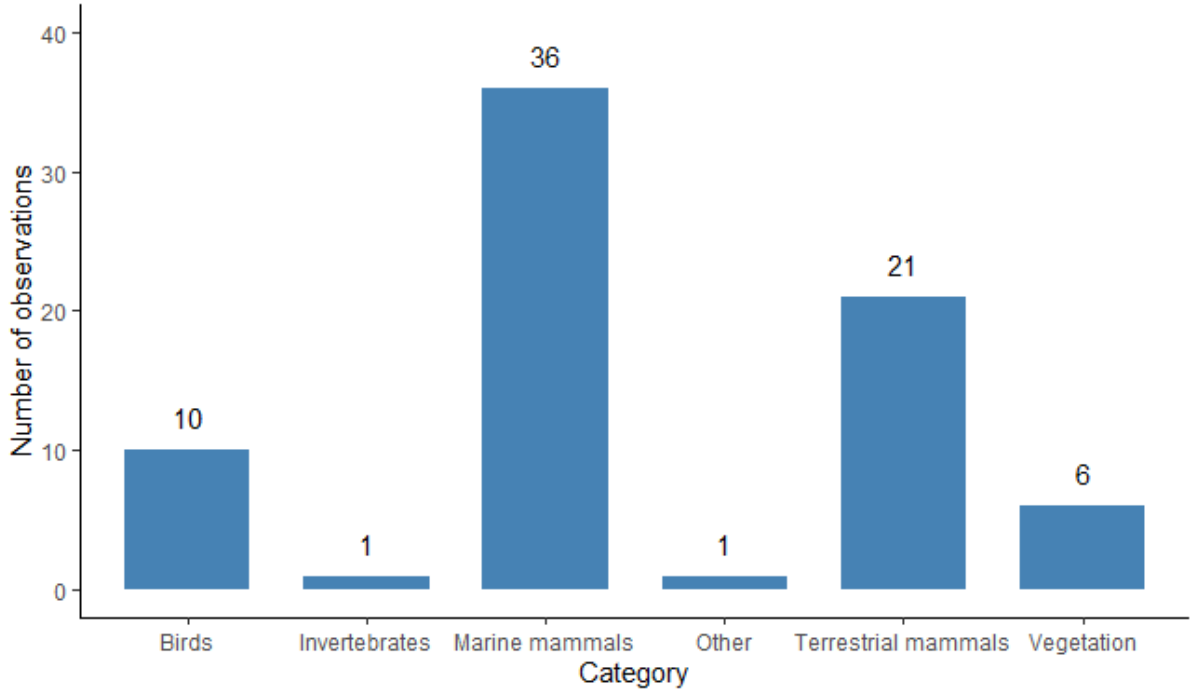

Figure 2: The number of observations per category in plants- and wildlife observations.

The observations are summarized and presented in table 3, where the categories of marine mammals and terrestrial mammals are divided into each of their subcategories. The observations as they were reported in the survey can be found in appendix 7 with each observation being numbered and referred to in the summary. Even though there are only 21 respondents there is a high diversity among the observations, with in total 6 categories and 7 subcategories covering many species and species groups.

Table 3: Summaries of the observations of plants- and wildlife. The number in the parentheses are referring to the observation number as shown in appendix 7.

Category	Summary of observations (observation number in parenthesis)
Birds	One respondent has seen fewer birds for each year in 2018-2022 in Longyearbyen (1), while another has reported an increasing abundance of Barnacle goose (*Branta leucopsis*) and Great skua (*Stercorarius skua*) in Van Mijenfjorden (2,3) and Van Keulenfjorden (4). There are also seen some Mallards (*Anas platyrhynchos*) (5,6) in Longyearbyen. It is reported Arctic skua (*Stercorarius parasiticus*) and Snow bunting (*Plectrophenax nivalis*) that have moved nesting places in Longyearbyen (9,10). One respondent has reported a noticeable decrease of seabirds in the colonies around Isfjorden (7) and especially Black-legged kittiwake (*Rissa tridactyla*) close to Grumant (8).
Invertebrates	Observation of more flies and mosquitoes around Longyearbyen and the surroundings in 2021 compared to 2002-2003 (11).
Marine mammals	General more marine mammals in the fjords. A larger proportion of different whales and walrus (*Odobenus rosmarus*) in the past years (18)
Marine mammals: whales	Observations about both abundance and distribution. In Isfjorden there are observations of Fin whale (*Balaenoptera phylsalus*) (13), Common minke whale (*B. acutorostrata*) (15-16), White whale (also known as beluga; *Delphinapterus leucas*) (14), and observations of more whales in general without specifying the species (17). One respondent reported a late arrival of whales (white whale, fin whales, and blue whales) in the autumn of 2021 (12).
Marine mammals: polar bears	There is an increase in sightings and abundance of polar bears (*Ursus maritimus*) mostly in the area around Isfjorden and Van Mijenfjorden (20-27, 29). One observation is specifying the area around Adventdalen, Hiorthhamn, and Longyearbyen (25). In Hornsund they have observed polar bears close to the station building (19). Some observations are related to changing behaviour where they have

	observed polar bears are seeking out more populated areas and cabins in the hunt for food (28-30), where some encounters have fatal outcome (30).
Marine mammals: seals	Observations of an increase in abundance of seals (34-35), and Harbour seal (*Phoca vitunlina*) (32-33). In Tempelfjorden one respondent has reported less visible seals on the sea ice after snowmobile traffic was stopped on the fjord sea ice, and thereby also fewer polar bears (31)
Marine mammals: walrus	An increasing number of observations and abundance of walruses in Isfjorden and the area around (36-37, 40-43). Many observations are tied to the appearance of Walruses on Hotellneeset, Longyearbyen in June 2021 (39, 42, 44, 47). There is one registration of a large colony in Forlandsundet on Poolepynten (45), while the colony on Sarstangen is decreasing (37). On Moffen and in Isvika in Gustav V Land there are observations of increasing colonies.
Vegetation	More lush vegetation and higher grasses in 2021 compared to 2002-2003 (74). Dandelion (*Taraxacum officinale*) has been seen both in Pyramiden in 2021 (48) and Barentsburg in 2016 (49). In Endalen, close to Longyearbyen, there are observations of Dwarf birch (*Betula nana*) and flowers in 2021 (50) and Crowberry (*Empetrum nigrum*) that had produced berries due to warm summer in 2020 (51). In 2021 it was reported of an unusually late blooming of plants and flowers in and around Longyearbyen (52).
Terrestrial mammals	In the spring of 2012, there were cases of rabies in Svalbard for the first time in long, affecting both reindeers (*Rangifer tarandus platyrhynchus*) and foxes (*Vulpes lagopus*) (55). A shorter icing period on Van Mijenfjorden led in 2013-2020 to the rare activity of foxes on Akseløya and supply of new reindeers on the island (56).
Terrestrial mammals: fox	Observations of more arctic fox both summer and winter in 2021. The respondent also reported seeing an arctic fox with the blue fur colour morph (53).

Terrestrial mammals: rodents	One observation of increasing abundance of Sibling vole (*Microtus levis*) in the Vestpynten area (54).
Terrestrial mammals: reindeer	The observations are mainly about an increasing abundance of reindeers in general in Svalbard (62-67, 70-73), but also specifically in named areas such as the area between Kapp Wiik and Skansebukta (59-61). One observation says that there are fewer reindeers close to Longyearbyen in the period 2020-2021 (68). There are also observations of reindeers with human waste in their antlers (58) and reindeers starving to death caused by rain-on-snow events in January 2021 (57).
Other	One respondent reported that there were no observations of animals when out picking garbage with Sysselmesteren in June 2021 (75).

Figure 3: map showing the distribution of the observations in the categories assigned. The sections show Longyearbyen with surrounding areas. Many of the observations are located so close together that the points overlap each other.

5.3 Observed ecological phenomena

Spatial distribution

As the map in figure 3, shows the distribution of the observations gathered by the respondents was spread over most of Svalbard. Even though people travel to more remote areas there is no doubt that there is a higher quantity of observations close to where people live, and that the quality of the observations can be higher in the areas where people spend the most time. There are more observations on spatial distribution for the more charismatic and easily recognised species. Many respondents reported on observations of changes in the distributions of walrus colonies, where the increasing population is spreading to new locations, and leaving others. This is mostly already covered by existing monitoring (Norwegian Polar Institute, 2022c), but other observations from the respondents does not seem to be monitored in the same extent. People who travel in the more remote areas can also observe how climatic factors can influence the spatial distribution. For instance, a respondent has observed an incident with rare activity of foxes and reindeers on Akseløya in Van Mijenfjorden caused by a change in the sea ice on the fjord. None of the sources analysed mentioned specific monitoring programs targeting spatial distribution in Svalbard, but spatial distribution could be mapped in relation to other projects without being mentioned. This seems to be the case for vegetation, where Ims et al. (2014) writes that the knowledge about the species inventory distribution of vegetation in Svalbard is solid, but without mentioning any specific monitoring on the spatial distribution of vegetation. Remote sensing is the most common way of monitoring spatial changes in vegetation, such as the greening and browning of tundra (Karlsen, Elvebakk, Høgda, & Grydeland, 2014).

Abundance

About two-thirds of the observations gathered in the survey were related to changes in abundance of either a specific species or a species group. These observations are mostly on charismatic species such as reindeers, arctic foxes, birds, polar bears, whales, walruses, and seals where there already exist comprehensive monitoring programs (for instance density of territorial male Svalbard rock ptarmigans (Norwegian Polar Institute, 2022a), reindeer population in Adventdalen (Norwegian Polar Institute, 2022b) and walrus population in Svalbard (Norwegian Polar Institute, 2022c)). The abundance of mammals and birds are often mentioned as aims for monitoring, both for specific species (Fauchald et al., 2014; Ims et al., 2014), specific species as indicators (Fauchald et al., 2014), and for monitoring food web structures (Ims et al., 2014).

There are also observations of abundance of invertebrates and vegetation changes, where there is less existing monitoring (Taylor et al., 2020). The monitoring of vegetation in Svalbard is deficient, and even though several field studies are being conducted, the limited time frame of the projects excludes them as monitoring projects (Aronsson et al., 2021; Ims et al., 2014). In Ims et al. (2014) they do not have any indicators on vegetation due to lack of MOSJ indicators at the time of the assessment, but they mention other, often short-term, projects looking on the effect of herbivory on the vegetation. Since their assessment a monitoring program has been established where time-series are still short (Ravolainen et al., 2020). A review of plot-based approaches looking on abundance in vegetation has revealed large variation in both species and sites regarding change in abundance (Taylor et al., 2020). I was not able to identify any existing programs for monitoring decline or increase of insects in Svalbard. Taylor et al. (2020) were only referring to a species data base where they are mapping out the species present in the Arctic region including Svalbard with the only long-term dataset on invertebrates in the Arctic region from Zackenberg, Greenland (Taylor et al., 2020).

Behaviour

The behaviour of polar bears constitutes half of the observations of the species, where people are observing more polar bears in areas close to human settlements. The respondents have also observed and experienced polar bears breaking into cabins in search for food. This is also reported by researchers working with polar bears in publications aimed for the public (Andersen, Aars, & Vongraven, 2021), but without seemingly any monitoring directly on the behaviour. The respondents are also able to observe the lack of sightings of animals, such as one respondent who reported seeing no animals on an annual field cruise with Sysselmesteren in 2021. This is also shown in the observation reported by someone seeing less seals and polar bears on Tempelfjorden after there was a ban on snow mobiles driving on the sea ice. If this is caused by the change in behaviour after humans have changed the use of the area, or just by there being less people in the area able to observe the animals can be discussed.

Phenology

The observations related to phenology is supplementary to the existing monitoring. Phenology is the most monitored trait of vegetation in the Arctic, where remote sensing approaches have revealed an earlier green-up in plants in the spring and plot-based monitoring have revealed mixed responses in timing of flowering (Taylor et al., 2020). With the heterogeneity and variations at small spatial scale, people who are present in an area year after year can observe

the local changes in the timing of seasonal variations. The lack of data from long-term monitoring programs can be supplemented with data from citizen science projects (Taylor et al., 2020).

Abnormal events

With a changing climate there will be more sudden shifts in the environment, both in biotic and abiotic factors. These events are mostly not monitored themselves, but the mechanisms behind might be. An example of this is changes in the permafrost, where one respondent shared an observation of arctic skua (*Stercocarius parasiticus*) moving nesting site after instabilities in the permafrost changing the structure of the plain. There is no monitoring on the nesting sites of artic skua, but the permafrost is a topic of high interest and there have been found evidence of birds relocating nests due to changing permafrost in the Arctic tundra (Berteaux et al., 2016).

6 Discussion

In this thesis I have explored how citizen science can contribute to ecology through citizen monitoring of plant-and wildlife emphasizing the profound environmental changes taking place in Svalbard relating to Arctic warming. I expected that people living and visiting Svalbard would map observations, but also experiences of changes and their potential causes. I based my analysis on five "ecological phenomena" known as important for understanding plant-and wildlife ecology and their management. I found that people mostly registered charismatic species without referring to their experiences of environmental changes and the potential link to drivers of change. The charismatic species are more recognisable and easier spotted which could explain the overrepresentation of these species, but especially sea mammals have previously been subject for citizen science in the project Svalbard Marine Mammals Sightings by the Norwegian Polar Institute. Theobald et al. (2015) states that even though there are biases in the sampling effort by citizens, the same bias can be found in sampling effort by professionals. In Svalbard, as in many other remote locations, wildlife has been the primary focus of monitoring, whereas monitoring of insects is limited to presence and absence of species on the archipelago (Taylor et al (2020).

I observed that people are mapping wildlife observations from a broad spectre of themes. While citizen observations were concentrated close to settlements, citizens mapped wildlife over the extent of Svalbard, including remote areas. This shows that people can contribute with observations and data collection in areas where it is laborious to obtain monitoring data through traditional methods. The potential of covering large areas and to discover novel observation in remote location is usually put forwards as one of the merits of citizen science (Peacock et al., 2020; Vohland et al., 2021b). This is particularly important given the local variations in plant- and wildlife distribution in Svalbard (Jónsdóttir, 2005).

Despite of having few respondents in this study, there are some indications that citizens can contribute with observations that can be of interest to investigate further. For example, respondents mapped interesting behaviours of polar bears that have been recorded also by scientists (Andersen et al., 2021). Another interesting observation is the relocation of birds' nests in response to instabilities of permafrost, which is also reported from Berteaux et al. (2016) in the Arctic tundra. The phenology of flowers and other vegetation can have distinctly local variations uncovered by already existing monitoring (Taylor et al., 2020). In general, citizens can provide observations on these local variations to better understand these

differences, which is promoted by Taylor et al. (2020) to increase the capacity of the monitoring on a broader spatial and temporal scale. In this case it is not possible to say anything about the local variations due to the small number of observations and it takes more than a handful of notions to understand differences between localities. Abnormal events such as rabies outbreaks in Svalbard are also reported in the survey. This is known to happen and are monitored by researchers, and people who travel in the areas year-round may in some cases observe sick animals and make the first alert.

The time researchers spend in field should not be underestimated, and they have access to resources and permissions that is unavailable to residents and visitors. For residents and visitors to increase the spatial or temporal scale they need to go to places where there is no or limited monitoring, or at a times where there is no monitoring. When they go to such places their mind needs to be observant and aware of the nature around them. This last point might be a reason for the large proportion of the charismatic species.

To increase the quality of citizen data, the main challenge is to increase the number of people participating (Brown, 2017). One measure that was done in this project was therefore to send a personal invitation, which is shown to increase both participation rate and quality of the data mapped (Brown, 2017). Also engaging with people directly showed to be an effective measure to increase the engagement and motivation to participate for people I talked with during my stay in Longyearbyen. In unformal conversations and settings with people it seemed like that the threshold to ask questions about the project and be motivated to participate were lower when meeting them in person.

In some scientific disciplines there are some concerns on the quality of the data gathered through citizen science projects (Balázs, Mooney, Nováková, Bastin, & Jokar Arsanjani, 2021). Data quality can mean different things for different stakeholders, and it is important to be able to assess the quality of the data gathered through citizen science project to assure a high credibility and a good reputation (Balázs et al., 2021). Brown (2017) have through his work developed methods to assess data quality based on the time and effort used by the participants to online mapping platforms. This can further be used to assess data quality in projects using similar approaches (Brown, 2017).

In this project very few of the respondents decided to map plant- and wildlife to compared to changes in the snow, ice, water, and landscape. The proportion of respondents mapping on plants- and wildlife was only 23 % of all mapping respondents, although they mapped as

much as 55 % of all the observations in the survey. Some of these respondents can be referred to as “super-mappers” as defined by Brown (2017), respondents who has mapped considerably more than the average. They spent considerable time in the survey with a median of 17 minutes and 39 seconds. Brown (2017) found that people on average spend 13.6 minutes on mapping, which is difficult to compare using the Maptionnaire platform that do not separate between among the time used on mapping versus the rest of the survey. Nevertheless, a higher number of mappers would be preferable to increase the quantity of data points as well as to have the possibility to increase the quality of the data in entirely. There are possibly several reasons for the few respondents deciding to map plants and wildlife, including: i) personal knowledge and interest by the respondents, ii) the visibility and time span of changes in plants- and wildlife, and iii) the lack of a basis for comparison to be able to say what has changed.

In this study I had limited time to recruit participants, and despite of efforts used to spread information using both media and social media there were only 88 local respondents and very few visitors that mapped something. The respondent rate of 11 % is not much less that what would be expected from previous PPGIS surveys (Brown, 2017), but the low number of residents in Svalbard makes a small pool of possible participants. To increase participation, we also arranged two workshops which is known to increase participation in PPGIS surveys (Vohland et al., 2021b), but this did not have any effect since no one attended the workshops. This can be a sign of participant fatigue, and people I talked with during my stay in Longyearbyen expressed their weariness of the increasing number of research projects asking residents of Longyearbyen to participate. Some also expressed their concern that their knowledge was not good enough since they feel they are not experts and therefore their knowledge was of no use to share. In these cases, it was possible for me to talk with them and motivate them to participate when I was in dialogue with residents, but it is limited how many it is possible to talk with in less than a week. For citizen monitoring to be useful, Fagerholm, García-Martín, Torralba, Bieling, and Plieninger (2022) suggests a minimum of one year to complete a scientifically valid PPGIS study, which gives more time to increase the participation with possibilities to target and recruit additional groups.

An untapped resource for monitoring plants- and wildlife on Svalbard is the tourism industry. The increase in tourism and interest in the environment and wildlife, visitors alongside with residents can contribute with local nuances in the monitoring of spatial distribution. To be able to give visitors the best experience tour operators need to acquire knowledge about where

and when distinct species can be found, which is information that can be systematized and used in monitoring purposes. In other monitoring program, such as Svalbard Marine Mammals Sightings, tourists are asked to map where and how many individuals of charismatic marine mammals they observe in the waters around Svalbard (Bengtsson et al., 2022). The restrictions on where and when people can travel at given times makes the tour guides crucial for the tourists who wants to seek out the nature and wildlife (Stortingsforhandlinger. Meld. St. 32, 2015-2016), which gives the guides have many opportunities to observe and experience the same areas throughout the season, and from year to year.

In conclusion, my study has provided an approach to assess whether and how local knowledge gathered through an online PPGIS platform can contribute to and complement current monitoring programs. The comparison between the observations gathered through the survey and the monitoring data through ecological phenomena showed to be a useful way to qualitatively assess whether and how local knowledge can contribute to ecological monitoring. It appears that citizen science observation is most likely to contribute to monitoring by expanding the spatial scale of observations. Abnormal events are also something that people usually notice, but there were few such observations in this case. However, the limited amount of data in this thesis makes it difficult to conclude on the full potential and possibilities of using citizen science in ecological monitoring. The possibilities of using citizen science in ecological monitoring are seemingly present given further effort to improve the methods to include local knowledge in the traditional ecological monitoring.

7 Contributions

The survey was an already a planned part of SVALUR and based on their aims and some of their work. Team members from SVALUR reviewed the survey before launch and helped with the translation to Russian and looked over the English translation. This thesis would not be possible without the participants sharing their knowledge and experiences.

8 References

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9 Appendix

9.1 Appendix 1: Template of survey

PAGE 1

Climate and Environmental changes in Svalbard

People who live, work or travel to Svalbard can contribute with important knowledge about changes in climate, environment, and the Arctic nature. In this study we ask people with different affiliation to the archipelago to share observations and experiences on changes in the Svalbard environment. See https://arcticsustainability.com/2020/07/09/svalur/ for more information about the project

The survey first takes you to a mapping page. Here you will be asked to mark areas where you have observed, or experienced changes related to climate and environment. It is up to you how much time you want to spend on the mapping and whether you want to share photos and other documentation on the website. You can answer this survey from a smartphone, but we recommend using a PC.

PAGE 2

Welcome!

Q.1: Are you a permanent resident or a former resident?

A.1: Resident

Q.2: Were you invited in the mail?

A.2 Yes

Unique ID code

You start the survey by entering your unique ID code, which you received in the mail, here:

[Your unique ID code]

Q.3: How many years have you lived on Svalbard?

A.3: Less than 6 months

A.3: 1-2 years

A.3: 3-5 years

A.3: 6-10 years

A.3: 11-20 years

A.3: More than 20 years

Skips to page 3

A.2: No

Skips to Q.4

A.1: Former resident

Q.4: How did you first learn about the study?

A.4: Facebook

A.4: SVALUR's website

A.4: Instagram

A.4: On another website than mentioned above.

A.4: I was invited by someone else

A.4: I read about it in the local news

A.4: Other

Q.3: How many years have you lived on Svalbard?

Skips to page 3

A.1: Visitor

Q.5: How often do you visit Svalbard?

A.5: More than 2-3 times a year

A.5: 2-3 times a year

A.5: Yearly

A.5: Every 2-3 years

A.5: Sometimes

A.5: Only visited once

Q.6: Please estimate the average time of your stay

A.6: [Write your answer here]

Q.7: When visiting Svalbard, where have you primarily spent the night?

A.7: In Longyearbyen

A.7: In Barentsburg

A.7: In Ny-Ålesund

A.7: In a cabin outside mentioned places

A.7: In a tent outside mentioned places

A.7: On a boat

A.7: Other

PAGE 3

Declaration of consent

I have read the information (LINK) regarding this research. I am 16 years or older and voluntarily agree to participate. I am free to withdraw from this study at any time. I understand that I will not be able to be identified and my personal results will remain confidential, unless otherwise required by law.

- I have received and understood the information about the project.
- I agree to participate in this online survey.
- I understand that the information is processed until the project is completed on August 31, 2023
- I agree to that the pictures and documents I share can be used in non-commercial purposes and dissemination of the project, including on social media. I am aware of that sharing of pictures of third persons require consent.

PAGE 4

Instructions for the survey

We ask you to mark places where you have observed or experienced environmental and climate changes or events. You first identify the place and then you can choose whether to enter a small text and upload pictures.

To move the map, hold the mouse and drag the map. You can zoom in with + and zoom out with -.

To choose a location on the map, you first have to click the pin, after which the pin will appear on the map. You may then move and drag the pin to a desired location. Then select another pin that you want to map.

After placing a pin, questions to this pin will pop up. Skip questions that you do not have answers to. You may continue by clicking to the next question.

Click on the pin below to see how this works!

[VIDEO - https://youtu.be/sgZ0bqY30bE]

PAGE 5

Mapping

Register changes in climate or the environment that you have observed/ experienced related to:

Category	Help text
Weather	In this area I have observed or experienced that the weather has changed (temperature, rainfall, wind, storms etc.).
Ice and Snow	In this area I have observed or experienced that snow and ice conditions have changed (amount, timing of melt, withdrawal of glaciers, etc.)
Land/landscape	In this area I have observed or experienced changes in the landscape or events that have changed the landscape (erosion, landslide, crater, land becoming wetter or drier, etc.)
Freshwater	In this area I have observed or experienced changes in a river, lake or other freshwater body, or an event impacting on a freshwater environment (flooding, drought, algal blooms, smell, etc.)
Ocean and Sea	In this area I have observed or experienced (environment-related) changes or events in or on the sea (sea ice, flooding, coastal erosion, etc.)
Plant and animals	In this area I have observed or experienced changes in the presence

	or abundance of animal or plant species
Pollution and littering	In this area I have observed or experienced changes or events concerning pollutions or littering.
Buildings – and Infrastructure	In this area I have observed or experienced changes or events in climate or environment that result in changes in buildings and infrastructure (buildings or infrastructure that are moved or destroyed by changes, etc.).
Others	In this area I have observed or experienced a climate or environment related change or event that does not fall within any of the above-named categories.

At each category:

Which observation do you want to register?

When did you do the observation?

Upload files/pictures here related to the observation

PAGE 6

Thank you! You are almost done! The questionnaire will take about 5 minutes for you to answer.

Q.8: Indicate your level of agreement or disagreement with each statement

A.8: Strongly agree, Agree, neither agree nor disagree, Disagree, Strongly disagree

- I feel that Svalbard is a part of me.
- Svalbard is the best place to experience or do the things I appreciate.
- I have no particular attachments to Svalbard
- Svalbard is special to me.
- There is no place that can compare to Svalbard.
- I have an emotional attachment to Svalbard – it has meaning to me
- I would not replace Svalbard with another place for the things I like to do.
- I have good knowledge of the environment and nature on Svalbard.
- Svalbard would mean less for me if the plants and wildlife that belong there disappears.
- Svalbard would mean less for me if snow and ice were to disappear.

PAGE 7

Q.9: Are you…

A.9: Female

A.9: Male

A.10: Other / I don't want to answer

Q.10 When were you born?

A.10: [write year here]

Q.11: What is your highest level of education?

A.11: No education or Primary school

A.11: Lower secondary school: *Ungdomsskole, folkeskole, realskole, framhaldsskole*

A.11: Upper secondary school: *videregående (vk2 og 3, gymnas)*

A.11: Higher education: University and College education, lower level (Bachelor's degree)

A.11: Higher education: University and College education, higher level (Master's degree, PhD degree, Post graduate university degree)

Q.12: Before taxes and other deductions; how much is your households' approximate gross annual income, including your own income?

A.12: NOK 270,000 or less

A.12: NOK 271 000 to 420 000

A.12: NOK 421 000 to 540 000

A.12: NOK 541 000 to 660 000

A.12: NOK 661 000 to 790 000

A.12: NOK 791 000 to 920 000

A.12: NOK 921 000 to 1 050 000

A.12: NOK 1 050 000 to 1 225 000

A.12: NOK 1 225 000 to 1 500 000

A.12: NOK 1 501 000 or more

A.12: I don't know/do not want to answer

Q.13: Which of these apply to you? (Choose all that apply)

A.13: I have good knowledge of Svalbard

A.13: I am of Norwegian origin

A.13: I am from an EU country or Great Britain

A.13: I am from a country outside EU (excluded Norway)

A.13: I work in tourism or as a guide

A.13: I am a local politician

A.13: I am a member of an environmental organization

A.13: I am a member of an outdoors organization

A.13: I am a member of a hunting and fishing organization

A.13: I work with management and / or planning

A.13: I work as a researcher or consultant

A.13: I am a student studying on Svalbard

A.13: I grew up on Svalbard

Q.14: If you want a summary of the results of this study, please type your email address in the field below:

A.14: [Email address]

Q.15: Would you like to be contacted by email in the future to participate again in this survey?

A.15: Yes, I allow that my email address will be stored for participating in SVALUR's survey in the future.

A.15: No, I want my email address to be deleted from the database and I do not want to be contacted regarding future surveys.

This ends the survey! Thank you so much for your participation. If you have more comments, then you can write them down here:

[Answer]

9.2 Appendix 2: Information and consent

Information and consent

Please read the following information before deciding whether to participate in this study. You should be 16 years of age or older to participate. The project has been approved by the NSD – Norwegian Center for Research Data AS (http://www.nsd.uib.no, nr. +47 53 21 15 00.)

Purpose of the study

SVALUR invites people with connections to Svalbard to a web-based story mapping, where you can use microblogs and pictures to register observations and experiences related to climate and environmental changes and events on Svalbard (http://slu.se/svalur). SVALUR is an interdisciplinary research project where researchers from different research institutions are involved to combine experience-based knowledge and the traditional environmental monitoring. The findings of the project will be communicated back to residents and visitors to Svalbard and will document and provide a comprehensive insight into long-term environmental changes. The findings could also be used to identify how current environmental monitoring programs can be made more relevant to people living and visiting the Arctic. With an increase in activity in the region, where people stay for a shorter time, it is more important than ever to develop ways in which experiential knowledge can complement scientific knowledge.

Who is responsible for the research project?

UiT – The Arctic University of Norway owns the data in this survey and have the responsibility to manage the data according to EUs privacy policy rules. The project is funded by Belmont Forum (http://www.belmontforum.org/news/belmont-forum-awards-funding-for-resilience-in-a-rapidly-changing-arctic/). Aggregated data are used by SVALUR, which has different participating institutes (Norwegian Polar Institute, SLU, SEI, Mälarden University, INSTARR, RUG, Scott Polar Research Institute), but these institutes will not have access to personal data.

Who participates in the study?

Participants are recruited from the Tax Register. Participants are contacted via a card sent in the mail with information about the survey and a code for login. It is important that those who have received this code use it so that we can assess whether our survey is representative of the

population in Svalbard.

In addition, we also recruit participants who were not drawn from the Tax Register, and we also encourage you to pass on information to others who may consider participating.

What does it mean for you to participate?

Risk and benefit

We do not anticipate any risk by participating in this study. We follow research ethics guidelines for the processing of information. As a respondent, you should feel confident that your answers always are treated confidentially. Data that is handed out for public use will always be unidentifiable. In cases where information provided in the survey will be able to identify you, the information will be reworked or removed before it is further processed.

The project can contribute useful knowledge that can further contribute to improve environmental monitoring and management in Arctic areas.

What does it mean for you to participate?

If you choose to participate in the project, it means that you fill out a survey. It will take you approximately 20 minutes. Your answers will be registered electronically.

It is voluntary to participate

Your participation is completely voluntary. You can withdraw from this study at any time.

Data collection, storage, and use

The data is collected in the Maptionnaire program, which processes the information confidentially and in accordance with the privacy regulations in Norway and the EU. The data is encrypted when sent to project manager Prof. Vera Helene Hausner who stores the data in a secure database.

Name lists and email addresses will be stored separately from this database. Your answers will thus not be able to be linked personally to you and individual responses will not be reproduced in reporting the research. The data will be processed by a project group at UiT – the Arctic University of Norway. No one else has access to the personal data.

We also ask about how you first learned about the project. We only use this information to assess how we can best recruit participants for our study.

What happens to your information when we end the research project?

The project will according to plan end 31. August 2023. Personal information and information about place of residence, age, gender, education, and income will be deleted at the end of the project.

Participants are contacted via a card sent in the mail with information about the survey and a code for login. After completing the survey, participants are asked to register their email addresses. The email address is important for the dissemination of the results and for drawing relevant rewards for participation in the survey. You will also be able to choose to be contacted again by email to participate in future rounds of this survey if you wish. The email address is not under any circumstances passed on to any third party and it is stored separately from the answers to the questions according to procedures approved by NSD. The email address will also be deleted if you have chosen to not participate in future rounds of this survey.

Your rights

As long as you can be identified in the data material, you have right to:

Access to which personal information is registered about you

To have personal information about you corrected

Have personal information about you deleted

Obtain a copy of your personal information (data portability)

To send a complaint to the Privacy Representative or the Data Inspectorate about the processing of your personal data

What entitles us to process personal information about you?

We process information about you based on your consent.

Where can I find out more?

You can find more information about the project at https://www.slu.se/svalur.

Contact information

Feel free to contact us if you have any questions regarding the research:

Contact:
Linn Bruholt, lbr048@uit.no, phone: +47 98807254

The project is led by:

Prof. Vera Hausner (vera.hausner@uit.no)

UiT – the Arctic University of Norway (phone: +47 776 45905)

If you have any ethical reservations regarding the project or questions regarding your rights as a participant, please contact NSD – Norwegian Center for Research Data AS, by email (personverntjenester@nsd.no) or telephone: +47 55 58 21 17.

You can also contact the Privacy Representative at UiT – the Arctic University of Norway, Joakim Bakkevold (personvernombud@uit.no, phone: +47 776 646322)

9.3 Appendix 3: Application NSD

Meldeskjema

Referansenummer

703522

Hvilke personopplysninger skal du behandle?

Navn (også ved signatur/samtykke)

Fødselsdato

Adresse eller telefonnummer

E-postadresse, IP-adresse eller annen nettidentifikator

Bilder eller videoopptak av personer

Gps eller andre lokaliseringsdata (elektroniske spor)

Bakgrunnsopplysninger som vil kunne identifisere en person

Andre opplysninger som vil kunne identifisere en fysisk person

Beskriv hvilke bakgrunnsopplysninger du skal behandle

Vi trenger å ta et tilfeldig utvalg basert på uttrekk fra Evry (skatteregisteret). Vi benytter følgende opplysning fra Folkeregisteret: navn, adresse, fødselsdato, kommunenummer for personer i alderen 18-79.

Beskriv hvilke andre opplysninger som vil kunne identifisere en person du skal behandle

Vi bruker programmet Maptionnaire til å kartlegge hendelser og observasjoner knyttet til miljø- og klimaendringer og hendelser.

Vi spør også om alder, kjønn, utdanning og inntekt. Disse dataene sletter vi ved prosjektslutt.

Deltakerne i studiet kan last opp bilder for å illustrere klima - og miljøendringer på Svalbard. Vi informerer deltakerne om at deling av bilder av tredjepart krever samtykke.

Prosjektinformasjon

Prosjekttittel

SVALUR- Understanding Resilience and Long-Term Environmental Change in the High Arctic: Narrative- Based Analyses from Svalbard

Prosjektbeskrivelse

Lokalbefolkningen - og tilreisende på Svalbard kan bidra med verdifull kunnskap om endringer i klima, miljø og den arktiske naturen. I dette studiet spør vi folk med ulik tilknytning til øygruppen om å dele observasjoner og erfaringer om endringer i Svalbardmiljøet.

Studiet er en del av prosjektet SVALUR som har som formål å utvikle kunnskap - og observasjonssystemer som kan bidra til en helhetlig forståelse av miljøendringer og bærekraftige tilpasninger på Svalbard. Funnene fra dette studiet vil sammenstilles med eksisterende miljøovervåkningsdata for å vurdere endringer i klima - og miljø på Svalbard.

Dersom opplysningene skal behandles til andre formål enn behandlingen for dette prosjektet, beskriv hvilke

Kartlagene fra Maptionnaire vil blir brukt SVALUR og i andre prosjekter, men personopplysningene vil bli slettet eller omarbeidet (e.g. alder vil grupperes til intervaller og tekstmateriale vil omarbeides). Det vil ikke være mulig å identifisere enkeltpersoner sine kartlegginger og svar på spørsmål. For de som krysser av at de kan tenke seg å delta i framtidige studier tar vi vare på alder, kjønn, kommune og epostliste i en kryptert database for å gjenta dette studiet om 2-3 år

Begrunn behovet for å behandle personopplysningene

Vi ønsker å invitere alle fastboende på Svalbard til å delta. Vi trenger navn og adresse for åsende invitasjon til å delta i undersøkelsen. Folk på Svalbard tilbringer mye tid ute i naturen og observerer endringer i klima og miljø. Sosiodemografiske variabler vil primært bli benyttet for å forstå hvilke endringer ulike grupper observerer på Svalbard.

Ekstern finansiering

Norges forskningsråd (NFR)

Type prosjekt

Forskerprosjekt

Behandlingsansvar Behandlingsansvarlig institusjon

UiT Norges Arktiske Universitet/ Fakultet for biovitenskap, fiskeri og økonomi/ Institutt for arktisk og marin biologi

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Vera Helene Hausner, vera.hausner@uit.no, tlf: 77645905

Skal behandlingsansvaret deles med andre institusjoner (felles behandlingsansvarlige)?

Nei

Utvalg 1 Beskriv utvalget

Vi rekrutterer lokalbefolkningen ved å sende brev til alle som har registrert adresse på Svalbard i folkeregisteret.

Rekruttering eller trekking av utvalget

Vi ønsker følgende uttrekk fra folkeregisteret: navn, adresse, fødselsdato. I tillegg rekrutterer vi også deltakere som ikke ble trukket ut fra Folkeregisteret. Dette gjøres via sosial media, gjennom ulike forum og organisasjoner, og gjennom å rekruttere tilreisende på flyplassen. Vi oppfordrer også deg til å videreformidle informasjon til andre som kan tenke seg å delta.

Alder

18 - 100

Inngår det voksne (18 år+) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 1

Navn (også ved signatur/samtykke)

Fødselsdato

Adresse eller telefonnummer

E-postadresse, IP-adresse eller annen nettidentifikator

Gps eller andre lokaliseringsdata (elektroniske spor)

Bakgrunnsopplysninger som vil kunne identifisere en person

Andre opplysninger som vil kunne identifisere en fysisk person

Hvordan samler du inn data fra utvalg 1?

Elektronisk spørreskjema

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstava)

Informasjon for utvalg 1

Informerer du utvalget om behandlingen av opplysningene?

Ja

Hvordan?

Skriftlig informasjon (papir eller elektronisk)

Utvalg 2 Beskriv utvalget

Rekruttering av deltakere via epostlister, sosial media, aviser og tilreisende til Svalbard

Rekruttering eller trekking av utvalget

Vi vil sende link til alle som ønsker å delta i studiet via sosial media og epost lister. Vi kontakter organisasjoner og aviser for å få folk med tilknytning til Svalbard til å delta. Vi vil også rekruttere folk til å delta på flyplasser og via cruiseship. De vil i dette tilfellet få muntlig informasjon og et postkort med informasjon og link til prosjektet. Der vil de få skriftlig informasjon og samtykke.

Alder

18 - 110

Inngår det voksne (18 år+) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 2

E-postadresse, IP-adresse eller annen nettidentifikator

Bilder eller videoopptak av personer

Gps eller andre lokaliseringsdata (elektroniske spor)

Bakgrunnsopplysninger som vil kunne identifisere en person

Andre opplysninger som vil kunne identifisere en fysisk person

Hvordan samler du inn data fra utvalg 2?

Elektronisk spørreskjema

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstava)

Informasjon for utvalg 2

Informerer du utvalget om behandlingen av opplysningene?

Ja

Hvordan?

Skriftlig informasjon (papir eller elektronisk)

Utvalg 3 Beskriv utvalget

Videregående avdeling ved Longyearbyen skole

Rekruttering eller trekking av utvalget

Rekrutteringen foregår personlig, ila en workshop som SVALUR forskere skal tilby til VG 2 og VG 3. Vi skal kontakte skolen, avtale et besøk i klassen der vi forteller om prosjektet og gir ungdommene mulighet til å delta i undersøkelsen. Foresatte til personer under 18 vil bli infonnert gjennom skolen når vi avtaler workshopen.

Alder

16 - 19

Inngår det voksne (18 år+) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 3

E-postadresse, IP-adresse eller annen nettidentifikator

Bilder eller videoopptak av personer

Gps eller andre lokaliseringsdata (elektroniske spor)

Bakgrunnsopplysninger som vil kunne identifisere en person

Andre opplysninger som vil kunne identifisere en fysisk person

Hvordan samler du inn data fra utvalg 3?

Elektronisk spørreskjema

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstava)

Hvem samtykker for ungdom 16 og 17 år?

Ungdom

Informasjon for utvalg 3

Informerer du utvalget om behandlingen av opplysningene?

Ja

Hvordan?

Skriftlig informasjon (papir eller elektronisk)

Tredjepersoner

Skal du behandle personopplysninger om tredjepersoner?

Nei

Dokumentasjon

Hvordan dokumenteres samtykkene?

Elektronisk (e-post, e-skjema, digital signatur)

Hvordan kan samtykket trekkes tilbake?

De kan informere kontaktperson på epost og da vil all data som de har lagt inn slettes.

Hvordan kan de registrerte få innsyn, rettet eller slettet opplysninger om seg selv?

Deltakerne kan få innsyn i kolonnen med data som vi har i databasen og be om å rette eller slette denne kolonnen.

Totalt antall registrerte i prosjektet

1000-4999

Tillatelser

Skal du innhente følgende godkjenninger eller tillatelser for prosjektet?

Behandling

Hvor behandles opplysningene?

Ekstern tjeneste eller nettverk (databehandler)

Hvem behandler/har tilgang til opplysningene?

Prosjektansvarlig

Interne medarbeidere

Databehandler

Hvilken databehandler har tilgang til opplysningene?

Maptionnaire fanger dataene som sendes kryptert til prosjektleder. Dataene oppbevares og behandles i kryptert server. UiT har laget en avtale med Maptionnaire om dette.

Tilgjengeliggjøres opplysningene utenfor EU/EØS til en tredjestat eller internasjonal organisasjon?

Nei

Sikkerhet

Oppbevares personopplysningene atskilt fra øvrige data (koblingsnøkkel)?

Ja

Hvilke tekniske og fysiske tiltak sikrer personopplysningene?

Opplysningene krypteres under forsendelse

Opplysningene anonymiseres fortløpende

Opplysningene krypteres under lagring

Varighet Prosjektperiode

01.09.2021 - 31.08.2023

Skal data med personopplysninger oppbevares utover prosjektperioden?

Nei, data vil bli oppbevart uten personopplysninger (anonymisering)

Hvilke anonymiseringstiltak vil bli foretatt?

Personidentifiserbare opplysninger fjernes, omskrives eller grovkategoriseres

Vil de registrerte kunne identifiseres (direkte eller indirekte) i oppgave/avhandling/øvrige publikasjoner fra prosjektet?

Nei

Tilleggsopplysninger
[Ingen]

9.4 Appendix 4: Application Norwegian Tax Adminitstration

UiT – Norges Arktiske Universitet Dato: xx.09.21
Att: Vera Hausner
Biologibygget
Framstredet 39
N-9019 Tromsø

Skattedirektoratet
Juridisk avdeling
Postboks 9200 Grønland
0134 Oslo

Søknad om tilgang til folkeregisteropplysninger undergitt lovbestemt taushetsplikt av personer registrert i Folkeregisteret via EVRY AS – til forskning

I forbindelse med forskningsprosjektet SVALUR, som er godkjent av NSD (referansekode 703522), ønsker vi uttrekk av følgende folkeregisteropplysninger for alle fastboende registrert i Longyearbyen, Svalbard.

- fullt navn
- fødselsdato
- fødselsår
- kjønn
- adresse inkl. flyttedatoer
- fødested
- statsborgerskap
- sivilstand
- barn

Folkeregisteropplysningene skal kun benyttes til statistiske analyser av et stort datasett og opplysningene vil slettes når prosjektet avsluttes. Vi har vedlagt følgende informasjon som vedlegg til denne søknaden.

1. Bekreftelse på førstestillingskompetanse for Prof. Vera Helene Hausner (prosjektleder). Vedlegg 1.
2. REK- godkjenning er ikke relevant da prosjektet omhandler folks verdier og opplevelse av klima og miljøendringer på Svalbard, men vi legger ved uttalelser fra NSD. Vedlegg 2.
3. Kort beskrivelse av forskningsprosjektet. Vedlegg 3.
4. Uttrekk av data fra Evry og folkeregisteropplysninger som det søkes tilgang til. Vedlegg 4.
5. Spørreskjemaet for spørreundersøkelse. Vedlegg 5.
6. Bekreftelse på bruk av dataene til forskningsformål. Vedlegg 6 og 7

Egenerklæring

Søker bekrefter at opplysningene utelukkende skal brukes til det formål som er angitt i denne søknad.

Dato og underskrift av den som er ansvarlig for forskningen

---------- ----------

Søknaden sendes skriftlig pr brevpost til: Skattedirektoratet, Juridisk avdeling, Postboks 9200 Grønland, 0134 Oslo

Søknader som godkjennes oversendes EVRY AS som vil ta kontakt for den nærmere avtale vedrørende utlevering/uttrekk. Oppgi kontaktinformasjon.

Navn	Vera Helene Hausner
Epost	vera.hausner@uit.no
Telefonnummer	+4777645905

For Skattedirektoratet:

Søknaden er godkjent:

Søknaden kan ikke vurderes da vedlegg nr mangler/ikke tilfredsstiller et eller flere av de innholdsmessige krav og returneres, årsak:
Dato, underskrift og stempel

---------- ----------

Vedlegg 3. Kort beskrivelse av forskningsprosjektet

SVALUR er et forskningsprosjekt der den tradisjonelle og mer formelle miljøovervåkningen med kunnskapen og observasjonene fra lokalbefolkningen på Svalbard, samt de som er på øygruppen for å jobbe eller på besøk for kortere perioder. Den erfaringsbaserte kunnskapen som disse gruppene innehar, kan være en viktig brikke i å forstå endringene i miljø og klima på Svalbard. SVALUR vil utvikle metoder der den erfaringsbaserte kunnskapen blir sett i sammenheng med tradisjonell miljøovervåkning. Dette gjør vi fordi den kombinerte kunnskapen vil gjøre det enklere for folk å relatere den til livene sine enn den vitenskapelige kunnskapen alene, og vår tilnærming skal kunne hjelpe i beslutningsprosessen når miljø- og klimaspørsmål skal håndteres lokalt. Vi fokuserer på Svalbard der de fleste bor og jobber i relativt få år. Derfor er det ekstra viktig å lære hvordan vi kan føre kunnskapen fra lokalbefolkninga og kombinere den med miljøovervåkninga, for å skape et såkalt «miljøminne» som kan brukes for å ta gode forvaltningsbeslutninger både lokalt og internasjonalt. PPGIS undersøkelsen vil bli sendt ut til alle fastboende på Svalbard registrert i skatteregisteret. Samtidig så vil vi rekruttere de som jobber og besøker Svalbard uten å være fastboende, samt elever ved den videregående skolen i Longyearbyen.

Vedlegg 4. Uttrekk av data fra Evry og folkeregisteropplysninger som det søkes tilgang til

Vi ønsker å rekruttere alle fastboende over 18 år som er registrert i Skatteregisteret med bostedsadresse i Longyearbyen.
For dette utvalget ønsker vi tilgang til følgende folkeregisteropplysninger.

- fødselsdato
- fødselsår
- kjønn
- adresse inkl. flyttedatoer
- fødested
- statsborgerskap
- sivilstand
- barn

Dataene vil kun bli benyttet til dataanalyse for store datasett og vil slettes ved prosjektslutt.

Vedlegg 5. Spørreskjemaet for spørreundersøkelse

Vedlegg 6 Bekreftelse på bruk til forskningsformål

Som prosjektleder for PPGIS surveyen i SVALUR prosjektet, bekrefter jeg at dataene fra folkeregisteret kun vil brukes til forskningsformål og ikke utleveres til andre. Persondataene behandles

av en liten gruppe forskere ved Universitetet i Tromsø der tilgang kontrolleres av prosjektleder Prof. Vera Helene Hausner og ingen andre som får tilgang til dem. Folkeregisterdata vil kun benyttes til denne undersøkelsen, og vil slettes når prosjektet er avsluttet.

Vera Hausner (prosjektleder)

Sideskift

Vedlegg 7 Bekreftelse på konfidensialitet

Vi bekrefter at vi ikke vil publisere resultater fra undersøkelsen som kan gi opplysninger om identifiserbare personer. Dataene brukes til statistiske analyser av store data og folkeregisteropplysningene vil kun benyttes for å analysere sammenhenger med PPGIS data.

Vera Hausner (prosjektleder)

9.5 Appendix 5: Invitation letter (12th of November)

Fakultet for biovitenskap, fiskeri
og økonomi (BFE) Institutt for
arktisk og marin biologi (AMB)
Dato: 12.11.2021

SURNAME, NAME
ADRESS
ZIPCODE, CITY

Invitasjon til å delta i en kartlegging av miljø- og klimaendringer på Svalbard

Universitetet i Tromsø - Norges Arktiske Universitet inviterer fastboende på Svalbard til å dele egne observasjoner om endringer og hendelser i klima og miljø på Svalbard. Undersøkelsen er en del av arbeidet til SVALUR – et tverrfaglig forskningsprosjekt som formål å bidra i arbeidet med å se hvordan lokale kan bidra med kunnskap og observasjoner som kan forbedre nåværende miljøforståelse innenfor forskning. Samt hvordan det menneskelige perspektivet kan gjøre denne kunnskapen mer relevant for de som besøker og bor på Svalbard. Se mer på https://arcticsustainability.com/2020/07/09/svalur/.

Undersøkelsen og tilleggsinformasjon finner du på følgende webside:

www.mpt.link/svalbard

I undersøkelsen ber vi deg oppgi din unike ID-kode som er: CODE

Når du oppgir koden i undersøkelsen er du med i trekningen på et gavekort med verdi 5 000 kroner dersom du deltar innen 6. desember.
Du bruker så lang tid som du selv ønsker på kartleggingen, i tillegg kommer det noen spørsmål som tar ca. 5 minutter å svare på. Du kan svare på denne undersøkelsen fra en smarttelefon, men vi anbefaler å bruke en PC.

På forhand takk for din deltakelse.
For flere spørsmål, ta kontakt med Linn Bruholt på epost lbr048@uit.no eller mobil +47 98807254.

Med vennlig hilsen
UiT – Norges Arktiske Universitet

Faculty of Biosciences, Fisheries
and Economics (BFE)
Department of Arctic and Marine
Biology (AMB)

Invitation to map environmental and climate change on Svalbard

UiT – the Arctic University of Norway invites residents on Svalbard to share observations of change and events in the climate and environment. The survey is part of the work at SVALUR – an interdisciplinary research project with the purpose to see how locals can contribute with knowledge and observations that can improve current environmental understanding in science. As well as how the human perspective can do this knowledge more relevant for those who visit and live on Svalbard. For more information, visit: https://arcticsustainability.com/2020/07/09/svalur/.

You will find the survey and more information on this web page:

www.mpt.link/svalbard

In the survey, please enter your unique ID-code that is: CODE

If you enter the code in the survey and deliver it before December 6th you have the chance to win a gift card valued 5 000 NOK.
You may use as much time as you need for the mapping, whereafter there are some questions that will take about/approximately 5 minutes. You can answer to this questionnaire on a smartphone, but we recommend using a PC.

Thank you in advance for your participation. In case of any questions, do not hesitate to contact Linn Bruholt via email lbr048@uit.no or by phone +47 98807254.

Best wishes,
UiT – the Arctic University of Norway

9.6 Appendix 6: Postcard

Hei,

Dette er en vennlig påminnelse om å delta i SVALUR sin kartleggingsundersøkelse der du kan dele egne observasjoner om endringer og hendelser i klima og miljø på Svalbard. Undersøkelsen er en del av arbeidet til SVALUR – et tverrfaglig forskningsprosjekt som har som formål å bidra i arbeidet med å se hvordan lokale kan bidra med kunnskap og observasjoner som kan forbedre nåværende miljøforståelse innenfor forskning, samt hvordan det menneskelige perspektivet kan gjøre denne kunnskapen mer relevant for de som besøker og bor på Svalbard. Har du allerede besvart undersøkelsen kan du se bort fra denne henvendelsen.

This is a friendly reminder to participate in SVALUR's mapping survey where you can share observations on changes and events in climate and environment on Svalbard. The survey is part of the project SVALUR – an interdisciplinary research project that aims to develop methos where local knowledge can contribute with knowledge and observations which can increase the environmental knowledge in research, as well as how the human perspective can increase the relevance of this knowledge to people who lives and visits Svalbard. If you have already participated, you can disregard this inquiry.

Undersøkelsen finner du på følgende webside/ You find the survey at this website:
http://mpt.link/svalbard

I undersøkelsen ber vi deg oppgi din unike ID-kode / In the survey we ask you to enter your unique **ID-code: kode**
Du kan lese mer om prosjektet på / You can read more about the project on
https://arcticsustainability.com/2020/07/09/svalur/

For spørsmål, ta kontakt med Linn Bruholt på epost lbr048@uit.no eller telefon +47 98807254 / Feel free to contact Linn Bruholt via email lbr048@uit.no or phone +47 98807254 if you have any questions.

Med vennlig hilsen / Kind regards
UiT – Norges Arktiske Universitet / UiT – The Arctic University of Norway

Etternavn, Fornavn
Adresse
postnummer, sted

NORGES ARKTISKE UNIVERSITET • UIT •

9.7 Appendix 7: Observations

Table 4: Original observations presented in original language on plants- and wildlife divided into categories and ecological phenomena. The observation number refers to the numbers also given in the summaries in table 3.

Category	Subcategory	Ecological phenomenon	Which observation do you want to register?	When did you do the observation ?	Latitude	Longitude	Observation #	Respondent
Birds	Birds	Abundance	Færre fugler for hvert år	18-22	78.21955	15.694143	1	K
Birds	Birds	Abundance	stadig stadig større forekomst av kvitkinngås og storjo	2007-2021	77.721338	14.661018	2	Q
Birds	Birds	Abundance	økende forekomst av kvitkinngås og storjo	2007-2021	77.68047	14.811879	3	Q
Birds	Birds	Abundance	økende forekomst av kvitkinngås og storjo	2007-2021	77.599663	14.904625	4	Q
Birds	Birds	Abundance	Flere stokkender, minst 3 stk	Juli 2021	78.221423	15.648041	5	R
Birds	Birds	Abundance	En ensom stokkand	Våren 2013 og 2014	78.215668	15.627527	6	R
Birds	Birds	Abundance	merkbar nedgang i sjøfuglbestand i denne og flere andre kolonier i Isfjorden	2011-2021	78.35725	16.143605	7	T

Birds	Birds	Abundance	Merkbar nedgang i sjøfuglbestanden (spesielt: krykkje) ved Grumant	2011-2021	78.176649	15.12472	1	T
Birds	Birds	Abnormal events	Tjuvjo flyttet reirplass, da den forhøyningen på sletta de hadde brukt som reirplass i flere år, plutselig "forsvant". Det aktive laget i permafrosten hadde endret strukturen på sletta.	Juni 2019	78.221695	15.662515	9	F
Birds	Birds	Spatial distribution	Snøspurven har flytta fra vei 219. Var bare et par i 2»22 mot 4-5 par tidligere år 2027-2»20	N/A	78.213527	15.620711	10	K
Invertebrates	Insects	Abundance	This pin is for the whole Longyearbyen and surroundings: more flies and mosquitoes around (I am comparing 2002-2003, when I first lived in	N/A	78.219074	15.634406	11	P

			Longyearbyen, and 2021.)					
Marine mammals	Whales	Phenology	Very late arrival of whales (belugas, fin whales, blue whales). Only saw big pods of belugas in Adventfjorden by the end of August, Beginning of September 2021	End of August - Beginning of September 2021	78.278906	15.459343	12	J
Marine mammals	Whales	Abundance	FInnhval	September 2021	78.450343	15.886276	13	R
Marine mammals	Whales	Abundance	Det var en enorm flokk med Belugahval, ntar at det var flere hundre. Det er og masse Belugahval hver sommer i Adventfjorden.	September 2021	78.273383	15.509899	14	R
Marine mammals	Whales	Abundance	Masse hval, trolig minkehval.	September 2021	78.443062	16.218673	15	R
Marine mammals	Whales	Abundance	Masse hval, trolig minkehval	September 2021	78.385345	15.993613	16	R

Marine mammals	Whales	Abundance	flere (store) hvaler	N/A	78.283841	14.720682	17	I
Marine mammals	Marine mammals	Abundance	Mer maritime dyr i fjorden. Større andel med hval og hvalross de siste årene.	N/A	78.28824	14.853007	18	E
Marine mammals	Polar Bear	Behaviour	Så en isbjørn som løpte rett forbi stasjonsbygningen, bare 2 meter ifra	Mars 2021	77.001455	15.541004	19	R
Marine mammals	Polar Bear	Abundance	stadig hyppigere isbjørn opservasjoner/ flere individ	N/A	78.639634	16.577244	20	D
Marine mammals	Polar Bear	Abundance	stadig hyppigere isbjørn opservasjoner/ flere individ	N/A	78.253659	15.681045	21	D
Marine mammals	Polar Bear	Abundance	stadig hyppigere isbjørn opservasjoner/ flere individ	N/A	78.244079	15.369605	22	D
Marine mammals	Polar Bear	Abundance	stadig hyppigere isbjørn opservasjoner/ flere individ	N/A	77.762139	14.315487	23	D
Marine mammals	Polar Bear	Abundance	stadig hyppigere isbjørn	N/A	78.704966	16.563558	24	D

			opservasjoner/ flere individ					
Marine mammals	Polar Bear	Behaviour	Markant økning av isbjørnbesøk i området rundt Adventdalen - Hiorthhamn og Longyearbyen	N/A	78.192732	15.939936	25	E
Marine mammals	Polar Bear	Abundance	Isbjørn, 3 stk	2021 31 oktober kl 1030	77.900886	16.77899	26	G
Marine mammals	Polar Bear	Abundance	Flere isbjørn med unger	Våren 2014	78.649126	16.566759	27	R
Marine mammals	Polar Bear	Behaviour	Det er flere isbjørner de siste årene som har brutt seg inn i hytter for å lete etter mat. Det er nok fordi det blir dårligere tilgang på mat pga isen er borte fra Svalbard lengre enn tidligere	2021	78.251575	15.687731	28	R

Marine mammals	Polar Bear	Behaviour	Isbjørn gikk igjennom sentrum av Longyearbyen. Det blir bare flere og flere isbjørnobservasjoner i nærområdet rundt Longyearbyen som jeg har sett og hørt om de siste årene. Fra 2011 var det ikke ofte man så bjørn, men som jeg har observert fra 2018 så har det vært flere og flere ganger i året at det er bjørn i området.	Julen 2018	78.216224	15.630262	29	R
Marine mammals	Polar Bear	Behaviour	Isbjørnangrep som hadde dødelig utfall for en person og bjørnen. Bjørnene blir mer og mer påtrengende nær hytter og Longyearbyen	2019	78.247229	15.53852	30	R

Marine mammals	Seals	Behaviour	Etter at det ble ferdselsforbud på isen, er det færre seler å se, (vi går på ski inn fjorden). Og dertil lite bjørn. Dette kan skyldes at sootertrafikk gir en grad av trygghet for selen?	N/A	78.406115	17.097688	31	E
Marine mammals	Seals	Abundance	antall steinkobber er økende	2001-2021	77.83618	13.66042	32	Q
Marine mammals	Seals	Abundance	antallet steinkobber er økende	2001-2021	77.864981	15.320723	33	Q
Marine mammals	Seals	Abundance	mye sel	N/A	78.604463	14.641963	34	I
Marine mammals	Seals	Abundance	mye sel	N/A	78.523823	13.015099	35	I
Marine mammals	Walrus	Abundance	Død hvalross	August 2021	78.33339	14.2408	36	M
Marine mammals	Walrus	Abundance	Hvalrosskolonien blir mindre. Kanskje fordi noen har flyttet til borebukta?	2019	78.443885	11.890831	37	B
Marine mammals	Walrus	Abundance	raskt økende antall individer hvalross	N/A	79.972758	18.596794	38	D
Marine mammals	Walrus	Abundance	Økt observasjoner av hvalrosser	2021	78.245834	15.550526	39	H

Marine mammals	Walrus	Abundance	Mer hvalross, mye mer tare	sommer	78.24414	15.3715	40	L
Marine mammals	Walrus	Spatial distribution	Hvalrossene har laget ny koloni	2019	78.336527	14.164928	41	B
Marine mammals	Walrus	Spatial distribution	ny tillholds plass for hvalross hvalrossbestanden i isfjorden vokser raskt etter mine opservasjoner	N/A	78.245938	15.55247	42	D
Marine mammals	Walrus	Spatial distribution	ny tillholds plass for hvalross hvalrossbestanden i isfjorden vokser raskt etter mine opservasjoner	N/A	78.38031	14.273637	43	D
Marine mammals	Walrus	Spatial distribution	Hvalross ved Hotellneset i Adventfjorden har vissnok blitt observert veldig sjelden de siste årene, men sommeren 2021 kom de på gjentatte besøk over noen uker.	22.06.2021	78.246475	15.551785	44	N
Marine mammals	Walrus	Spatial distribution	Stor koloni med Hvalross	Juli 2021	78.729344	11.483582	45	R

Marine mammals	Walrus	Spatial distribution	Stor koloni med Hvalross	Sommeren 2012, 2013	80.012873	14.48001	46	R
Marine mammals	Walrus	Spatial distribution	Hvalross koloni.	Sommeren 2021	78.24576	15.55174	47	R
Vegetation	Vegetation	Abundance	Masse løvetann i sentrum av Pyramiden	September 2021	78.655803	16.319842	48	R
Vegetation	Vegetation	Abundance	Løvetann	Sommer 2016	78.060258	14.21694	49	R
Vegetation	Vegetation	Abundance	Dvergbjørk og diverse blomster	2021	78.186017	15.7611	50	R
Vegetation	Vegetation	Phenology	Crowberry (krekling) had produced berries due to warm summer 2020	2020	78.182833	15.718137	51	A
Vegetation	Vegetation	Phenology	Unusually late blooming of plants and flowers in and around Longyearbyen.	June-August 2021	78.223848	15.637737	52	J
Vegetation	Vegetation	Abundance	This pin is for the whole Longyearbyen and surroundings: vegetation is more lush. Grasses are higher. (I am comparing 2002-2003, when I first	N/A	78.219074	15.634406	74	P

			lived in Longyearbyen, and 2021.)					
Terrestrial mammals	Fox	Abundance	Flere polarrev, både i sommer og vinterpels. En blårev og.	September 2021	78.654634	16.322496	53	R
Terrestrial mammals	Rodents	Abundance	More and more East european moles (Østmarkmus) in Vestpynten area	2021	78.250836	15.415499	54	A
Terrestrial mammals	Terrestrial mammal	Abnormal events	Det kom og rabies tilbake til Svalbard for første gang på lenge, trolig fra en polarrev som gikk over nordpolisen fra Russland. Flere reinsdyr og rev ble smittet og døde eller ble avlivet av Sysselmannens folk den våren.	Våren 2012	78.206781	15.807466	55	R
Terrestrial mammals	Terrestrial mammal	Spatial distribution	Sjeldent reveaktivitet og tilførsel av nye rein på Akseløya - jfr	2013-2020	77.703927	14.734313	56	U

			kortrere isleggingsperiode på Van Mijenfjorden					
Terrestrial mammals	Reindeer	Abnormal events	Pga styrtregnet og stålisen i januar 2012 så kunne ikke reinsdyrene krafse seg igjennom isen og flere dyr døde av sult.	Våren 2012	78.206781	15.807466	57	R
Terrestrial mammals	Reindeer	Abnormal events	Reinsdyr med menneskeavfall i geviret.	Høst 2021	78.211263	15.274685	58	S
Terrestrial mammals	Reindeer	Abundance	det er blitt enorme mengder reinsdyr i skansebukta. Bør begynne jakt der snart så ikke pesten tar stammen	N/A	78.534343	16.001943	59	C
Terrestrial mammals	Reindeer	Abundance	Generelt er det en økning av antall reinsdyr, men spesilet i dette området fra Kap Wiik og mot Skansbukta.	N/A	78.534266	15.559863	60	E

Terrestrial mammals	Reindeer	Abundance	Gjenerelt mer rein. Men spesielt i dette området mellom Kap Wiik og Skansbukta har bestanden økt betraktelig	N/A	78.440674	16.739882	61	E
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	78.184857	16.190108	62	I
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	78.562912	15.324197	63	I
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	77.957066	15.783392	64	I
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	79.341956	16.01955	65	I
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	79.931818	16.360666	66	I
Terrestrial mammals	Reindeer	Abundance	flere reinsdy	N/A	78.748719	11.755591	67	I
Terrestrial mammals	Reindeer	Abundance	På våren/sommeren har det i 220-2021 vært færre reinsdyr enn tidligere i bynære områder.	N/A	78.213527	15.620711	68	K
Terrestrial mammals	Reindeer	Abundance	økende antall svalbardrein	2001-2021	77.917475	13.669288	69	Q
Terrestrial mammals	Reindeer	Abundance	økende antall svalbardrein	2001-2021	77.816785	14.773708	70	Q

Terrestrial mammals	Reindeer	Abundance	økende antall svalbardrein	2001-2021	77.886817	15.377116	71	Q
Terrestrial mammals	Reindeer	Abundance	økende antall svalbardrein	2007-2021	77.537383	16.020751	72	Q
Terrestrial mammals	Reindeer	Abundance	Masse reinsdyr	Våren 2021	77.755856	14.400778	73	R
Other	Other	Behaviour	Ingen dyr å observere den dagen jeg var med Sysselmesterens søppeltokt.	Juli 2021	79.814853	13.018553	75	R

9.8 Appendix 8: Respondent data

Table 5: Demographic data from the respondents. The data are presented this way to prevent individuals from being recognized. Some respondents left the survey before completing all the questions, and it is therefor a different total in the questions. All the calculations in table 1 and table 2 are done with the number of answers to the question.

Question	**Answer option**	**All respondents**	**Plants- and wildlife respondents**
Are you a permanent resident or a former resident?	Resident	88	20
	Former resident	0	0
	Visitor	4	1
	TOTAL	**92**	**21**
Were you invited by post?	Yes	85	18
	No	3	2
	TOTAL	**88**	**20**
How many years have you lived on Svalbard?	Less than 6 months	5	0
	1-2 years	15	4
	3-5 year	20	4
	6-10 years	16	4
	11-20 years	18	5
	More than 20 years	13	2
	TOTAL	**87**	**19**
Gender	Female	30	6
	Male	49	13
	TOTAL	**79**	**19**
Which year are you born?		1986, 1978, 1988, 1977, 1971, 1991, 1989, 1962, 1995, 1965, 1987, 1972, 1991, 1980, 1973,	1986, 1978, 1988, 1977, 1971, 1991, 1989, 1962, 1995, 1965, 1987, 1972, 1991, 1980, 1973,

		1990, 1975, 1982, 1991, 2000, 1973, 1982, 1974, 1972, 1973, 2002, 1965, 2002, 1973, 1980, 1971, 1975, 1976, 1967, 1972, 1947, 1978, 1994, 1971, 2000, 1964, 1987, 1972, 1998, 1993, 1992, 1989, 1973, 1961, 1969, 1948, 1974, 1971, 1971, 1969, 1970, 2004, 1989, 1981, 1987, 1965, 1965, 1969, 1963, 1970, 1996, 1994, 1981, 1986, 1979, 1998, 1935, 1972, 1982, 1981, 1985, 1992, 1995, 1981	1990, 1991, 1975, 1982
What is your highest level of education?	Less than Bachelor's degree	16	2
	Bachelor's degree or higher	63	16
	TOTAL	**79**	**18**
Before taxes and other deductions; how much is your households'	Kroner 270 000 or less	7	2
	Kroner 271 000 to 420 000	6	1

approximate gross annual income, including your own income?	Kroner 421 000 to 540 000	3	1
	Kroner 541 000 to 660 000	14	5
	Kroner 661 000 to 790 000	7	0
	Kroner 791 000 to 920 000	7	5
	Kroner 921 000 to 1 050 000	3	0
	Kroner 1 050 000 to 1 225 000	6	2
	Kroner 1 225 000 to 1 500 000	12	2
	Kroner 1 501 000 or more	6	1
	Don’t know / don’t want to answer	6	2
	TOTAL	**97**	**21**

Time used (hh:mm:ss):

All Respondents:

00:11:45, 00:08:47, 00:24:42, 00:24:38, 00:35:00, 00:02:56, 00:14:53, 00:17:39, 00:23:38, 00:22:13, 00:12:51, 01:51:23, 00:09:26, 00:08:53, 01:31:01, 01:43:35, 14:09:36, 00:16:42, 00:05:30, 00:06:55, 00:10:13, 00:05:37, 00:12:12, 00:11:54, 00:06:25, 00:04:01, 00:34:46, 00:05:58, 00:09:30, 00:11:07, 00:06:58, 00:10:02, 00:12:21, 00:21:21, 00:05:11, 00:11:16, 00:10:03, 00:20:29, 00:50:38, 00:07:12, 00:03:41, 00:03:23, 00:14:50, 00:06:46, 00:05:00, 00:15:54, 00:03:09, 00:12:06, 01:02:44, 00:33:08, 00:07:25, 00:04:32, 00:04:33, 00:24:09, 00:33:39, 00:05:33, 00:06:20, 00:57:59, 00:09:57, 00:08:18, 00:13:34, 00:17:50, 00:06:40, 00:22:01, 00:13:57, 00:15:26, 00:12:39, 00:10:50, 00:10:30, 00:28:03, 00:37:10, 00:55:48,

00:16:30, 00:14:34, 00:16:23, 00:24:49, 00:08:35, 00:06:22

Plants- and wildlife respondents:

00:11:45, 00:08:47, 00:24:42, 00:24:38, 00:35:00, 00:02:56, 00:14:53, 00:17:39, 00:23:38, 00:22:13, 00:12:51, 01:51:23, 00:09:26, 00:08:53, 01:31:01, 01:43:35, 00:05:30, 14:09:36, 00:16:42

Number of observations:

Table 6: Number of observations per respondent. A cross in the plants and wildlife column indicate a minimum of one observation in the plants- and wildlife category. The respondent ID is the one given by Maptionnaire.

Respondent ID	Number of observations	plants and wildlife
4ko3xi7a2li4	4	
2e6vt79y6sd8	5	
7pk36wpo7en3	3	
8n9uoe9eb437	10	
8tk6rlh8rlr3	1	
6bv33wbf9gg6	6	x
98kau433r3c3	15	x
3l9k4dcz7e46	3	
8yp2vv9xzs39	1	
4xp9dbs2t9v9	4	
6a6un9ege8ob	3	
74pzy8imt3g7	11	
9jr6c7iyn4c4	2	
8odr4aiv6cm9	3	
686np73jpj46	2	
3vbo3e7mnh29	12	
3vsv732gkp46	7	x
2r7bpl8fhu28	1	
3p2j3ybl4mc8	3	
39lav8hri9j4	62	x
6wv9khz32le3	2	x
66hpn2fnv3a9	5	
226fuf8ebe3h	1	
4egh7fmi4ec7	2	
9c76wpf44lw3	6	
7k6b3u2bcv97	1	
4mk4p4xws7g9	1	
7wl6fyr3ywx7	2	
36eie3trl773	1	
6ob4bzu8jit7	1	
3gj8npf77nh4	5	
2sm9ikw72y89	2	
6m699znf2t48	1	
67xtg2j49fd6	4	
3b6njv4eff2u	12	x
6my48xnx7syt	7	
2fg8bmo37ws4	2	
2vm9ybh2dbr8	5	x
8na3giy8ssx8	22	x
4wm4fci47kk7	1	
9f2l8msh3v49	9	
8lz4zvo78zuw	7	x
7wd3mlk4uzr8	4	x
26ee2ccf6dd3	3	
3ax8u6x7roa7	32	x
6wx7yud39663	2	
9zy9jkj3uj7l	7	
2zf9vyd4lep6	5	x
9sg82cft42h8	4	
96d7iph79f6j	2	x
7du6asy9dhf8	1	
8lw3j8svp388	3	
747pbl7c8c23	2	
66zzh7tfb4o7	2	
7aj9ob6vno93	7	x
7z94wsc4zwc6	27	x
9a8js6ges4z4	2	
48omz7rtt86a	5	x
3fh6vfz898ya	4	
7ol7bo9g4tla	28	x
7237fvt7cgh7	7	
7ppw8o9jcc38	6	
9lj2wtj7kwo7	1	

4rs4et48wzz8	1	
9g9kn36rpu76	1	
82psh6lsm3ja	1	
8my69a948jcy	2	
4j344s9crj89	3	
7rv3egu9hoz6	3	x
3447vv2reg38	1	
8v6hg7nkp9mm	2	
2yl6ufn8y46v	2	
4gp4436gx686	3	
9k2boe2boi28	2	
794fyt3jot98	2	
2vj4rve4fw4p	1	
46zpa6lzi2ea	1	
2wp733mpz9d6	1	x

9vlv3vvy4o69	2	
6ll6dth2vzm8	1	x
9ix2kxy9oyu7	1	x
79amm82ckc3a	1	
29aze4uv3a96	1	
4rt27hk8xok9	2	
4by92kyu267w	2	
8nn2p8wmb3e9	2	
89g4ifo9au86	2	
9y9ekw382um6	1	
9iu8t8ssc8ba	1	
8icp6w4epl8a	1	
7rd6cus2p4hc	2	
248et3v9si68	4