



## Deliverable 2.3

*Experimental campaign report and policy brief*



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## Deliverable description.

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CI	Classified, as referred to in Commission Decision 2001/844/EC

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## Acronyms

Acronym	Description
CRP	Ciljni raziskovalni programi (Target research programmes)
CS	Citizen Science
CSI(s)	Citizen Science Initiative(s)
CT	Camera trap
D	Deliverable
DNA	Deoxyribonucleic acid
EUSEA	European Science Engagement Association
HAS	Lovska Zveza Slovenije (the Hunters Association of Slovenia)
NGO	Non-governmental organization
REM	Random encounter model
SfC	Science for Change
SRNA	Spremljanje in Raziskovanje Narave z Aplikacijo (Application for Monitoring and Exploring Nature)
T	Task
UP	University of Primorska
WP	Work Package



## Summary

This deliverable consists of two main parts. The first part (Experimental campaign report) provides a summary of our main findings from systematic camera trapping, findings from a newly established citizen science (CS) app for wildlife monitoring in Slovenia, SRNA, and results from the quiz for wildlife identification. This part also includes a plan for engagement and recruitment of citizen scientists and stakeholders in this Citizen Science Initiative (CSI). The second part of the deliverable is the Policy brief, which introduces the impacts of this CSI, and implemented in Work Package 2 (WP2).

WP2 aims to improve the existing data collection and analysis of wildlife presence, movements, and behaviour in Slovenia through planned CSI by involving citizen scientists with different backgrounds and knowledge. Citizen scientists collect data on wildlife presence, reproduction, and health status with an app and/or camera-traps. Professional scientists validate data by comparing data collected by citizen scientists with information collected through ecological sampling techniques, and by developing a procedure for verifying collected CS data (D2.4). Finally, WP2 aims to provide information for evidence-based wildlife conservation and management in Slovenia and to raise public awareness about this topic.

### ***Research Team, WP advisors, stakeholders, and extended participants***

The Research Team:

- Prof. dr. Elena Bužan, University of Primorska (Leader of the CSI and Project Coordinator)
- Prof. dr. Boštjan Pokorny, Faculty for Environmental Protection and Hunting Organisation (Co-leader of the CSI)
- Luka Duniš, University of Primorska (member of the Core Team)
- Minja Krstić, University of Primorska (member of the Core Team)
- Dr. Žiga Velkavrh, University of Primorska (member of the Core Team)
- Prof. dr. Hubert Potočnik, University of Ljubljana (member of the Extended Core Team)
- Izr. Prof. dr. Aleksandra Perčin, University of Zagreb (ethical officer)

Relevant advisors for WP2:

- Dr. Francesca Cagnacci (Fondazione Edmund Mach, Member of the Advisory Board of Step Change)



- Dr. Luca Corlatti (ERSAF Regione Lombardia, external advisor for WP2 and co-author of (D2.1)

Stakeholders and extended participants:

- Tilen Bartol (HAS), who will assist the Research Team in hunter recruitment and engagement
- Klara Kopač (BIODIVA – Society of Conservation Biologists), who will assist with student recruitment and engagement
- Lili Mahne (Notranjska Ecological Centre), who will assist the Research Team in CS (farmers) recruitment and engagement
- Irena Mrak (Alpine Association of Slovenia), who will assist with the Research team in CS (nature lovers and photographers) recruitment and engagement
- Rok Haviček (Ministry of the Environment and Spatial Planning), who will represent the contact point with the Ministry
- Matevž Adamič (Ministry of Agriculture, Forestry and Food), who will represent the contact point with the Ministry
- Mitja Stregar (Slovenian Forestry Service), who will be the contact point regarding the management policy



## Experimental campaign report

This report presents the results obtained by the core team of the University of Primorska (UP) working on the CSI for wildlife monitoring in Slovenia. The results include data collected by camera traps and analysed by the UP team, data from the citizen science app SRNA and data from the quiz for wildlife identification. In future months, the UP team will start using another method for data collection, i.e., analysis of non-invasive DNA (environmental DNA from water bodies).

The results presented in this deliverable (and eDNA, not presented here), will be used for the validation of data obtained by citizen scientists in D2.4 Validation approach for CS data in wildlife monitoring.

### **Camera traps**

#### **Research design**

Camera trapping is used as the "gold standard" to measure species distribution, richness and density, alongside with the activity rhythms of wildlife. The camera traps (CTs) were deployed in accordance with the European Observatory of Wildlife, part of the ENETWILD project. The ENETWILD project (<https://enetwild.com/>) aims to improve the European capacity for monitoring wildlife populations by implementing standards for data collection and providing guidance.

In the ongoing project, the CTs were deployed on the field by UP researchers and students, and by hunters from two Slovenian hunting grounds where the CTs were deployed (Figure 1). The two selected hunting grounds were Rižana (

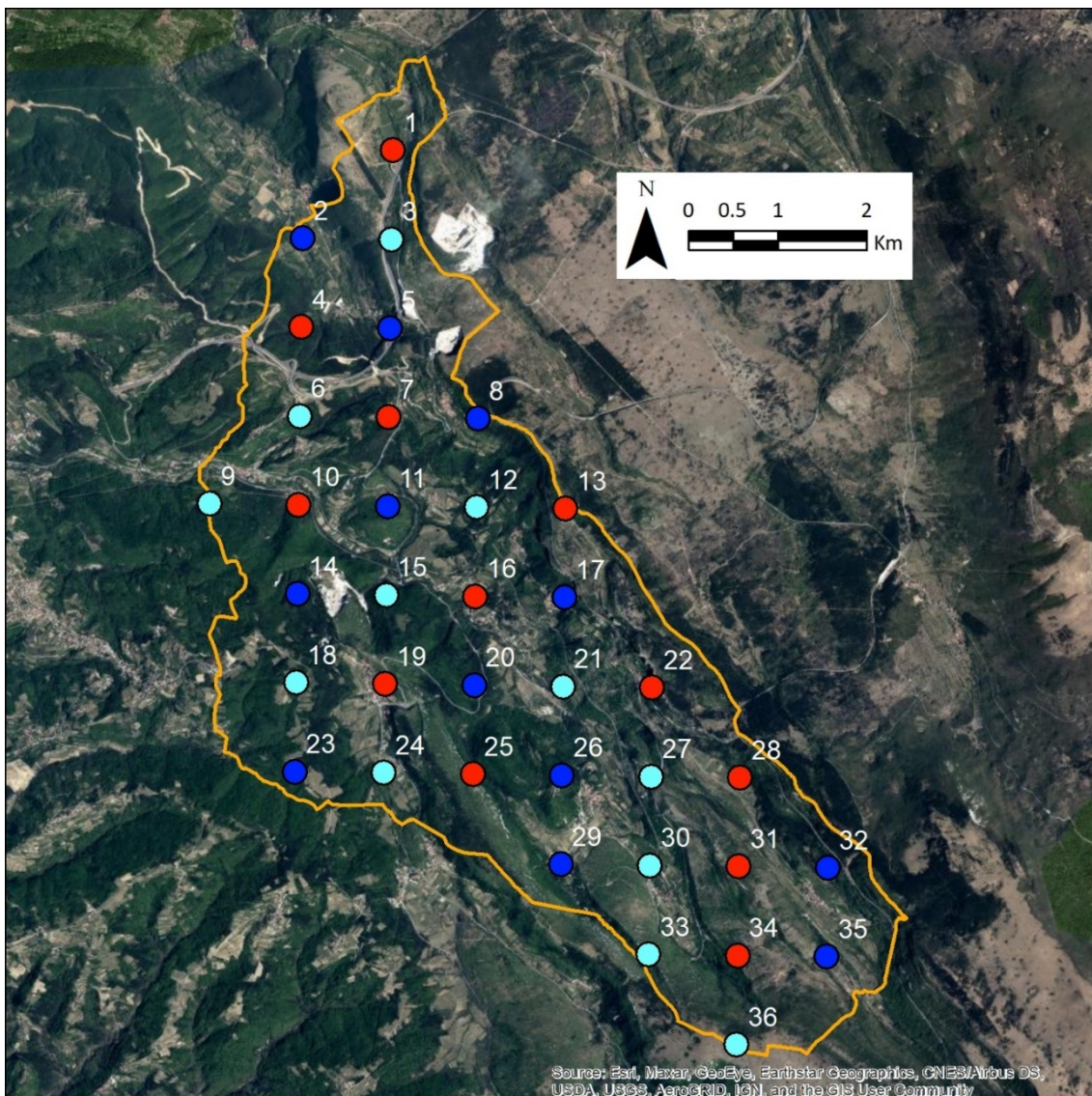
Figure 2 **Error! Reference source not found.**) and Vrhe Vrabče (Figure 3). The CTs were deployed there from July 2022 to November 2022, by following a regular distribution grid with 36 CT deployments per hunting ground. Each hunting ground had 12 CTs that were deployed three times - in different locations within the hunting ground, to cover the entire hunting ground (i.e.,  $12 \times 3 = 36$ ). The detailed protocol used for placing the cameras can be found here: <https://enetwild.com/2022/06/20/ct-protocol-for-wild-boar/>.



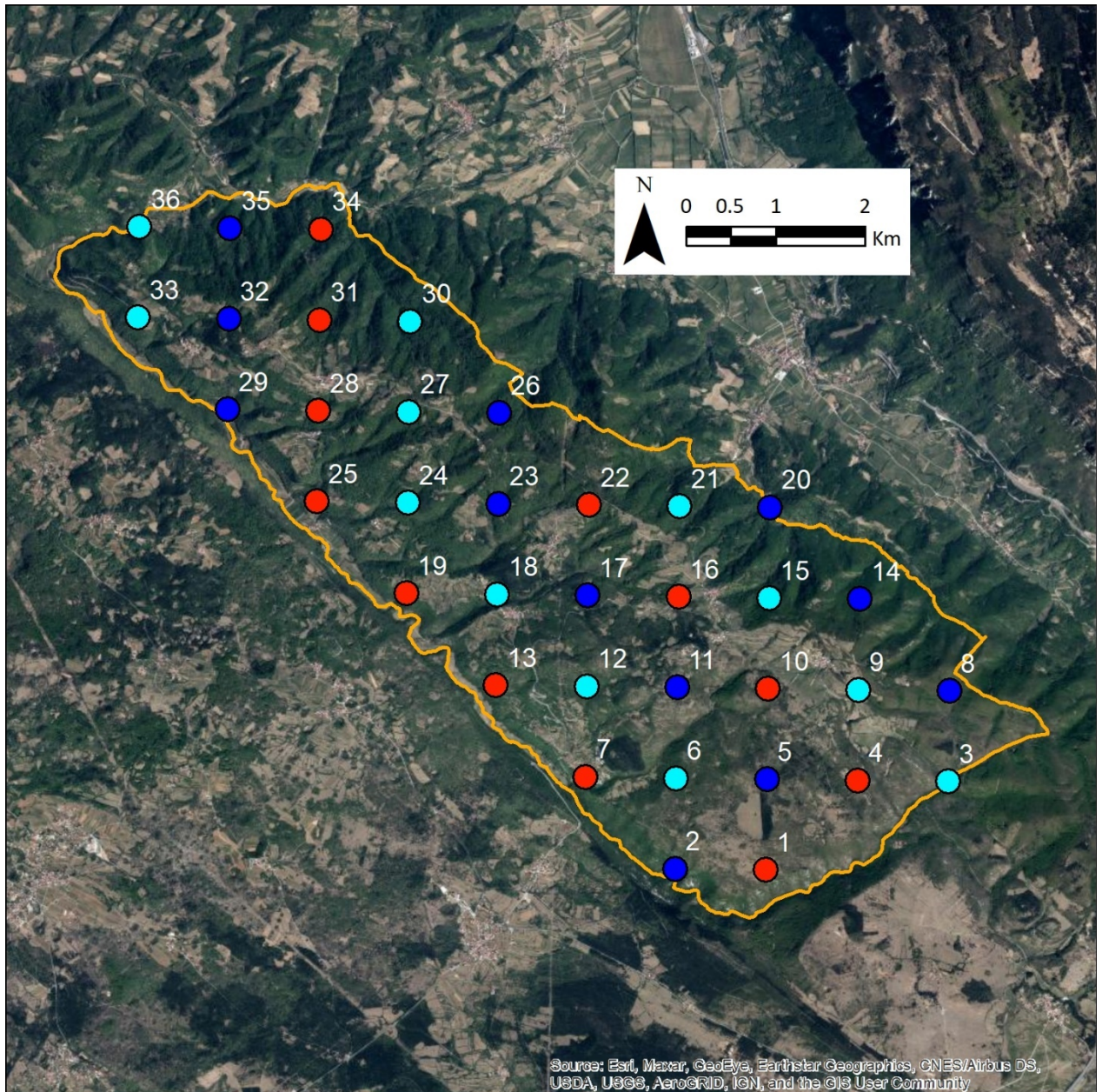


**Figure 1.** Fieldwork, CTs deployment with the help of hunters

After the images were acquired, they were analysed with the online tool Agouti (<https://www.agouti.eu/#/>). Using Agouti one can organise surveys, safely archived data, processed images, and obtain standardized outputs of the results. The obtained results were then analysed with MS Office Excel and RStudio using the camtraptor package (Microsoft Corporation, 2018; RStudio Team, 2018; Oldoni et al., 2023). The analysis included species richness, abundance, and density. Density was estimated with the random encounter model (REM) method (Rowcliffe et al. 2008).



**Figure 2.** Map of the Rižana hunting ground. The closed orange curve represents the border of the hunting ground, and the coloured dots indicate the sites where CT was deployed. Different colours represent the three different repetitions.



**Figure 3.** Map of the Vrhe Vrabče hunting ground. The closed orange curve represents the border of the hunting ground, and the coloured dots indicate the sites where CT was deployed. Different colours represent the three different repetitions.

### **Results from the collected data**

Wildlife was observed at almost every location. In particular, it was observed in 32 locations in Rižana and 34 locations in Vrhe Vrabče. In total, cameras were deployed for 2219 camera days (1208 in Rižana, 1011 in Vrhe Vrabče). **Table 1** shows for each species the number of observed individuals by hunting ground. The most common species were the wild boar (*Sus scrofa*, 835 total) and the European roe deer (801 total). A moderate number of red deer, red foxes, and



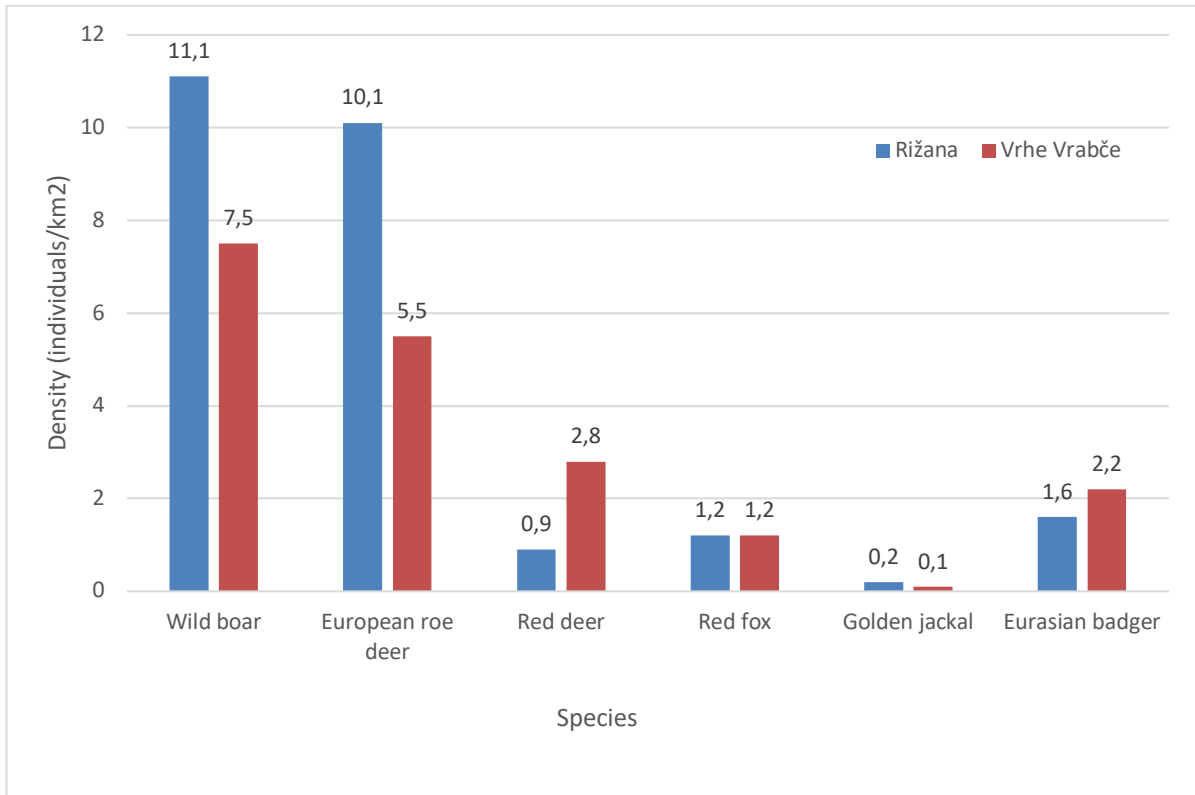
Eurasian badgers were also observed. In total 23 different species were observed, of which 16 are included in the SRNA app (presented in the next subsection).

**Table 1.** The number of observed individuals by species and by hunting ground

Species common name	Rižana	Vrhe Vrabče	Total
Wild boar	500	335	835
European roe deer	541	260	801
Red deer	75	198	273
Red fox	147	114	261
Eurasian badger	81	89	170
European hare	120	4	124
European pine and beech martens	30	84	114
Cat	53	25	78
Golden jackal	42	15	57
<i>True Thrushes</i>	18	10	28
Red squirrel	8	11	19
<i>Eurasian jay</i>	2	9	11
Least weasels and stoat	8	1	9
<i>Dog</i>	5	2	7
Rodents	0	4	4
Edible dormouse	0	2	2
<i>Great tit</i>	0	2	2
<i>Common buzzard</i>	0	1	1
<i>Wood pigeon</i>	0	1	1
<i>Human*</i>	103	101	204

Notes: Species in italics are species not included in the SRNA app; \*The images of human observations were deleted during the processing of the images. Sorted by Total observations (except *Human*).

In each hunting ground, the densities were estimated for the wild boar, European roe deer, red deer, red fox, golden jackal, and Eurasian badger (see **Figure 4**. Estimated densities of selected species in each hunting ground. Estimates are reported only for these six species due to the limitations of the model used for density estimation, which is better suited for larger mammals. Wild boar had the highest densities in both hunting grounds (11.1 individuals/km<sup>2</sup> in Rižana and 7.5 individuals/km<sup>2</sup> in Vrhe Vrabče). The species with the second highest density was the European roe deer with 10.1 individuals/km<sup>2</sup> in Rižana and 5.5 individuals/km<sup>2</sup> in Vrhe Vrabče.



**Figure 4.** Estimated densities of selected species in each hunting ground



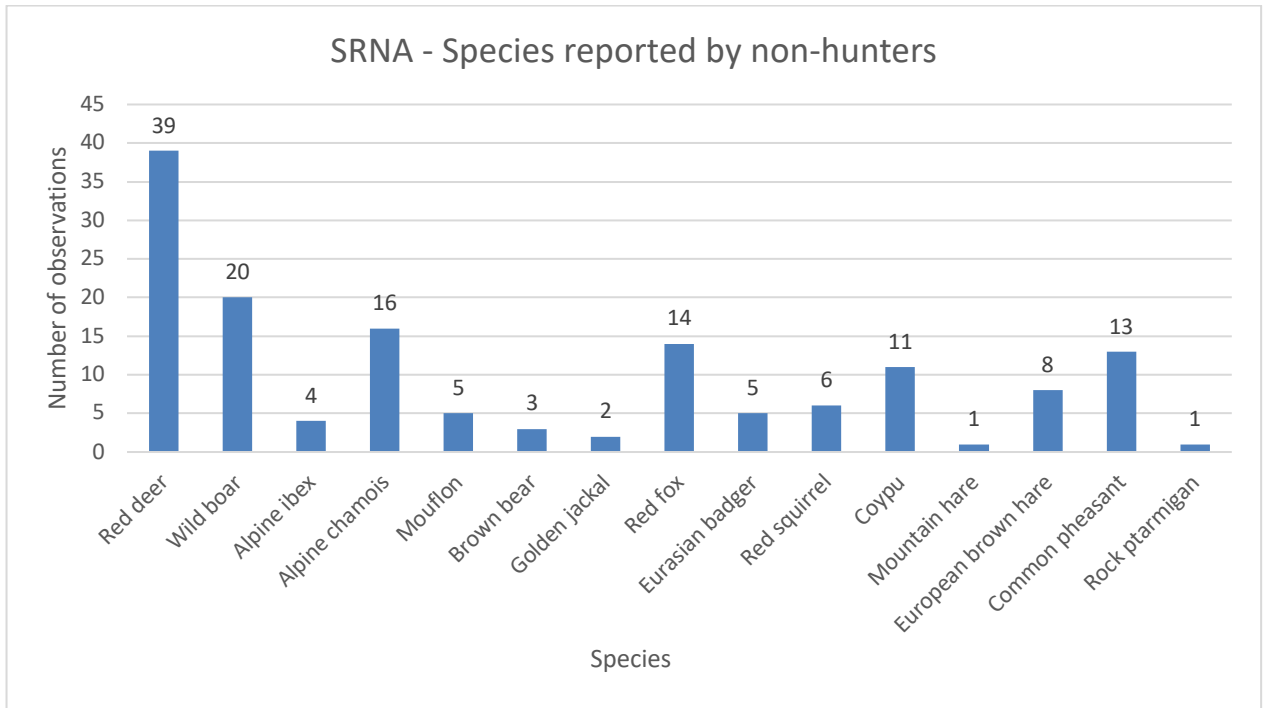
## **SRNA app**

SRNA (“*Spremljanje in Raziskovanje Narave z Aplikacijo*”) is the CS app adopted in WP2 and successfully launched in the first half of 2022. The app is user-friendly and allows citizen scientists to report observations of wildlife. The aim of SRNA is to facilitate systematic monitoring of selected wildlife (especially game) species. The functionality of the app depends on whether the user is a hunter or not. Hunters, who generally have greater knowledge about wildlife species than non-hunters, can report some additional information about wildlife observations and characteristics of wildlife that has been harvested during their hunting activities (diseases, injuries, reproduction (number of offspring)). The data reported by hunters is, therefore, more comprehensive. Non-hunters can also report data about wildlife observations and animals that were found dead (including roadkill). They also have the option to upload a picture without specifying the species. Non-hunters can also add information about the sex and age of the observed individual. The entries analysed in this deliverable range from June 1<sup>st</sup>, 2022, to March 31<sup>st</sup>, 2023.

### **Results from the data reported by non-hunters**

In the analysed period, 371 users registered in the app, of whom 51 (i.e., 13.7%) submitted an observation. Current users reported 341 live wildlife individuals, 16 roadkill and dead animals, and nine unknown observations. Citizen scientists observed 16 different species out of the 39 available in the app. The most common live species observed by non-hunters was the European roe deer, with 193 observations (56.6%). **Figure 5** shows the number of other observed (live) species that, in total, represent 43.4% of the observations.

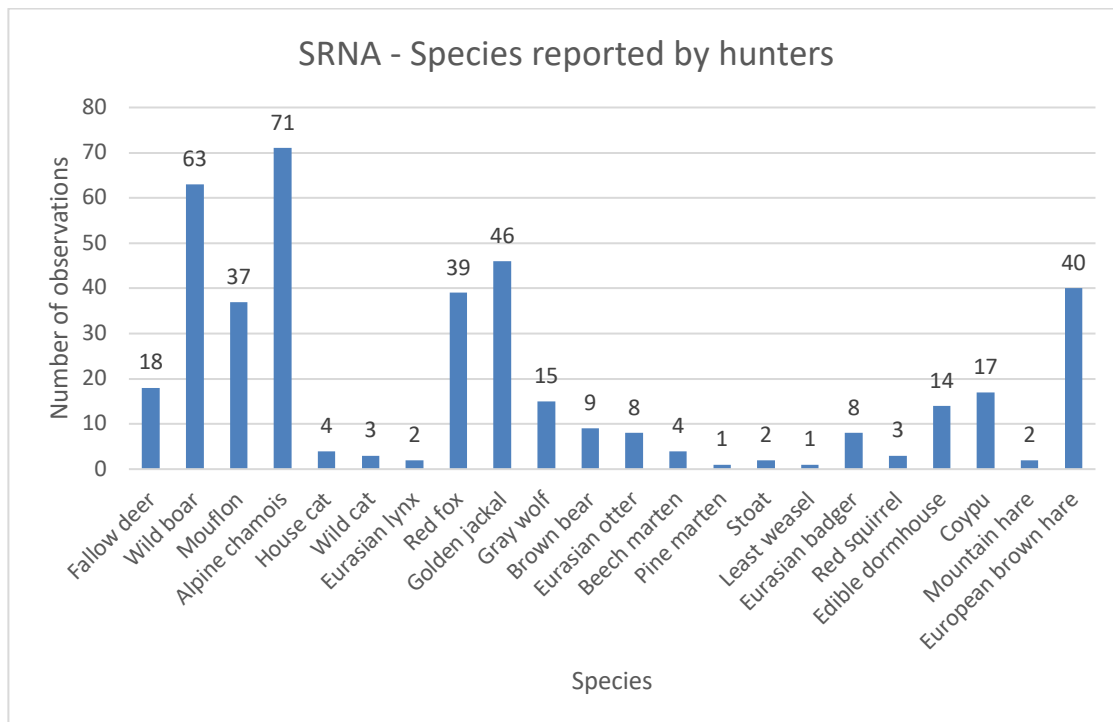
Non-hunters reported 16 cadavers’ observations: five roe deer, three badgers, two wild boars, two squirrels, one red deer, a pine marten, and a brown hare. The nine unknown observations were identified by researchers based on submitted photos. One of the unknown observations corresponded to a wild boar track. The rest were animals, in particular a roe deer, two badgers, a chamois, three coypus, and even an Ural owl (*Strix uralensis*), which is not one of our target species.



**Figure 5.** Several observations of the 16 species were collected in the SRNA app by non-hunters. European roe deer were excluded from this graph.

### ***Results from the data reported by hunters***

Hunters reported 911 live wildlife individuals, 17 harvested individuals, and six unknown observations. Hunters' involvement was greater than that of non-hunters, as 69 hunters submitted an observation. Hunters observed 25 different species, with roe deer being the most common with 426 observations (46.8%). **Figure 6** shows the number of other observed species. The data of harvested individuals was submitted for eight roe deer, four red foxes, three wild boars, one red deer, and one golden jackal. Five of them were reported as injured and three as parasitized. Of six unknown observations, five were identified as animals: two roe deer, one jackal, one marten, one coypu; and one as wolf faeces.



**Figure 6.** Several observations of the 25 species were collected in the SRNA app by hunters. European roe deer were excluded from this graph.



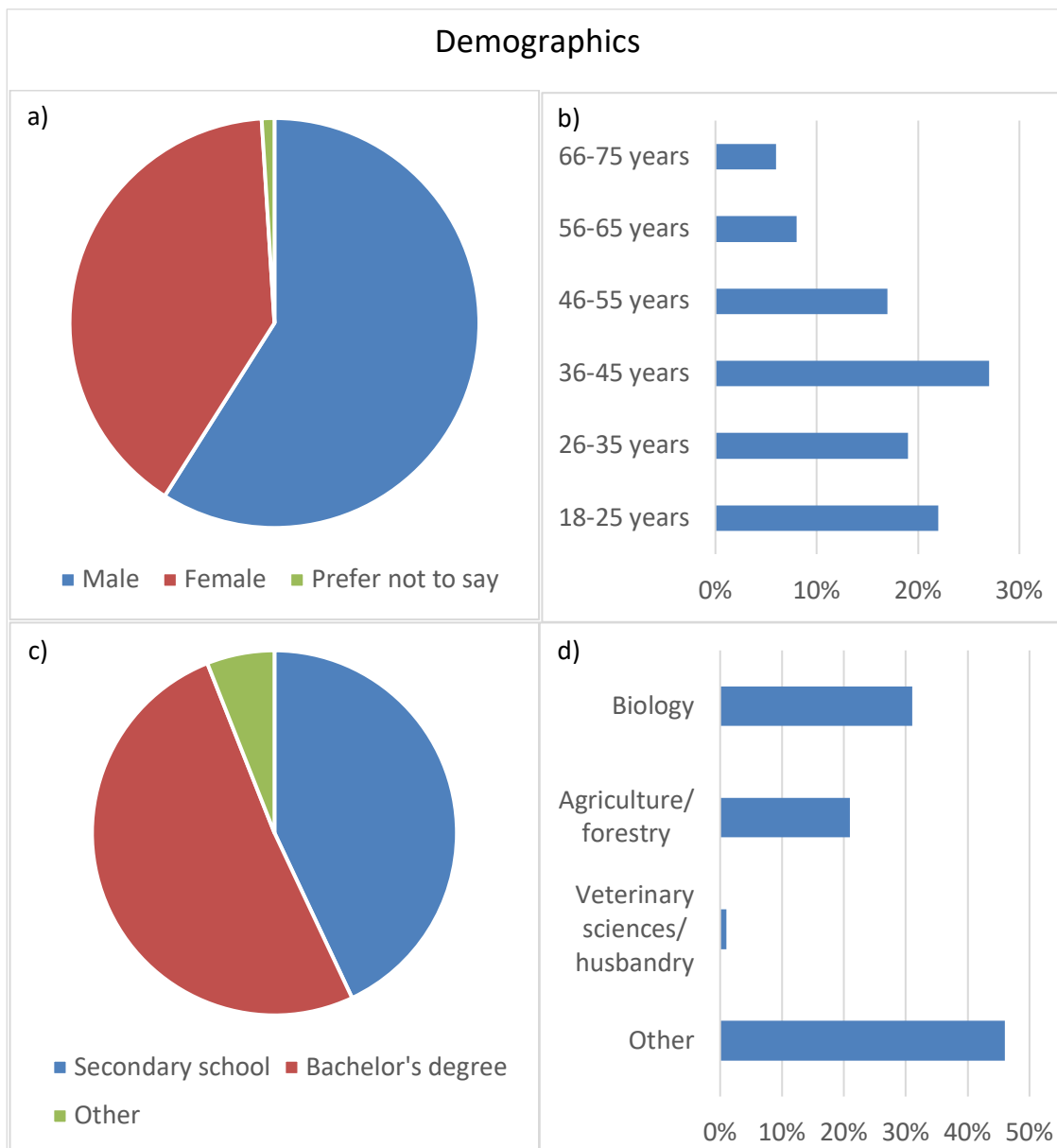


## ***Quiz for wildlife identification***

To assess the accuracy of wildlife identification, our team developed a quiz. Its main purpose was to measure and improve the ability of CS (mostly non-hunters; due to the fact that hunters passed a 3-year training in species monitoring) to recognise wildlife species, especially similar ones (shown in Figures 8-12 below). Results from the quiz were analysed to determine which species were the most difficult for CS to distinguish. This will represent valuable information for UP researchers when assessing the collected data, as otherwise blindly following the reports could lead to an incorrect assessment of wildlife abundance in Slovenia.

### ***Collected data***

In total, 191 users solved the quiz. Most of the respondents (75%) were “beginners” in the sense that they had never used an app to record the presence of fauna and flora. The quiz asked for demographics. The findings are displayed in **Figure 7** and show that 1) there were more male than female respondents (59% vs 40%), 2) the modal age of respondents was 36-45 (27%), 3) the majority of respondents (51%) had a bachelor's degree or higher education, with 54% having a degree in either biology, agriculture/forestry, or veterinary sciences/husbandry.



**Figure 7.** Wildlife identification quiz - Demographics. a) gender; b) age; c) education; d) field of university degree.

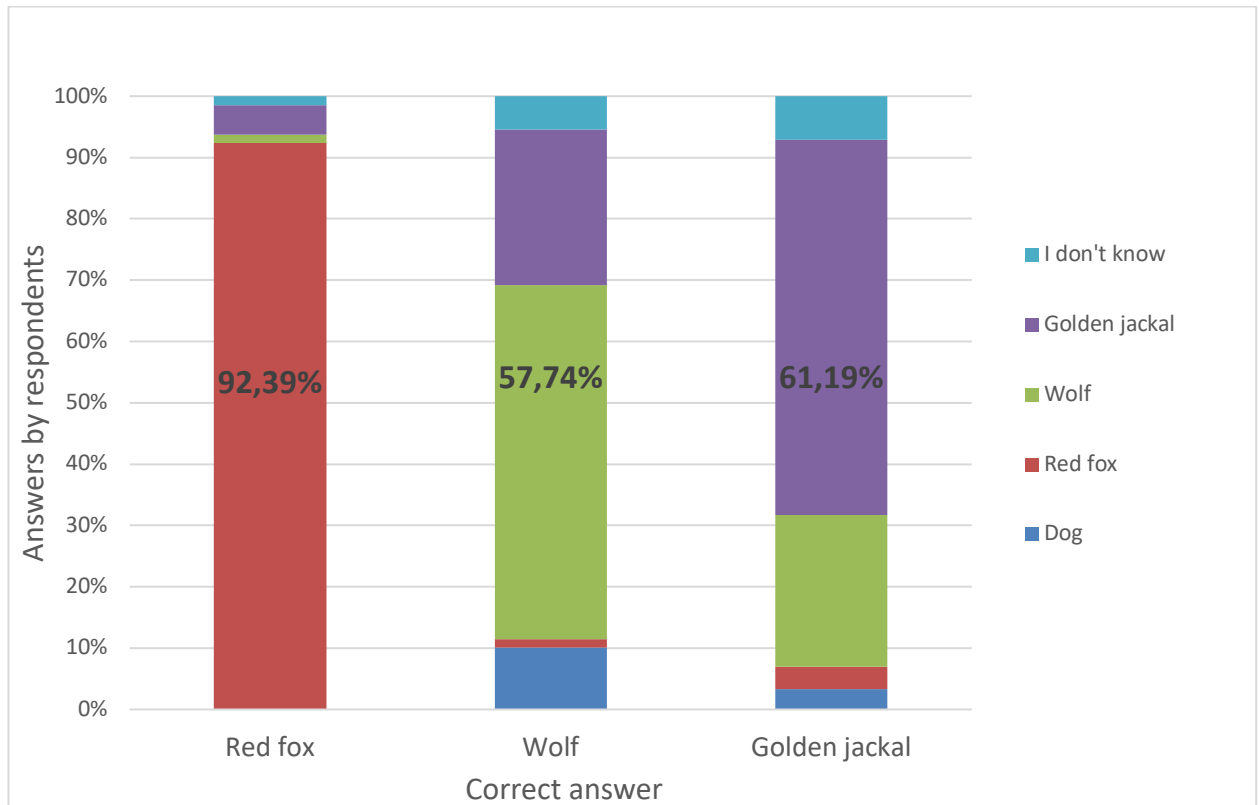
### ***Results from the collected data***

The results were analysed separately for each of the five groups of animals included in the quiz: Canidae, Eurasian beaver and coypu, Mustelidae, goat-like ungulates, and deers. The results are displayed with a percent stacked bar chart that, for each species, shows the percentage of correctly identified and misidentified species. For each species, the percentage of correctly identified individuals is also explicitly given; for instance, the red fox, wolf, and golden jackal were correctly identified by 92%, 58%, and 61% of the users, respectively (**Figure 8**).



## 1. Canidae

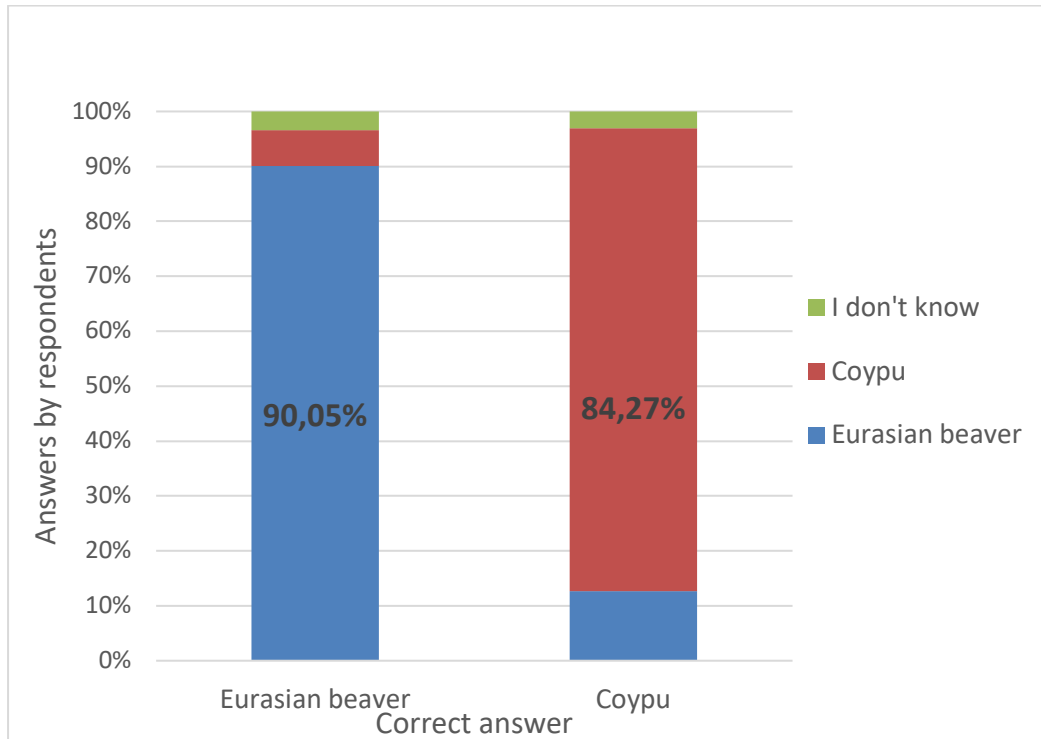
**Figure 8** shows the results of the identification of Canidae (red foxes, wolves, and golden jackals). Almost everyone (92%) correctly identified red foxes, whereas for wolves and golden jackals, this percentage was lower, 58% and 61%, respectively. In 25% of the cases, wolves were misidentified as golden jackals, and vice versa.



**Figure 8.** Quiz results for Canidae identification.

## 2. Eurasian beaver and coypu

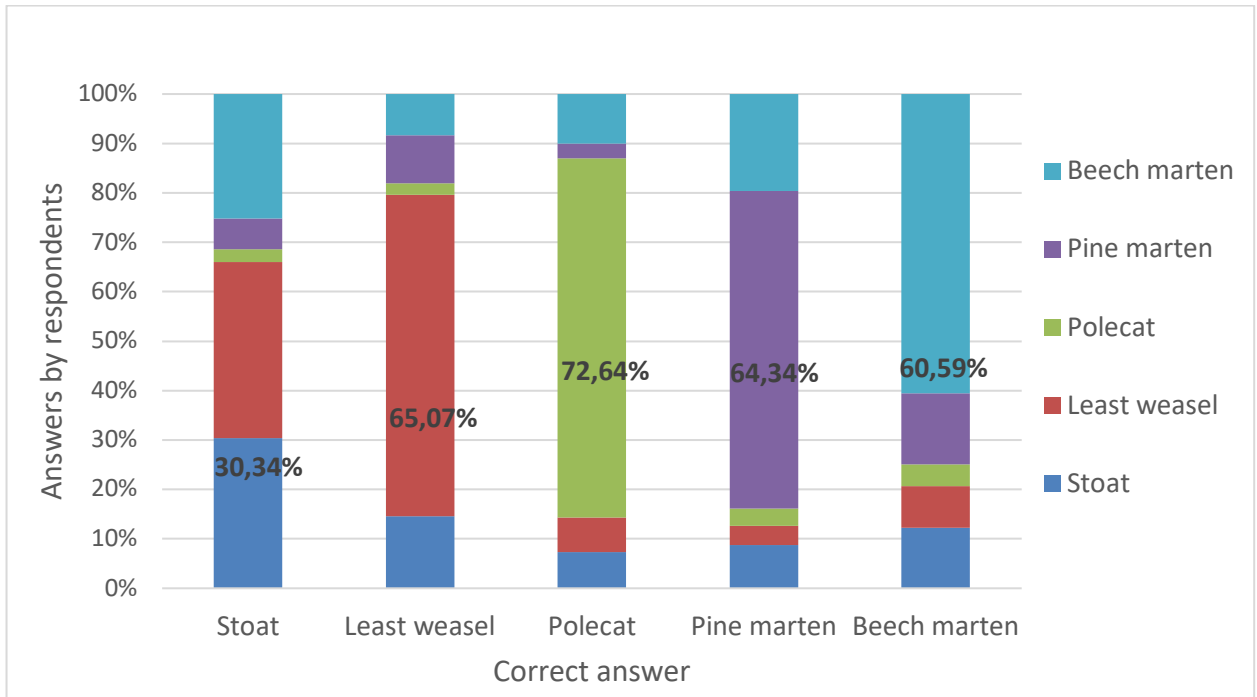
**Figure 9** shows the results of the identification of Eurasian beavers and coypus. We can see that most respondents did not have problems distinguishing between beavers and coypus. Beavers were correctly identified in 90% of cases and coypus in 84% of cases.



**Figure 9.** Quiz results for Eurasian beaver and coypu identification.

### 3. Mustelidae

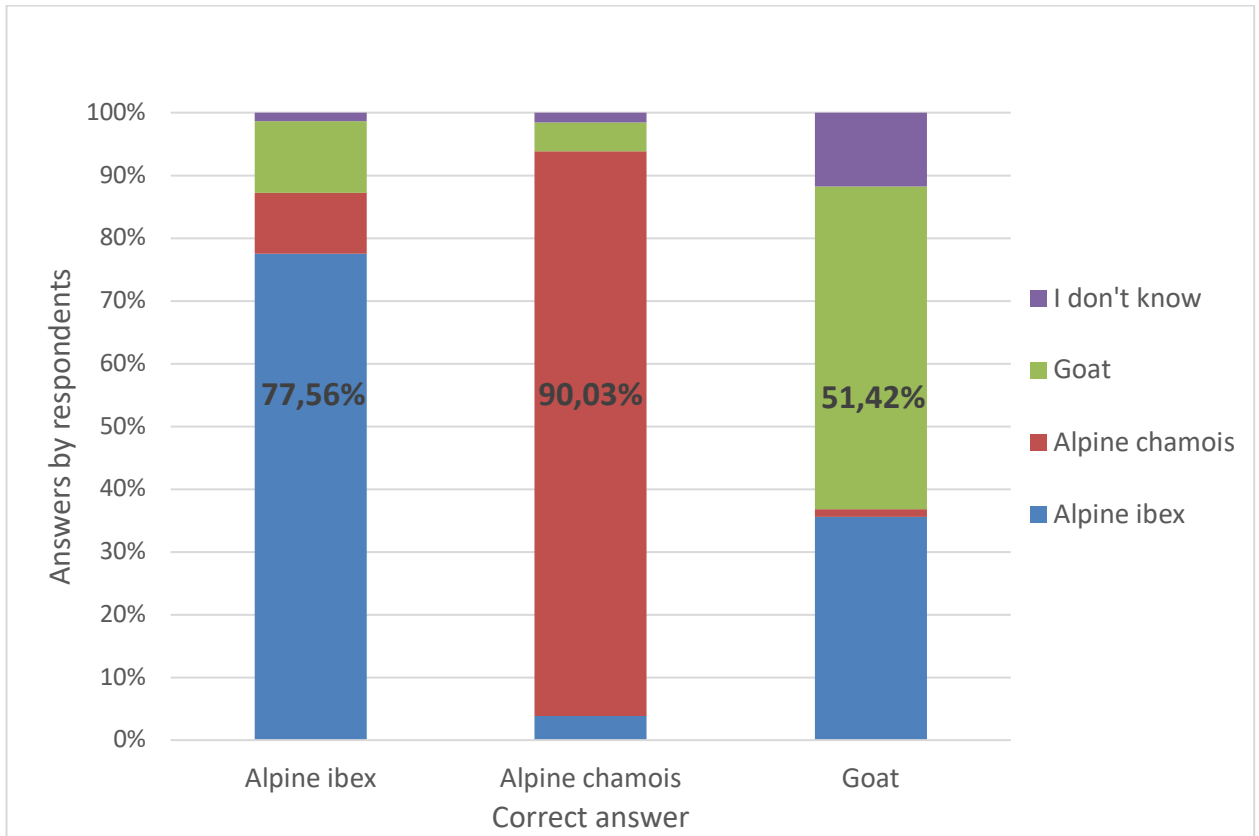
**Figure 10** shows the results of the identification of Mustelidae (stoats, least weasels, polecats, pine, and beech martens). Respondents correctly identified stoats in only 30% of cases, which were most commonly misidentified as least weasels (36% of cases) or beech martens (25% of cases). The other four species were correctly identified in more than 60% of cases. In particular, least weasels, polecats, pine martens, and beech martens were correctly identified in 65%, 73%, 64%, and 60% of cases, respectively. The common misclassification was between the two marten species.



**Figure 10.** Quiz results for Mustelidae identification.

#### 4. Goat-like ungulates

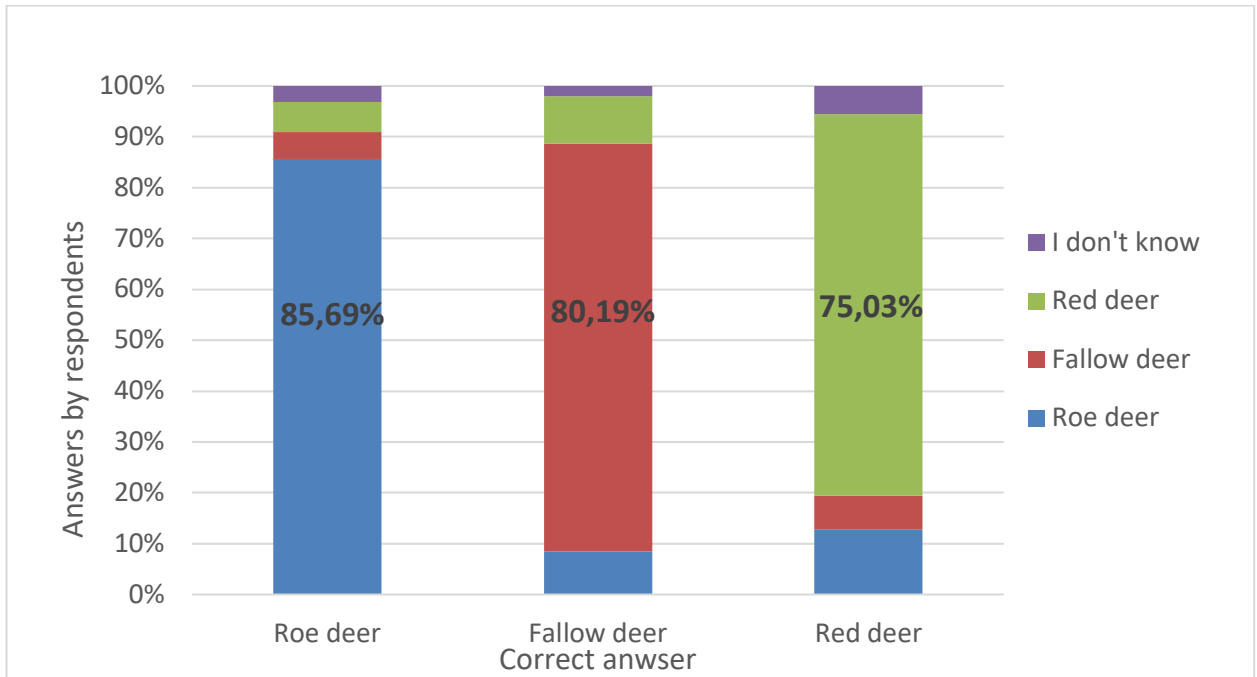
**Figure 11** shows the results of the identification of goat-like ungulates (Alpine ibex, Alpine chamois, and goats). Among them, Alpine chamois was most often correctly identified (in 90% of cases), followed by Alpine ibex (in 76% of cases). Interestingly, more than one third of goats (36%) were misidentified as Alpine ibex (but not vice versa).



**Figure 11.** Quiz results for goat-like ungulates identification.

## 5. Deers

**Figure 12** shows the results of the identification of deers (roe deer, fallow deer, and red deer). Respondents correctly identified most individuals. They had the most problems with red deer, which were correctly identified in 75% of cases and most often misidentified as roe deer. For roe deer and fallow deer, the identification was correct in 86% and 80% of cases, respectively.



**Figure 12.** Quiz results for deers identification.

By merging the correct and wrong answers for each group, the results show that, in general, respondents identify Canidae correctly in 72% of cases (60% if we exclude red foxes), while beavers and coypus are correctly identified in 84% of cases. For Mustelidae, this figure is 60%. As regards goat-like ungulates and deers, respondents correctly identified them in 79% and 80% of cases, respectively. Considering this information, researchers must pay attention to the reliability of data, especially for Mustelidae, wolves vs golden jackals, and goats vs Alpine ibex.



## Engagement and recruitment of citizen scientists and stakeholders

Before starting the promotion of the Step Change project and the SRNA app, the core team of WP2 first mapped and identified the stakeholders to involve, which is a crucial step for the success of the CSI. More information on stakeholder mapping and identification is described in the WP1 document "Protocol for Citizen Scientists Recruitment", which is part of Deliverable D1: Scoping Tools and Supporting Materials. The promotional campaign was co-designed by the core team of WP2 and the offices for public relations (PR) of HAS and UP. The promotion campaign was also supported by the Communications and Dissemination Officer, Chris Styles, from EUSEA, and the Science to Policy Specialist, Carla Perucca Iannitelli from Science for Change.



**Figure 13.** Scoping tools for stakeholders' engagement

The core team of WP2 identified 21 different stakeholders, as presented in Table 2. The table also includes the stakeholder category, the reasons for involvement in the CSI for wildlife conservation, and the potential stakeholder benefits of engaging in this CSI.





**Table 2.** Stakeholder identification, categorisation, reasons for engagement of the stakeholder, and potential stakeholder benefits of engaging

Stakeholder	Category	Reasons to involve the stakeholder (s)	Why the stakeholder may want to be involved (benefits)
Company for the SRNA app development	Private sector business	Development of the SRNA app	Opportunity to develop an app used in scientific research, possibility of further collaboration with researchers, HAS and the Slovenian Forestry Service. Improving the profitability of the company.
European Observatory of Wildlife project and the ENETWILD consortium Wildlife Insights consortium CRP V4 2223 - The rooting of wild boars: causes, consequences, and options to reduce damage and conflicts project and collaborating institutions CRP V1 2031 - Carnivores affect ungulates: determination of species-specific predation rate and the importance for management of wild large mammals in Slovenia project and collaborating institutions	International and national consortiums and institutions involved in projects with similar aims	Collaboration with different projects and consortiums allows sharing of methods used in research, obtained data, and results.	Collaboration with different projects allows for the sharing of methods used in research, obtained data, and results. Promotion of good practises used in wildlife monitoring and observation.
Slovenian hunting organisation and its members	NGO	Contribution of resources, data, and expertise to the project. Improve research questions.	They have a stake in issues related to hunting regulations and wildlife management. Opportunities to influence or drive research.



Nature conservation organisations and their members	NGO	Contribution of resources and expertise to the project. Public outreach and raising awareness about the importance of conservation efforts. Improved dissemination.	They share a commitment to protecting the environment and sustainability. Opportunity to develop a better network with academia.
Natural parks	NGO	Public outreach, raising awareness about the importance of conservation efforts, and improved dissemination.	They share a commitment to protecting the environment and sustainability. Interested in nature conservation at the local level. Opportunity to develop a better connection with academia.
Student organisations in public universities and private colleges	Public	Obtain data on wildlife presence and status. Public outreach and raising awareness to the general public.	Opportunity to involve and gain experiences and knowledge about nature conservation efforts and working with different stakeholders and researchers.
Primary and secondary schools	Public	Obtain data on wildlife presence. Raising awareness about the importance of nature conservation.	Gain knowledge about animal species, nature conservation and innovative methods for wildlife monitoring.
Farmers society	Public	Obtain data on wildlife presence and status to decrease conflicts.	Involving them will improve their ability to protect their farms (crops, livestock) from wildlife, which can be achieved with better monitoring and management of wildlife species and increase biodiversity conservation through key species management. Increase support for research.
Alpine Association of Slovenia	NGO	Obtain data on wildlife presence and status.	Opportunity to improve their knowledge about nature conservation and wildlife. Improve their active participation in the conservation of mountain areas.
Nature photographers	Public	Obtain data on wildlife presence and status.	Opportunity to improve their knowledge about nature conservation and wildlife. Improve the conservation of natural areas. Sharing their photos with a wider audience.
Ministry of Agriculture, Forestry and Food	Government policy maker	Improve consultations between policymakers and scientists. Allow access to national data and offer additional funding and sustainability for the CSI after the project ends.	Development of better policies based on scientific evidence.

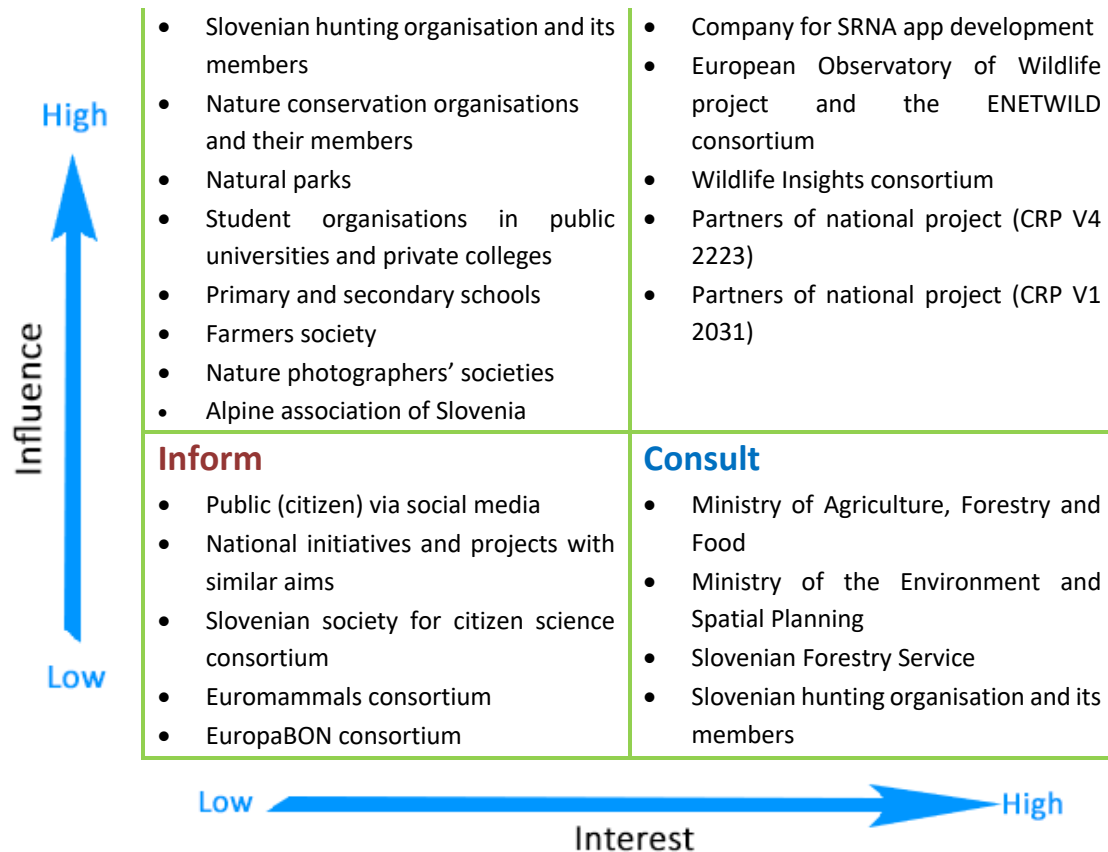


Ministry of the Environment and Spatial Planning	Government policy maker	Improve consultations between policymakers and scientists. Allow access to national data and offer additional funding and sustainability for the CSI after the project ends.	Development of better policies based on scientific evidence.
Slovenian Forestry Service	Government policy maker	Improve consultations between policymakers and scientists. Allow access to national data and offer additional funding and sustainability for the CSI after the project ends.	Development of better policies and management based on scientific evidence.
Public - citizens	Public	Inform citizens about the importance of nature conservation and citizen science.	The public is more informed about the work done by scientists in the fields of wildlife monitoring and nature conservation.
National initiatives and projects that focus on biodiversity monitoring and conservation	Professional contributors	Inform initiatives and other efforts about our work and research and the possibility for future collaboration.	Potential for collaboration and sharing knowledge.
Slovenian society for citizen science consortium	Consortium	Informing the society for citizen science about our project and work, helping with dissemination and knowledge sharing	Informing the public about other citizen science initiatives. Collection of citizen science projects for their database.
Euromammals consortium	Consortium	Informing them about our project, work, results, potential for data sharing, and future collaboration.	Potential for collaboration and sharing data about wildlife.
EuropaBON consortium	Consortium	Informing about our project and the potential for consultations about policy needs.	Potential for collaboration and sharing knowledge.

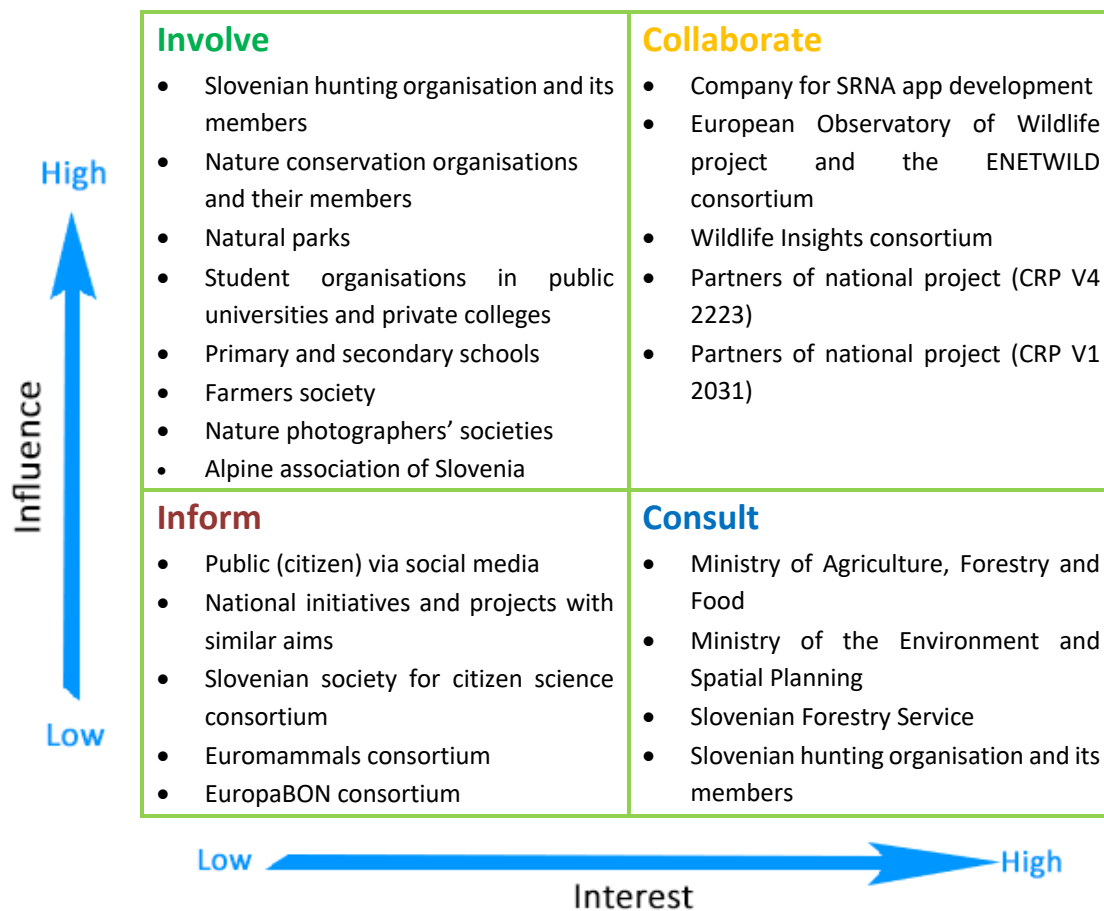
After the identification of stakeholders, stakeholders were mapped on an interest-influence matrix (

**Involve**

**Collaborate**



**Figure 14.** Interest-influence matrix of the engaged stakeholders in WP2., showing the different levels of engagement of each stakeholder. Informed stakeholders (bottom left entry of the matrix) are stakeholders who have little influence over research outcomes. Consulted stakeholders (bottom right entry of the matrix) have high interest but low influence, lacking the capacity to significantly help the project and deliver impact. Involved stakeholders (upper left entry of the matrix) are highly influential but have little interest in the research or lack the capacity or resources to engage. Collaborative stakeholders (upper right entry of the matrix) are those who can supply relevant information, permissions and resources or be impacted by the research outcomes (Durham et al., 2014).



**Figure 14.** Interest-influence matrix of the engaged stakeholders in WP2.



## **Stakeholders' collaboration**

- **Company for the SRNA app development**

UP, together with HAS, subcontracted an external company to develop an app for collecting CS data. The company was LOGOS (<https://www.logos.si>), which had already developed the national platform for game monitoring for HAS ([https://www.logos.si/Home/Produkti\\_Lisjak](https://www.logos.si/Home/Produkti_Lisjak)). The collaboration between UP and LOGOS means the opportunity for further collaboration in future projects or for further development of the current SRNA app.

- **European Observatory of Wildlife project and the ENETWILD consortium**

As previously mentioned in this document (Analysis of collected data, Camera traps), UP is collaborating with ENETWILD. ENETWILD is a European network of wildlife professionals capable of providing reliable data on species distribution and abundance of selected host species and their pathogens (<https://enetwild.com>). This collaboration allowed UP researchers to improve data collection with camera traps by using novel methods. The obtained results were included in a scientific report by the ENETWILD consortium; co-authors of the report are also core team members of WP2 (<https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2023.EN-7892>). Collaboration with the ENETWILD project will continue for the duration of the project.

- **The Wildlife Insights consortium**

The Wildlife Insights platform (<https://www.wildlifeinsights.org>) enables people to share wildlife data, thus improving management of wildlife populations. This improves decision-making with the goal of recovering global wildlife populations. WP2 provided Wildlife Insights with images obtained from camera traps deployed in 2022, thus expanding the available data for Slovenia.

- **National projects**

- **CRP V4 2223** - The rooting of wild boars: causes, consequences, and options to reduce damage and conflicts project and collaborating institutions and,
- **CRP V1 2031** - Carnivores affect ungulates: determination of species-specific predation rate and the importance for management of wild large mammals in Slovenia project and collaborating institutions

Collaboration was established with two national projects. The CRP V4 2223 - The rooting of wild boars: causes, consequences, and options to reduce damage and conflicts project ([\*\*Step  
Change\*\*](https://divji-</a></p></div><div data-bbox=)



[prasic.si/](http://prasic.si/)) aims to study the causes and consequences of wild boar rooting on grasslands in Slovenia and find solutions to reduce damages and conflicts. Part of the project aims to study wild boar distribution and density across Slovenia. Collaboration with Step Change WP2 will allow the sharing of data obtained from camera traps and observation data from the SRNA app. Data from the SRNA app will improve knowledge about the distribution of wild boar in areas not covered by researchers and camera traps.

The second project (<https://plenilci.splet.arnes.si/>) aims to study the effects of predation on wild large mammals in Slovenia and the importance of predation rates for managing wildlife. Collaboration with this project was established to share data about the distribution of large carnivores (*Ursus arctos*, *Canis lupus*, *Canis aureus* and *Lynx lynx*) collected by citizen scientists through the SRNA app and also to involve non-invasive genetic monitoring of predators' diets. The method developed in the project will be validated in Step Change phase two of WP2.

### ***Stakeholders' recruitment and involvement***

The **Slovenian hunting organisation and its members** are the main stakeholder group for WP2 wildlife conservation, contributing resources, data, and expertise to the project. Hunters' involvement is important as it will improve the reliability of collected data. Being involved also means having a greater impact on wildlife management, which is another benefit for hunters. Hunters will also have the opportunity to contribute to research and management due to their skills, experience and knowledge of wildlife. This can be achieved by improving communications between policymakers, hunters, and researchers. The SRNA app can play an important role in communication. To involve hunters, the core team of WP2 planned:

- sending messages and e-mails to hunters in Slovenia
- publishing articles in the journal "Lovec"
- publishing news for the HAS website
- presenting at events organised by the HAS (for example, Hunting Days)
- deploying traps in collaboration with hunters, presented in D2.3., Camera traps
- on-field demonstrations of the usage of the SRNA app



### SRNA: nova aplikacija za beleženje opažanj divjadi in drugih vrst prostoživečih živali

Monitoring (spremljanje stanja) populacij prostoživečih živali ne glede na to, ali so uvrščene med lovne vrste (to je divjadi) ali zavarovane, je nujen

Lovec, CV letnik, št. 9/2022

del sodobnega varstva in/ali trajnostnega upravljanja populacij. Sistematičen monitoring mnogih vrst je potreben tudi zaradi obveznosti, ki izhajajo iz slovenske in evropske zakonodaje.

Za lažji in bolj sistematičen monitoring izbranih vrst prostoživečih živali (predvsem divjadi) smo v sodelovanju **Lovske zveze Slovenije** in treh raziskovalnih institucij (**Univerze**

**na Primorskem, Univerze v Ljubljani in Fakultete za varstvo okolja iz Velenja**) razvili aplikacijo z imenom **SRNA** (*Spremljanje in Raziskovanje Narave z Aplikacijo*). Vsi zainteresirani z aplikacijo lahko beležite opažanja divjadi na terenu, zanimivosti pri uplenjenih živalih in zbirate pomembne podatke o njihovem zdravstvenem stanju ter razmnoževalnem potencialu.

Zbrani podatki bodo omogočili izboljšanje poznavanja, posledično pa tudi upravljanja in varstva prostoživečih živali (velikih sesalcev in izbranih vrst ptic) v Sloveniji.

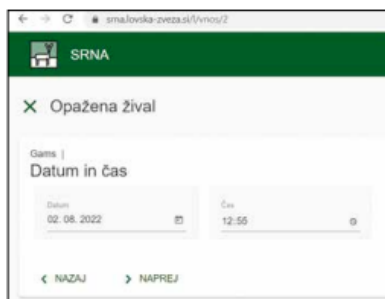
Lovci ste/smo najboljši poznavalci divjadi in mnogih drugih vrst prostoživečih živali, pri svojih izhodih v lovišča pa dnevno opažamo različne zanimivosti in pridobivamo številne podatke.

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## LOVSKA ORGANIZACIJA

Le-te pogosto tudi beležimo, a praviloma ostanje zgolj kot zapiski v lastnih arhivih in spominih, niso pa sistematično zbrani in obdelani. Prav zaradi nesistematičnega zbiranja in razpršenosti

delne podatke povežejo med sabo, jih ustrezno statistično obdelajo in analizirajo, je mogoče pridobiti nove pomembne informacije, ki so izjemnega pomena tudi za izboljšanje upravljalvskega procesa.



Aplikacija SRNA – vnos opažene živali

so bili v preteklosti v znanstvenih krogih podatki, pridobljeni z neposrednim opazovanjem, pogosto zanemarjeni oziroma celo podcenjeni. Vendar so z novimi tehničnimi možnostmi povezovanja podatkov številnih terenskih sodelavcev (v tem primeru lovcev) in sistematične analize ter njihove njihove sinteze usposobljenih raziskovalcev terenska opažanja zopet postala izjemno pomembna, lovci pa postajajo izjemno pomembni »ljubiteljski znanstveniki« (angl. *citizen scientists*). Le s sodelovanjem lovcev kot izjemno dragocenih terenskih sodelavcev in raziskovalcev, ki lahko zbrane

Tako bo, na primer, z zbiranjem in analiziranjem podatkov o številu mladičev, ki jih vodijo srne, mogoče za vsako leto določiti/napovedati prirastek (le-ta se med leti zaradi zunanjih dejavnikov, na primer vremenskih razmer in obroda plodonosnih listavcev, zelo spreminja) in posledično tudi bolj optimalno posegati v populacijo z odvzemom. Podobno bo mogoče učinkoviteje spremljati zdravstveno stanje populacij ter se ustrezno in pravočasno odzivati (na primer napovedati izgube oziroma jih upoštevati pri načrtovanju odvzema). Z beleženjem opažanj redkih in ogroženih vrst (na primer



Posnetek živali v naravnem okolju s pomočjo fotosast

predstavnikov kococonogih kur) bomo lovci bistveno izboljšali poznavanje njihove razširjenosti, populacijskega statusa in trendov, s čimer bomo pomembno prispevali tudi k varstvu teh vrst ter tako utrdili naše naravovarstveno poslanstvo.

Lovci lahko do aplikacije dostopajo prek pametnega telefona ali računalnika z lastno identifikacijsko številko, zapisano na lovski izkaznici. Uporaba aplikacije je kljub njeni kompleksnosti (omogočeni so res številni vnosi različnih opažanj) preprosta, saj nas od začetka do konca vnosa vodijo notranje povezave in pregledni meniji. Z uporabo aplikacije je mogoče poleg različnih vnosov opažanj slediti tudi statistiki vnosov (lastnih in na območju države). V aplikaciji je tudi mož-

nost nalaganja fotografij iz vaših fotokamer. Zelo bomo veseli, če boste pripravljeni z nami deliti vaše posnetke.

Aplikacija je namenjena tudi neposredni komunikaciji med lovci in raziskovalci, saj lahko prek nje posredujete kakršnakoli vprašanja v povezavi z vašimi opažanj oziroma divjadjo nasploh na naslov: [stepchange@famnit.upe.si](mailto:stepchange@famnit.upe.si).

O rezultatih vas bomo redno obveščali. Posameznike z največ vnosov bomo za sodelovanje in še lažje beleženje podatkov o prostoživečih živalih nagradili s sodobnimi lovskimi kamerami.

Vabimo vas, da aplikacijo čim prej preizkusite, na primer ob čakanju divjadi na preži, in jo uporabljate čim pogosteje.

Elena Bužan

Figure 15. Journal »Lovec« - September 2022 – Prof. Elena Bužan.

Nature conservation organisations and nature parks were contacted by email or visited in person. For them, participating in Step Change is an opportunity to share their commitment to environmental protection and sustainability, and an opportunity to develop better networks with academia. They can therefore contribute significant resources and expertise to the project and can be involved in organising workshops to raise public awareness of the importance of conservation efforts.





Figure 16. Promotional material in Landscape Park Strunjan (photo: Simona Cerrato)

The Step Change project allows **students** to be involved and gain experiences and knowledge about nature and wildlife conservation efforts, it also teaches them about working with different stakeholders and researchers. The core team of WP2 from the University of Primorska organised different presentations, events, workshops, and fieldwork to teach students how to identify wildlife presence, how to effectively deploy camera traps, and how to use the SRNA app in the field.



**Figure 17.** Deploying camera traps with students

The core team of WP2 organised different types of workshops for pupils from **primary and secondary schools** on the topic of innovative approaches for biodiversity monitoring. Knowledge of innovative teaching methods, focusing on the latest methods of biodiversity monitoring and data collection, as well as information about the Step Change project and the practise of citizen science, was also shared with their mentors and teachers.



**Figure 18.** Workshop for pupils from primary school

One of the main stakeholders of WP2 are **farmers**. They can obtain data on wildlife presence, thus helping researchers and policymakers improve the management of wildlife species to decrease conflicts between farmers and wildlife. For them, the core team of WP2 is organising presentations, events, and workshops to promote biodiversity conservation on farmlands and the implementation of the SRNA app in their daily routine.



**Figure 19.** Event for farmers

For the **Alpine Association of Slovenia** and **nature photographers** participating in the project, wildlife conservation can be an opportunity to improve their knowledge about nature conservation and wildlife identification. For the core team of WP2, it is an additional opportunity to obtain information on the presence and status of wildlife. Hiking and nature photography groups have been in contact via email, social media, and phone. In addition, on-field workshops are planned.

### ***Promotion and informing stakeholders of the SRNA app***

To attract more participants, the Step Change project and the SRNA app were promoted, and stakeholders such as the public (citizens) were informed through:

- national TV shows,
- radio podcasts,
- newspapers,
- social media: Instagram, Twitter, and Facebook
- leaflets
- for citizen scientists, the UP team is organising the Spring Wildlife Challenge, where users will have a week to photograph and submit as many wildlife observations as possible.



Figure 20. TV show – Jutro na Planetu

Other stakeholders, such as national initiatives and projects with similar aims (e.g., Life Narcis), the Slovenian society for citizen science (<https://citizenscience.si>), Euromammals (<https://eurodeer.org>), and EuropaBON (<https://europabon.org>) were also contacted to further disseminate the Step Change project and the activities of WP2.

### ***Stakeholders' involvement and sustainability of CSI (policymakers)***

The **Ministry of Agriculture, Forestry, and Food** was consulted regarding the possibility that the approach developed in WP2 involving camera traps, non-invasive genetic sampling, and developing the SRNA app could become national monitoring tools for species observation. Also, the core team of WP2 consulted with the **Ministry of Environment and Spatial Planning** and the **Slovenian Forestry Service** regarding the monitoring of protected species occurrence. The Slovenian Forestry Service agrees to use data collected through SRNA apps and camera traps in their management plan in the future. All this action and the data collected with camera traps and by CS through the SRNA app can improve national management policies, biodiversity management and conservation.



Vodstvo LZS in predstavniki SZS LZS na sestanku z državnim sekretarjem MKGP dr. Krajčičem. Foto: Urša Kmetec

**Figure 21.** Meeting with the Ministry of Agriculture, Forestry, and Food.



## References

Durham E., Baker H., Smith M., Moore E., Morgan V. (2014). *The BiodivERsA Stakeholder Engagement Handbook*. BiodivERsA, Paris (108 pp).

Microsoft Corporation. (2018). *Microsoft excel*. Retrieved from <https://office.microsoft.com/excel>.

Oldoni D., Desmet P., Huybrechts P. (2023). *camtraptor: Read, Explore and Visualize Camera Trap Data Packages*. R package version 0.19.5.

Rowcliffe, J.M., Field, J., Turvey, S.T. and Carbone, C. (2008), Estimating animal density using camera traps without the need for individual recognition. *Journal of Applied Ecology*, 45: 1228-1236. <https://doi.org/10.1111/j.1365-2664.2008.01473.x>.

RStudio Team. (2018). *RStudio: Integrated Development Environment for R [Computer software manual]*. Boston, MA. Retrieved from <http://www.rstudio.com/>.



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# POLICY BRIEF

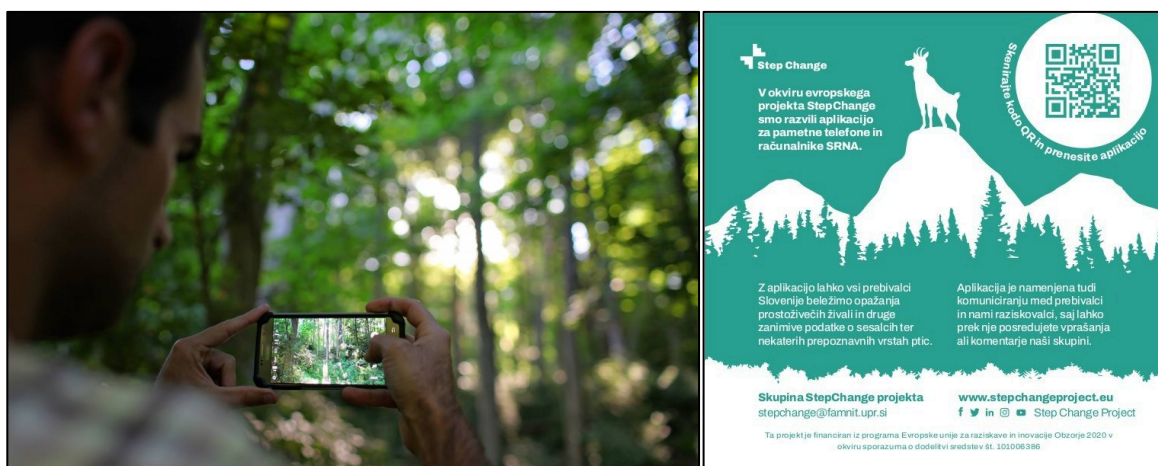
## ON WILDLIFE MONITORING AND CONSERVATION



Science Transformation in Europe through Citizens involvement in Health, conservation and energy research

### INTRODUCTION

The Citizen Science initiative (CSI) on wildlife monitoring and conservation in Slovenia is dedicated to exploiting, extending, and up-scaling the already existing hunters' wildlife observation database by involving citizens and professional scientists in data collection through a software for mobile phones called SRNA. This CSI also aims to foster the evaluation of the effects of citizen training in data collection, establish a data validation procedure to minimise bias, foster a policy dialogue on evidence-based wildlife management policies, and assess the up-scaling potential of the database.



**Step Change**

V okviru evropskega projekta StepChange smo razvili aplikacijo za pametno telefonno in računalniško SRNA.

Skenirajte QR kodo in prenesite aplikacijo

Z aplikacijo lahko vsi prebivalci Slovenije beležimo opažanja prostoživečih živali in druge zanimive podatke o sesalcih ter nekaterih prepoznavnih vrstah ptic.

Aplikacija je namenjena tudi komuniciranju med prebivalci in nami raziskovalci, saj lahko prek nje posredujete vprašanja ali komentarje naši skupini.

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f t in Step Change Project

Ta projekt je financiran iz programa Evropske unije za raziskave in inovacije Obzorje 2020 v okviru sporazuma o dodelavi sredstev št. 101006386

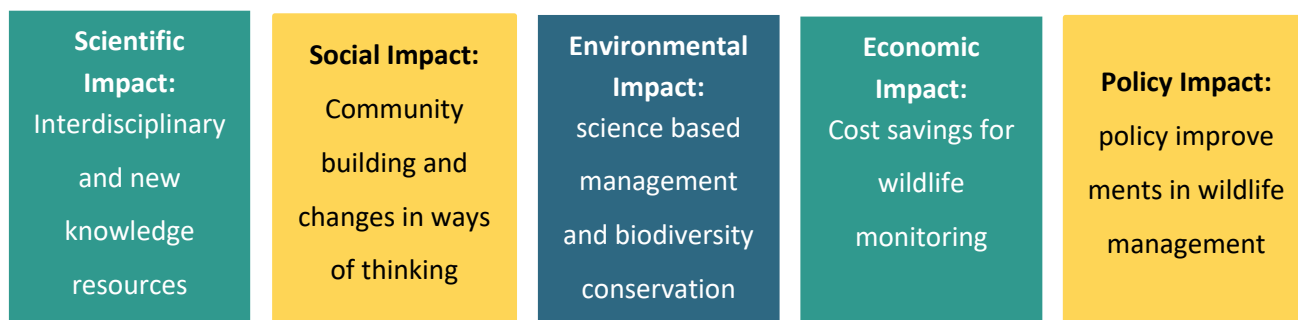






The Hunters Association of Slovenia (HAS) is the central Slovene hunting organisation, with almost 21,000 members. It is an independent NGO working in the public interest whose mission is the sustainable management of game species, the education of hunters, and the protection of the natural environment. To fulfil these aims, HAS has developed a unique and comprehensive Hunting Information System (HIS), unprecedented in the European Union, where a lot of data on wildlife is stored at the national level. In this context, the main objective of this CSI is to improve the capacity of the existing database and increase data validation with the help of citizen scientists and stakeholders. Developing an experimental campaign to extend the possibility of collecting data and interpretative data beyond hunters, including beginners (outdoor enthusiasts, camera trappers and photographers); setting up a data verification procedure; and obtaining the relevant outputs to improve policy in biodiversity conservation and management.

The CSI on wildlife conservation in Slovenia's impact is divided into five dimensions: scientific, social, economic, political, and environmental impact. To maximise it, the CSI adopted a multifaceted methodology that fosters alignment with local contexts and supports collecting and analysing data and information. While providing a diversified set of services to the CSI team, these activities also function as a network of sensors to produce a better understanding of CS in general by identifying recurrent obstacles, hindering factors, coping strategies, and potentially long-term impacts.



### **Impact 1: New knowledge and innovation with/by citizen science**

- New knowledge from citizen science:
  - A broader and deeper cross-disciplinary cooperation: Citizen scientists are involved in all the phases of the research, rather than only in data collection.
  - Enlarged and better empirical basis: Wildlife observation dataset extended, consolidated, and verified by using multiple data gathering methods (i.e., CS data, camera traps, national databases, non-invasive genetic monitoring). In particular, data standards and quality, as well as data dependability, are crucial factors since they affect the project's overall validity in research, society, and politics. When gathering data from numerous sources, inter-observer reliability should be taken into account. Reliability for photos or videos taken by volunteers should be determined by checking the volunteers' scores, or alternatively, by only admitting data points that have been verified by researchers.
  - New theoretical insights: Increased capacity to assess medium- and long-term changes in wildlife behaviours.
- Innovation with/by citizen science
  - New methodological innovations: Development of a validation approach allowing broad-scale integration of citizen science data in standardised, high-quality research on wildlife ecology research.
  - New social innovations: Creation of a national framework (software, database) for engaging citizens in wildlife conservation. Promotion of scientific education and the importance of wildlife conservation to citizens, for a better understanding of their role in conservation efforts.
  - New economic innovations: Case studies have shown that CS is an effective tool for studying animal biology and behaviour. The SRNA app makes it possible to collect data at the national level even with modest funds. By allocating a portion of the project budget to the training of citizen scientists, the reliability of the data can be increased.
  - New governance innovations: Inclusion of multiple stakeholders in policymaking decisions to ensure no unintended conflicts between various stakeholders or between stakeholders and wildlife.

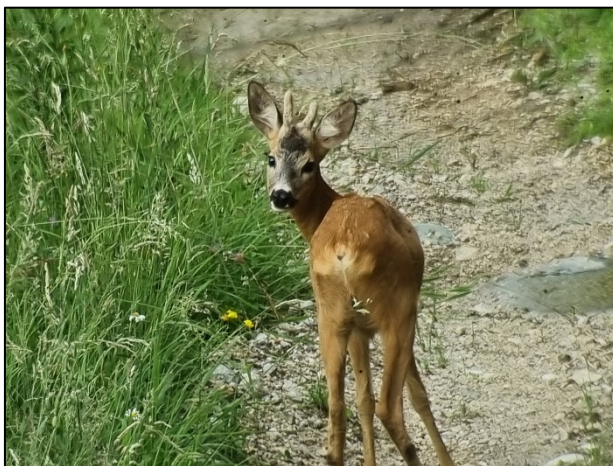
### **Impact 2: contribution to Sustainable Development Goals (SDGs)**

- Life on Land: By extending and improving the quality of the hunters' observation database, the initiative will support evidence-based decision-making for conservation at local and national levels to preserve the unique Slovenian wildlife and ecosystem.





- Broader and deeper cross-disciplinary cooperation among researchers and citizen scientists. Researchers should involve citizen scientists in all phases of the research to ensure their input is integrated into the research. This can be achieved by regularly involving expert citizen scientists (i.e., hunters) in discussions about the data collection, data validation, the obtained results and ways of using these results in further research.
- To improve wildlife conservation and monitoring, governments should promote the employment of novel tools and techniques, thus increasing the efficacy and efficiency of the efforts, such as the use of multiple tools to monitor wildlife, i.e., camera traps, non-invasive genetic monitoring, and field observations by citizen scientists. A protocol should be developed to evaluate both qualitative and quantitative data when combining multiple tools and techniques. Researchers should also establish a protocol for checking citizen science data by accepting only verifiable data, e.g., pictures, videos. Evaluation can be used to find areas for improvement, such as modifications to training or protocols.
- To promote scientific education and the importance of wildlife conservation to citizens, educational materials, that are designed in a way that is accessible and engaging to citizens (videos, booklets, infographics), should be developed. Social media should also be used to share these materials. Schools should also be engaged by organizing field trips, workshops and presentations for students about the importance of wildlife conservation.



- *Photos obtained by: citizen scientists and uploaded to the SRNA app (left), camera traps (right)*

- To assess medium- and longterm changes in animal behaviour it is important to make sure conservation and monitoring efforts started during the project are maintained after the end of the project. This can



be achieved by promoting citizen science to policymakers that can allocate funds for the continuation of these efforts. **The SRNA Wildlife Monitoring App and other novel approaches are currently being evaluated to integrate citizen-generated data into the national monitoring of wildlife in Slovenia.**

- Inform policy with scientific research on the ecological, social, and economic aspects that influence wildlife populations. Policymakers are encouraged to engage with wildlife experts and employ data-driven methodologies to create more effective policies. In this way, decision-makers can better ensure that conservation efforts are evidence-based and preserve wildlife populations for future generations by incorporating citizen wildlife monitoring data into policy-making processes.
- Create a protocol for the cooperation with different stakeholders, such as governmental organisations, non-governmental organisations, local communities, and researchers, as well as increased funding and resources to support wildlife monitoring efforts, will improve wildlife conservation efforts at the local and national levels.

**LJUBITELJSKI ZNANSTVENIK LAHKO POSTANETE TUDI VI!**

**Skenirajte kodo QR in prenesite aplikacijo**

**SRNA APLIKACIJA**

**Step Change**

**SRNA APLIKACIJA**

The project is funded by Horizon Europe, the European Union's research and innovation programme for 2021-2027. It is part of the Science in Action programme, which aims to support the development of innovative and interdisciplinary research projects.

Science in Action

EUBA

ECSA

WOLF

## TAKE HOME MESSAGES

- To provide better science based conservation management plans, accurate and reliable data are needed for wildlife monitoring.
- The inclusion of citizens in wildlife monitoring is beneficial as it promotes scientific education, improves relationships, and increases confidence in public authorities.
- Support the adoption of evidence-based policy decisions that contributes to increasing public awareness of biodiversity and conservation in the territory.
- Get involved in our research: Find out more on the Step Change project website ([www.stepchangeproject.eu](http://www.stepchangeproject.eu)) and the SRNA app ([www.srna.lovska-zveza.si](http://www.srna.lovska-zveza.si)).

## PROJECT IDENTITY



<b>PROJECT NAME</b>	Science Transformation in EuroPe through Citizens involvement in HeAlth, coNservaion and enerGy rEsearch ( <b>STEP CHANGE</b> )
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<b>FUNDING SCHEME</b>	Horizon 2020: SwafS-27-2020 Hands-on citizen science and frugal innovation

