Step Change

# Deliverable 2.2

*Wildlife data collection software*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006386

# Deliverable description.

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| **Deliverable** | 2.2 |
| **Work Package** | WP2 |
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| **Lead beneficiary of this deliverable** | University of Primorska |
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| **Submission Date** | 30-04-2022 |
| **Reviewers** | Tilen Hvala - Hunters Association of Slovenia<br>Irena Mrak - Alpine Association of Slovenia |

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|---|---|
| **PU** | **Public** |
| **CO** | **Confidential, only for members of the consortium (including the Commission Services)** |
| **CI** | **Classified, as referred to in Commission Decision 2001/844/EC** |

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# Acronyms

| Acronym | Description |
|---|---|
| APC | Article Processing Charges |
| AU | Aarhus University |
| CS | Citizen Science |
| CSI(s) | Citizen Science Initiative(s) |
| D | Deliverable |
| EC | European Commission |
| ECSA | European Citizen Science Association |
| EU | European Union |
| EUSEA | European Science Engagement Association |
| GDPR | General Data Protection Regulation |
| K&I | Conoscenza e Innovatione Società a Resposanbilità Limitata Semplificata |
| HAS | Lovska Zveza Slovenije (the Hunters Association of Slovenia) |
| M | Month |
| OA | OpenAccess |
| SfC | Science for Change |
| T | Task |
| UP | University of Primorska |
| WP | Work Package |
| ZSI | Centre for Social Innovation |

## Summary

The following Deliverable contains a detailed description of the citizen science app for wildlife monitoring in Slovenia, which has been developed by UP and HAS, for Work Package 2 of Step Change project.

WP2 aims to improve existing platforms for data collection and analysis about wildlife presence, movements, and behavior in Slovenia. WP2 also aims to assess the capacity of CS to provide high-quality data about wildlife, by comparing data collected by citizen scientists with information collected through ecological sampling techniques, and by developing a procedure for verifying collected CS data. WP2 aims also to provide information for evidence-based wildlife conservation and management in Slovenia and raise public awareness about this topic.

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

The Research Team includes:

- Prof. Elena Bužan, University of Primorska (Leader of the CSI and Project Coordinator)
- Prof. Boštjan Pokorny, Faculty for Enviromental protection and Hunting organization (Co-leader of the CSI)
- Dr. Laura Iacolina, University of Primorska (member of the Core Team)
- Dr. Jacopo Cerri, University of Primorska (member of the Core Team)
- Dr. Felicita Urzi, University of Primorska (member of the Core Team)
- Sandra Potušek, University of Primorska (member of the Core Team)
- Aja Bončina, University of Primorska (member of the Core Team)
- Prof. Hubert Potočnik, University of Ljubljana (member of the Extended Core Team)
- Prof. Aleksandra Perčin, University of Zagreb (ethical officer)

Relevant advisors for WP2 include:

- 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 will include:

- Tilen Bartol (HAS), who will assist the Research Team in hunter recruitment and engagement
- Taja Pajmon Rak (Student Council of the University of Primorska), 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 Reseach 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
- Jure Čuš (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

## *Tasks, related deliverables and timeline*

WP2 will Include six different Tasks:

- T2.1, the creation of the study design, protocols and plans, addressed by this Deliverable (D2.1). The development of D2.1 took place between October 2021 and February 2022.
- T2.1, the development of an app for Citizen Science. Currently, this task is being undergone by intensive collaboration between the core team and an external company with extensive experience with apps for CS in Slovenia. This task also focuses on the acquisition of complementary tools, namely camera traps, for the field campaign. This task is taking place between October 2021 and March 2022.
- T2.3, data collection through the field campaign and the CS initiative. This task will start in March 2022 and include four different activities, until December 2022:
    - Recruitment of minimum 100 hunters and 100 non-hunters, who will then collaborate as citizen scientists. The promotional campaign will be co-designed by the core team of WP2 and the offices for public relationships (PR) of HAS and UP

- Capacity building, where participants will be provided with information about Step Change, as well as about its goals, protocols for data collection and information about the use of the CS app
- Data collection through the citizen science app and through voluntary camera trapping
- Data collection through the deployment of camera traps over a systematic 10km lattice grid, made by members of UP and HAS

- T2.4, analysis of data collected during the field campaign, between December 2022 and April 2023. In this task, researchers will analyze data collected from: *i*) deployed camera traps, *ii*) SRNA, the citizen science app that hunters and non-hunters will use to upload their observations, *iii*) the quiz for wildlife identification. A complete overview of data analysis is provided in the following chapters
- T2.5, data verification and feedback, between December 2023 and April 2023
- T2.6, engagement and communication activities

# Implementation and structure of the citizen science app

## *Overall structure*

The citizen science app adopted in WP 2 has been named "SRNA" ("***S**premljanje in **R**aziskovanje **N**arave z **A**pplikacijo*" in Slovene language, literally "*An Application for Monitoring and Exploring Nature*"), corresponding to the Slovenian word used for the ***female roe deer***, one of the key species of the CS campaign.

Data collection in SRNA will involve 31 species of mammals and 8 species of birds. Mammals included are: wild boar (*Sus scrofa*), European roe deer (*Capreolus capreolus*), red deer (*Cervus elaphus*), fallow deer (*Dama dama*), Northern chamois (*Rupicapra rupicapra*), Alpine ibex (*Capra ibex*), Eurasian moufflon (*Ovis aries*), brown bear (*Ursus arctos*), gray wolf (*Canis lupus*), Eurasian lynx (*Lynx lynx*), golden jackal (*Canis aureus*), red fox (*Vulpes vulpes*), European wild cat (*Felis silvestris*), raccoon dog (*Nyctereutes procyonoides*), pine marten (*Martes martes*), stone marten (*Martes foina*), European polecat (*Mustela putorius*), Eurasian badger (*Meles meles*), American raccoon (*Procyon lotor*), Eurasian otter (*Lutra lutra*), stoat (*Mustela erminea*), weasel (*Mustela nivalis*), domestic cat (*Felis catus*), European brown hare (*Lepus europaeus*), mountain hare (*Lepus timidus*), red squirrel (*Sciurus vulgaris*), Eurasian beaver (*Castor fiber*), coypu (*Myocastor coypus*), muskrat (*Ondatra zibethicus*), European edible dormouse (*Glis glis*). Birds included are: capercaillie (*Tetrao urogallus*), black grouse (*Lyrurus tetrix*), ptarmigan (*Lagopus muta*), hazel grouse (*Tetrastes bonasia*), gray partridge (*Perdix perdix*), common quali (*Coturnix coturnix*), rock partridge (*Alectoris graeca*) and the common phaesant (*Phasianus colchicus*).

## *Collected data*

The app layout is different for hunters and non-hunters. These two groups of users will collect data about the same species but will partially differ in the type of data they will provide.

Namely, non-hunters will report three types of data:

- wildlife observations, animals observed during their outdoor activities
- animals that were found dead, including road-killed individuals
- pictures, taken directly from smarpthone cameras and their camera traps, positioned in their backyard as camera trapping amatheurs

Wildlife observations include animals that non-hunters will observe during their outdoor activities. The structure of the data is similar to that of hunters, as non-hunters will have the chance to report the age and sex of individuals, altogether with numbers of observed animals (Fig. 1). Moreover, SRNA offers an open-ended menu for collecting information about any other relevant detail (e.g. behavior). To facilitate its usage by non-Slovenian people, such as foreign tourists, the interface of SRNA for non-hunters was also translated in English. This option can also facilitate the integration of SRNA in transboundary monitoring activities or its application in other European projects.

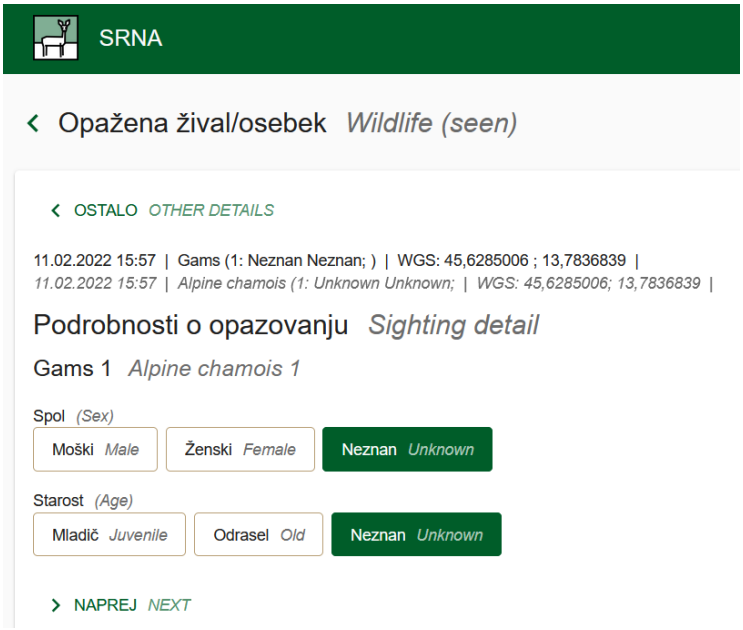


Fig. 1. An example of how non-hunters could classify the sex and age class of an Alpine chamois (*Rupicapra rupicapra*), spotted during an outdoor activity.

After an initial pilot phase on the beta version of SRNA, researchers from UP asked external company to allow non-hunters also to shoot pictures from the camera integrated in their mobile phones. This would allow, for example, to collect pictures of wildlife tracks and signs, which could subsequently be classified by researchers and practitioners, to increase available data about wildlife presence in Slovenia. Records of tracks and signs are particularly important for elusive species such as carnivores or the Eurasian beaver, which are seldom observed directly.

Hunters, will report three types of data:

- wildlife observations, animals that they observed during their everyday activities (e.g. hunting, but also simply hiking or working in countryside/woodlands)
- characteristics of wildlife that has been harvested during their hunting activities.

Compared to non-hunters, it is important to pinpoint that hunters will not collect any information regarding dead animals and roadkills. This because, they already record this information for other management purposes, and their data are already uploaded on the central server of HAS on a daily basis by another app (https://odvzem.lovska-zveza.si/login?returnUrl=povoz).

For wildlife observations, hunters included the observed species, the location of the record, the number of observed individuals and finally they also had the possiblity to include extra indications through an open-ended menu. For each record, hunters can include the characteristics of each observed individual, such as the age class or sex. Moreover, it is possible for them to add a picture of each observation. As for harvested wildlife, apart from sex and age, hunters must report the identification tag with which they had marked animals, once shot, along with sanitary-relevant details, such as injuries (fractures and wounds), traces of diseases (internal and external) and parasites found on individuals (Fig. 2).

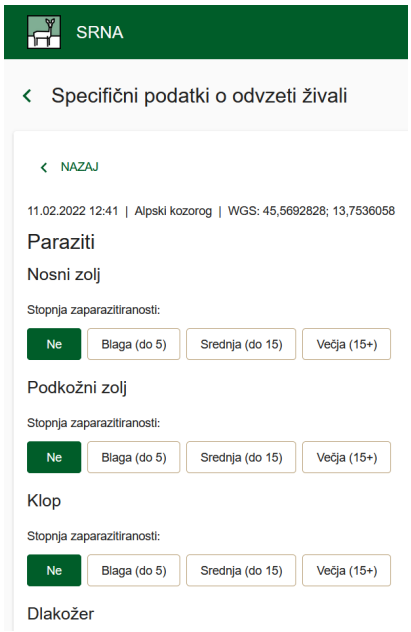


Fig. 2. Example of parasites and sign of disease, that could be reported from harvested animals. This information can be extremely precious for detecting outbreaks of infectious diseases.

## *Spatially-explicit information and privacy*

SRNA will allow users to decide if they want to make the location of their records publicly available, to app users, or not. This option has been selected to guarantee the maximum freedom of choice, in terms of re-usage of the collected data. For example, if a certain user does not want the location of his/her records to be disclosed, he could simply skip this detail and they would not appear on the map to other users in the "Statistics" section.

However, to ensure a sound evaluation of collected data, it is mandatory to include the location of each record: even if locations cannot be disclosed, it will still be possible for UP and HAS expert to check the location of each record (Fig. 3). This section functionality is fundamental to avoid mistakes and accidental data records. For both mobile and desktop users, SRNA could also automatically record the location of each users, or enable users to manually specify the location of their record. This distinction could also allow for subsequent recording, or to achieve a higher level of spatial accuracy.

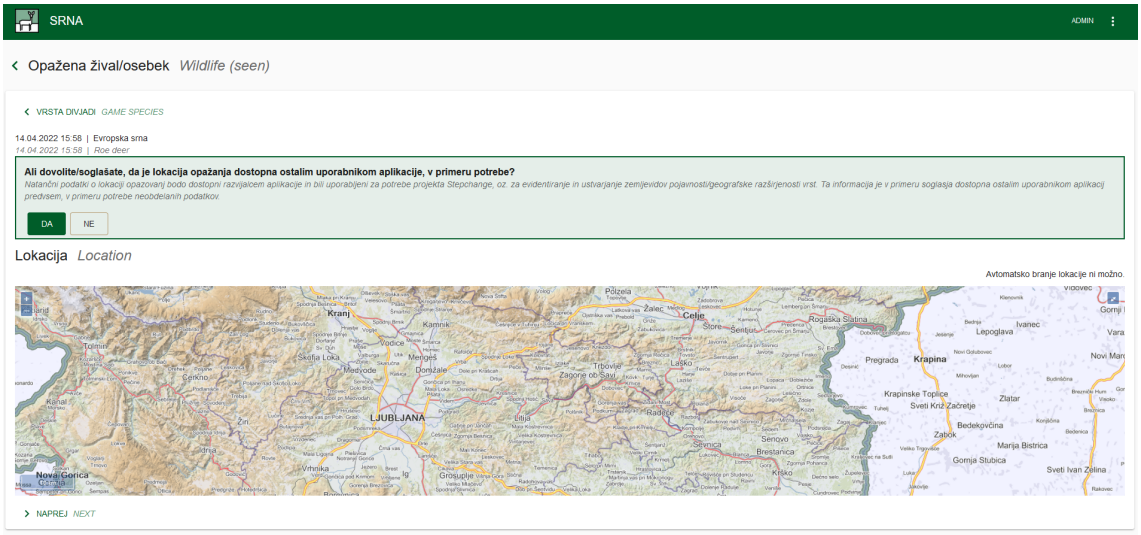


Fig. 3. The panel allowing users (an example for non-hunters) to specify if they want the location of their records to be disclosed to other users (top menu) and to add the location of their records, for app developers (interactive map on bottom)

## *Additional features for users*

SRNA also includes some additional functionalities, which are fundamental for engaging, informing and evaluating the proficiency of citizen scientists (Fig. 4)

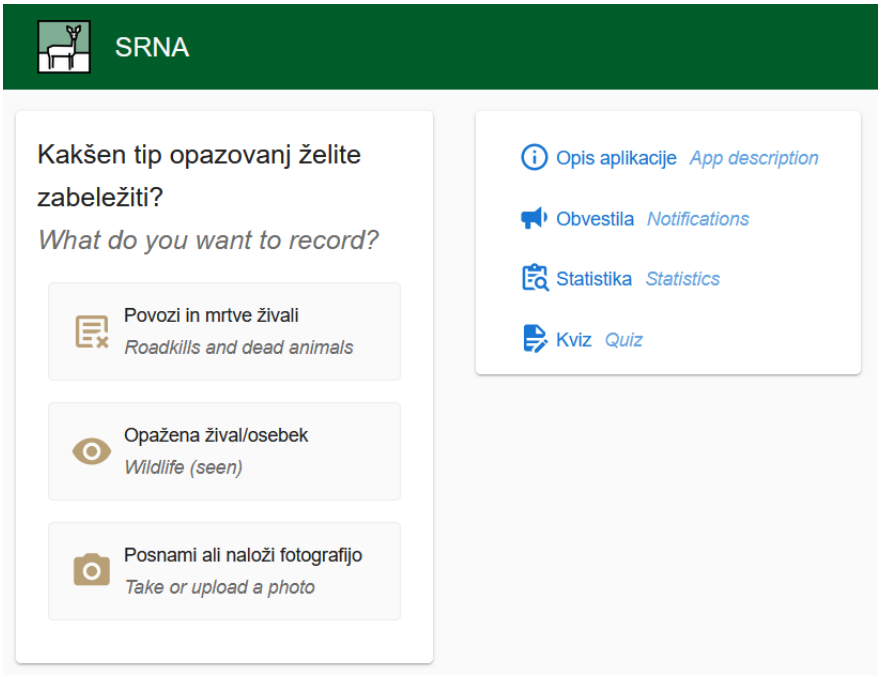


Fig. 4. The main menu of SRNA, for non-hunters. The menu allows users to access platforms for reporting observations (on the left) and to use additional features of the app (on the right).

These functionalities include:

- a quick description of Step Change and SRNA, and about the role played by citizen scientists in wildlife monitoring and conservation in Slovenia ("App description")
- a page where users could be notified from the core team of WP2 about project-related activities, as well as about news regarding wildlife in Slovenia. For hunters, a second option is available, to notify them about activities organized by HAS ("Notifications")
- a section summarizing individual statistics (Fig. 5). This section underwent some refinements during the piloting phase: in the final version of the app, citizen scientists ("Statistics")

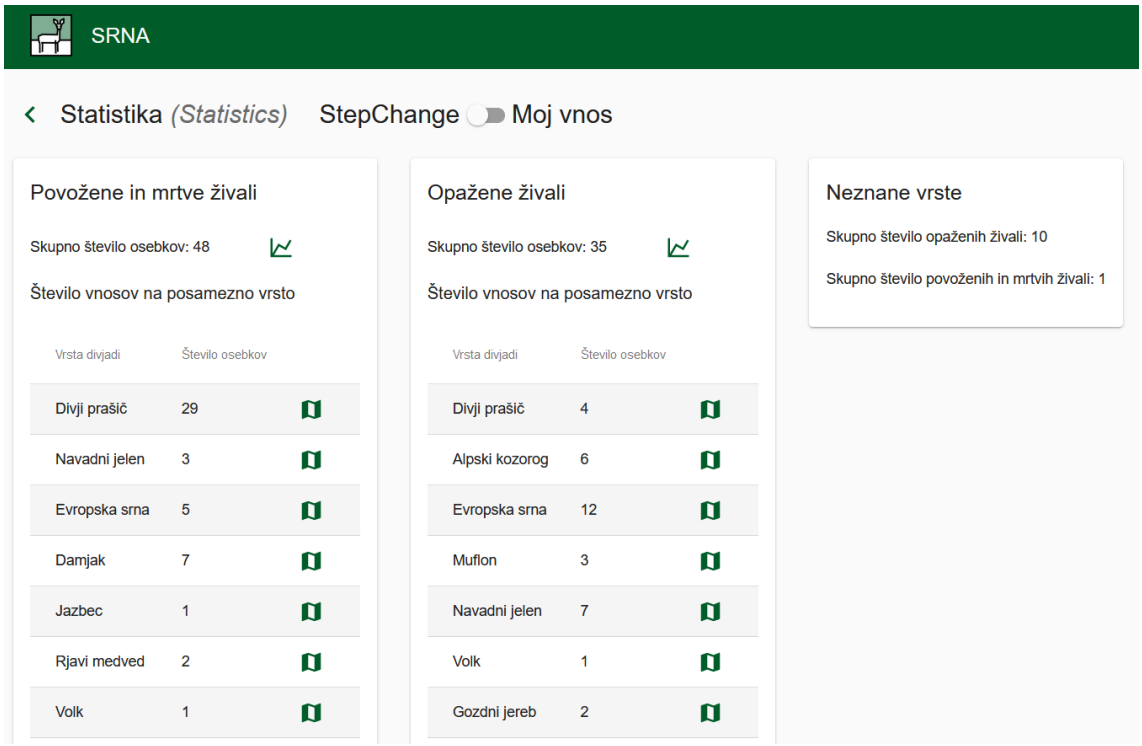


Fig. 5. Outline of the "Statistics" section, for non-hunters: citizen scientists could check overall records from StepChange ("StepChange" button, on top) and also their own records ("Moj vnos", on top). For each species they can also check the spatial distribution of records, at least for those where location was made available. They can also check a graphic summarizing the temporal trend for each species.

## *Quiz for wildlife Identification*

Between December 2021 and February 2022 a quiz for assessing the accuracy of wildlife identification by users was developed by UP. The quiz was implemented through 1KA (https://www.1ka.si/), and compliant with requirements from the GDPR (https://gdpr.eu/). The quiz could be accessed from the main menu of SRNA, and citizen scientists could play it to measure, and improve, their ability to recognize wildlife species. The identification quiz is one of the cornerstones of the data validation procedure. It will enable UP core team to understand more about the real capacity of citizen scientists to recognize different species of wildlife. In the quiz, participants are be asked to evaluate 30 pictures of wildlife, randomly extracted by a pool of ~ 200 Imaged about large carnivores, mustelidae, rodents and ungulates. All these images have been downloaded from the internet and are under CCBY license. Thus, proper credit to each picture was given at the end of the quiz.

The quiz is based on assessing the proficiency of participants to distinguish random pictures of similar wildlife species. Namely, the quiz will focus on five groups of mammals, which carry a high risk of being mistaken:

- Canidae, in particular the gray wolf, the golden jackal and the red fox (Fig. 6)
- The Eurasian beaver and the coypu
- Mustelidae, In particular the stone and pine marten, stoat, weasel and the european polecat.
- Goat-like ungulates, namely feral domestic goats, the Northern chamois and the Alpine ibex.
- Deers, namely the red deer, the roe deer and the fallow deer.

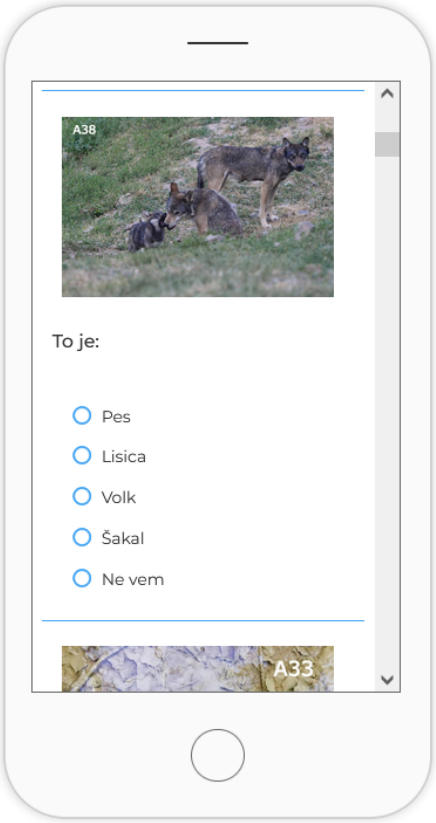


Fig. 6. A question from the quiz, where participants are asked to Indicate the species portrayed in the picture, from a list of similar species: the domestic dog ("*Pes*" in Slovenian), the red fox ("*Lisica*"), the gray wolf ("*Volk*"), the golden jackal ("Šakal").

## *Wildlife Identification handbook*

Between February and March 2022, a wildlife identification handbook was prepared. The scope of the handbook is to provide app users with concrete, real-time support about the identification of the various species. This can assist both seasoned and Inexperienced users: although many users are often aware about the shape of a certain species, there could be confusion between similar species, between winter of summer coats of Alpine species, as well as between individuals belonging to different sex, at least regarding birds.

The handbook was structured with comparative panels, like many field guides for the identification of birds and mammals in Europe. Species were shown on a white background, to emphasize their shape, and both sexes were displayed, at least for sexually-dimorphic species. To make the identification of each species easier, diagnostic features were highlighted and

indicated with arrows. A good example is provided in Fig. 7 for ptarmigan (*Lagopus muta*) and in Fig. 8 for mountain hare (*Lepus timidus*).


Fig. 7. Example of ptarmigan (*Lagopus muta*): differences between male and female individuals, in summer and winter coats.


Fig. 8. Example of mountain hare (*Lepus timidus*): differences between summer and winter coats.

For some species, a size comparison was added, comparing its size to that of a human being. This was deemed to be particularly helpful for the identification of Canidae and Mustelidae, where species are relatively similar in their shape, but differ in their size (Fig. 9).


Fig. 9. Example of gray wolf (*Canis lupus*): a comparison with the size of a human is in the lower-left corner.

To facilitate its usage by app users, the identification handbook was integrated in the main menu: when app users accessed the page to classify the species to which one record belonged to, they could also click on an icon, to consult the manual. From each picture they could then decide if to proceed adding the record, or to go back (Fig. 10).

For creating guidelines, authors used freely available pictures, protected by CCBY licenses. Attribution was given to each picture used for the handbook, in the form of a CCBY 4.0 license. This would allow the re-use of each picture, which could also contribute to Increase the visibility of Step Change, provided that adequate attribution was granted to authors.

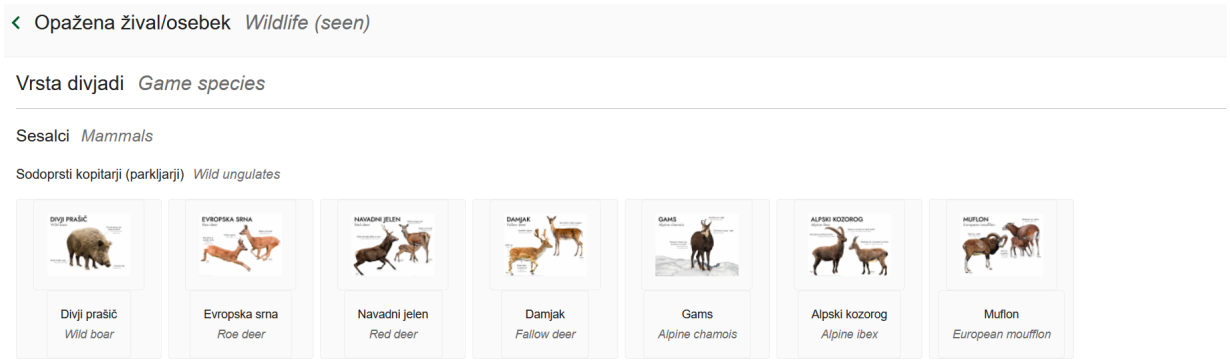


Fig. 10. Example of handbook integration into the app: each species could be checked by clicking on the icon appearing on top of its name.

## *Implementation and piloting*

The development of SRNA took four different stages:

1. Recruitment of the subcontracting company
2. App design
3. Implementation
4. Piloting and modifications

The recruitment of the external company, which then programmed the app, took place in October 2021. UP, together with HAS subcontracted external company (https://www.logos.si), which already developed the national platform for the game monitoring by HAS (https://www.logos.si/Home/Produkti_Lisjak).

UP, together with extended core team members (dr. Pokorny and dr. Potočnik), prepared the app design in November 2021. During the app design phase, virtual meetings were organized to brainstorm potential functionalities of the app, and to Iidentify the most crucial features which should have been includeed. Due to the emergency situation related to COVID-19 in autumn 2021, meetings were held on Zoom, in line with the risk mitigation strategy identified in the project management system (Deliverable 11.1). At the end of the app design phase, the main structure of the app was explained to company, which then turned it into a functioning app architecture.

The implementation of the app occurred between November and December 2021, with a beta-version of SRNA that was first presented in late December. Soon after app implementation, members of UP and HAS explored app functionalities and gathered preliminary feedbacks, between January and March 2022.

Main modifications included:

- The possibility, for non-hunters to include individual pictures of biological records, even without any prior knowledge of the species. This functionality is useful for collecting new records of unknown species
- The customization of the notification section for hunters and non-hunters
- The modification of the layout for the section about individual and project-related statistics
- The integration of the wildlife identification handbook in the main menu

The final version of the app was prepared within April 2022 and is now ready for being downloaded and used by citizen scientists. Further refinements could then occur, over the next few months, in case they are needed. Feedback will be collected from CS during recruitment and engagement initiatives (see Deliverable 2.1)

## Data management

Issues associated to data protection and ethics has already been discussed in Deliverables 2.1, 11.2 and 12.2. Regarding the centralization of data collected from app users, as this will occur on a server managed by the HAS, safety measures against data breaches and protocols for encryption and anonymization will be in line with those adopted to protect already existing data-sets, including the national platform for the game monitoring by HAS (https://www.logos.si/Home/Produkti_Lisjak).