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Mobile application – a powerful tool for monitoring the European bison (*Bison bonasus*) in its natural habitat

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Abstract: The free app that monitors the European bison was made available to users at the beginning of 2019. Each user, after observing a wisent in its natural environment, can add his report using a mobile phone. Each report contains a number of information such as the date, place and type of observation, data on specific animals or traces of their existence – traces, damage, faeces. Attaching a photo and additional comment enables verification of the entered data. After 30 months of operation of the application, it is possible to summarize its use and functions. During the discussed period, 1050 users registered, who added over 640 observations of wisents in Poland. Despite the large number of registered users, only 8.9% were active and send at least 1 report. The observation of males was registered more frequently. Unclassified observations accounted for a large percentage. Users correctly estimated the size of the European bison herds. Of all monitored populations the greatest number of observations were made for the Białowieska population, the least for the Bieszczady population. Two cases of long-distance migrating animals have been reported. The popularization of the application improves the monitoring of the European bison herds throughout the year. It facilitates the quick transfer of information, which may help prevent the damage caused by the wisents in agricultural crops or early recognition of potential danger (e.g. a potentially aggressive individual near human settlements).

Key words: Mobile app, population monitoring, European bison

Introduction

Modern technologies will increasingly support the environmental research of wild animals. Direct monitoring is very important research method, but often costly and time-consuming. The use of a new tool in animal monitoring – a widely available and free app installed on a mobile phone allows to collect data on several herds living in different regions of the country. In this paper we provided a short analysis of application use in the process of wisent populations monitoring in Poland.

The Polish telecommunications market continues to develop. In 2018, 15.8 million internet users were in Poland. Almost half of them (about 7.7 million) are users of mobile devices with Internet access (Urząd Komunikacji Elektronicznej, 2019). It shows that the average person does not part with their mobile almost all day long (especially young people). They use many different applications that help in everyday life, e.g. search and share information, monitor daily activities and even motivate to a healthier lifestyle. An intensive development of technologies is also increasingly used in life sciences. Telemetry-based studies have been performed on wild animals since the 1980s, but over the years the size and capabilities of the devices have changed (Agren *et al*. 2000; Amstrup *et al*. 2000; Nowak & Mysłajek 2007). In recent years, programs recording sightings of certain animal species have appeared. The data.biolovision.net application created in 2015 by the Swiss website enables quick registration of all observed bird species or other taxonomic groups: mammals, reptiles, amphibians, butterflies, dragonflies, etc. (internet source no.1). Biolovision offers web tools (app and website) potentially useful for naturalists to track their own wildlife sightings and helps scientists to learn and conserve nature. However, the application is not very popular in Poland. Its users are mainly nature photographers who create a database of their own observations.

For many years, the European Bison Friends Society has been collecting data of wisent populations and information on animals appearing outside the regular area. As the size of the population increases, such observations are becoming more frequent – populations expand their range and more animals, mainly single bulls, migrate. So far, such occurrence has been collected from several sources – media information, reports of forest workers and private individuals. The latter were always exposed to the certain risk resulting from the lack of knowledge of the wisent's appearance and confusion with farm animals. A good example is the situation from 2018. The reporting person was convinced of the presence of a small herd of wisents near Komorów (around Warsaw). Only the photographic documentation, made by Regional Directorate for Environmental Protection employees, verified all doubts – the observed animal was one of the domestic cattle breeds. On the other hand, it also happened that random user correctly recognized the wisent present in unusual place. In 2018 2 bulls appeared in the Troszyn commune (near Ostrołęka) and in 2019 a solitary bull was feeding on farmland near Nasielsk (internet source 2.3). Both observations were made in the central part of Poland, over 100 km from the nearest herd of wisents. The problem is that such data is not always sent to the European Bison Friends Society. Often, obtaining information resulted from a fortunate chance, and it also happened that the news was arriv-

ing with a delay of several months. Information about dead wisents in forests is a similar problem. The territory of one population may cover the area of several forest districts (Krasińska & Krasiński 2017). Failure to provide reports on dead animals complicates the monitoring and counting individuals in the population.

Overall, so far there has been no coherent system of collecting such data from all over the country. The idea of creating an app that allows to make the observations of the European bison should not be surprising. The European Bison Friends Society has launched the application for collecting information about the wisent population in Poland. The application is especially useful for the migration of individuals or the entire herd, which allows to verify the herd's home range.

Methods

The free application, available to every Android user, allows people interested in observing animals (not only scientists and employees of the State Forests) to be included in the animals' monitoring. The growing popularity of hiking and biking in Poland, especially within areas naturally occupied by wisents allows to include residents and tourists in the monitoring of these animals. This kind of application and device with GPS in nature tourism and sports are very popular and widely used e.g booking of stays and sightseeing (Piechota 2014). According to the study by Nadobnik (2018), about 90% of respondents (at different ages) have such device with the appropriate software. Moreover, using applications that monitor daily physical activity often motivates users to be more active. An animal monitoring app can be similarly motivating tourists, knowing that they are in the area occupied by wisents, may be more willing to walk along the trails with the hope of meeting this animal (or at least seeing traces it leaves in the wild).

The application was available to users for free since the beginning of 2019 in the Google Play store. After downloading and installing the application, the new user should set up an account and after approval can start adding observations. Each registered user can add his own reports. However, depending on the access level, the ability to see the observations of other users varies. Observations added by Level I users (mainly amateurs) must be approved by the administrator before appearing on the map. This method of data management allows to check reports quickly and effectively – in terms of identification of the animal species and correct location on the map. Most of the added observations contain a photo, which improves the verification of the reported information. Level II users (mainly people working or connected

with the forest) have access to the view of all observations made by the users of the application. Although, Level III users (the highest for those who directly work with European bison) can see all added observations along with their location on the map and current telemetry data from animals wearing GPS transmitters. The highest level is available to people who deal with the European bison every day in their work. The ability to view all the observation reports and direct access to the telemetry data from a mobile phone improves tracking and monitoring of wisent herds.

Users can add observations from a mobile device with the Internet connection. Each added report contains a series of information: date of observation (possible editing of the date in the case of sending the observations at a later time), type of observation (e.g. direct observation, winter census, photos from the camera trap), as well as the data on specific animals or traces of their existence – tracks, damage, corpse, dungs. The observer should also provide the number of animals seen, the composition (if he is able to recognize and count) and describe the behavior of the wisent herd (options: feeding, resting, moving, quiet or frightened). Finally, the location, photos and any comments regarding the health or behavior of the observed individuals can be added.

Within 30 months of the app's release (January 2019 – June 2021) 1050 users registered. Among them, only 94 have become active users. They added a total of 642 reports to the database from the following populations: Białowieska, Knyszyńska, Augustowska, Borecka, West Pomeranian and Bieszczady.

As mentioned, Level I users can only see their own observations. This can cause a difference between the number of application downloads and the number of active users. It is highly possible that people downloading the application expected an easy access to information about the wisent living places and thus be able to track those animals more easily. Lack of access to such data resulted in no further interest in the application. However, this restriction is due to animal welfare by reducing the risk of unnecessarily disturbing them.

Results and Discussion

The seasons of the year had a significant impact on the number of recorded observations and the number of animals seen (Fig. 1). The largest number of observations concerns the winter season, in the period January-April 2019 and November 2019-April 2020, when 257 locations were registered (102 in first and 155 in second winter season) and in winter 2020/2021, when 185 observations were made (Fig. 1). In total, winter observations are 67% of all observations. Significantly fewer reports were taken in the vegetation season.

There were 94 observations in 2019 and 108 in 2020. During April 2021 to the end of June 2021, only 25 sightings were recorded (Fig. 1). This is because in the vegetation season, observation of the wisent is much more difficult – animals avoid people, they are active mainly in the mornings and around dusk or they are hiding during the day in human inaccessible forest areas. Spring and summer are also the time of rearing calves, which also affects the selection of areas far from human presence (Krasińska & Krasiński 2017).

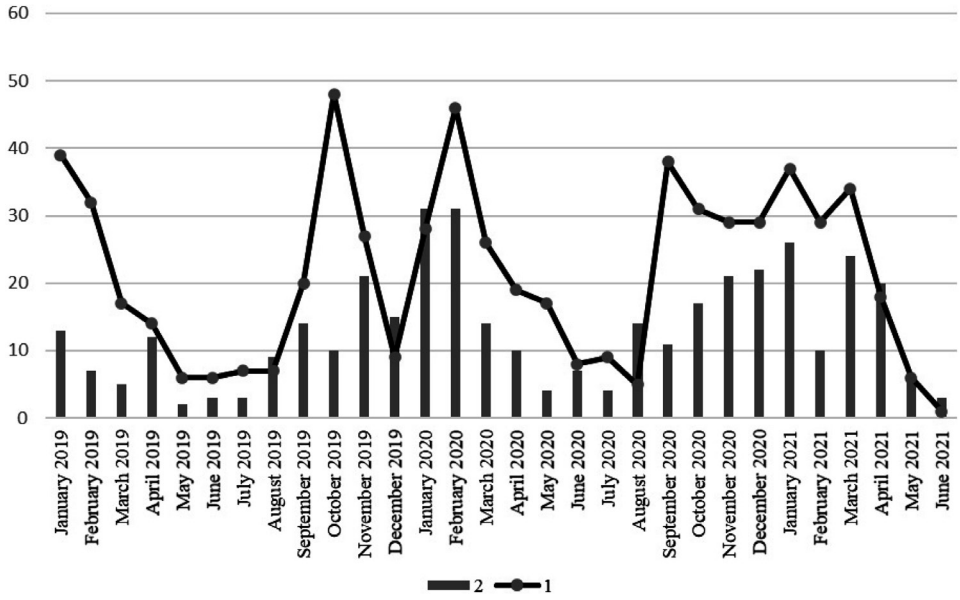

Figure 1. The number of registered observations (1) in the consecutive months and an average number of individuals sending observation (2)

The results of the reports regarding the number of the observed groups of wisents are different – the users were certain of the number of animals seen in 532 observations. Also, the over – or underestimating of the size of the group needs to be taken into account. The greatest number of reports concerned groups with a size of 2 to 10 individuals – a total of 256 registered records. Larger groups were seen 140 times (reports on a group of over 40 individuals were from one population). Single bulls were seen 146 times.

Of all the wisent populations, the greatest number of observations was made near the Białowieska Forest – 335 (253 observations were made in winter seasons) (Fig. 3). Compared to other herds, the wisent from Białowieska population were observed extremely often also during the vegetation season – 82 observations. Single or groups of bulls were most frequently seen – a total of 151 reports.

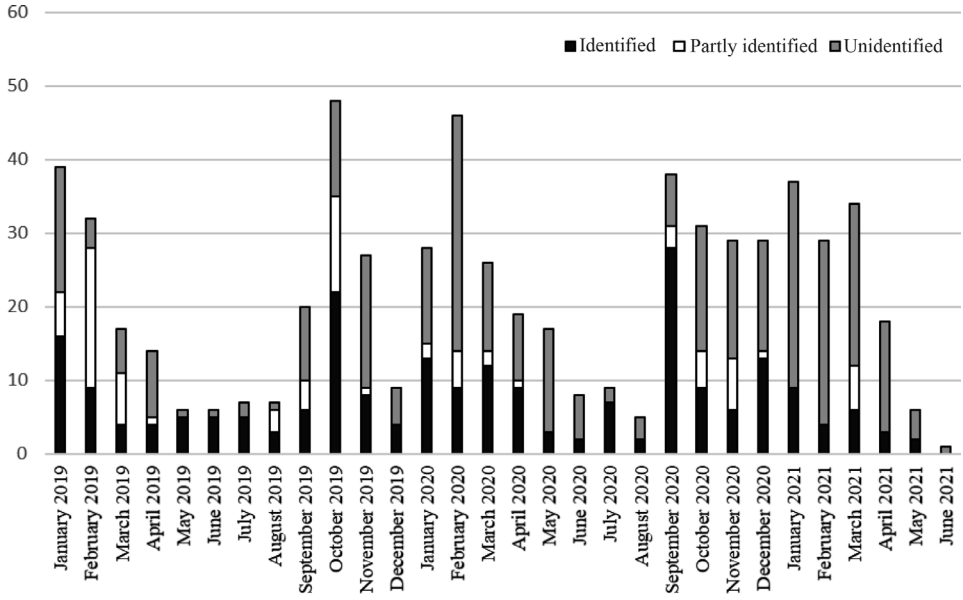

Figure 2. Division of registered observations into reports containing the exact age and sex identification of the observed individuals, partial identification and no identification

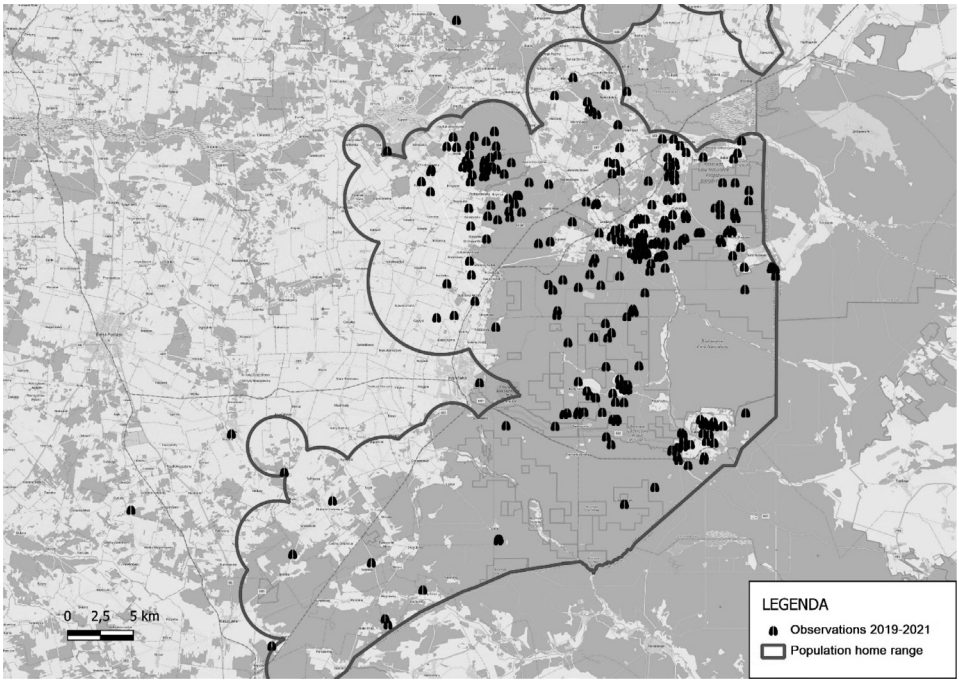

Figure 3. Registered observations of European bison from Bialowieska population in the years 2019–2021

Compared to the other European bison populations, the large number of observations of the Białowieska herd results from several factors. First, the great commitment of forest districts employees in registering observations. The Białowieska Forest is also a highly touristic region. This favors an increase of the interest in the application and thus enlarges the number of registered observations (tourists informed about the application are willing to install it). Finally, the Bialowieska herd is steadily increasing what affects the ease of observation. Actually the population is estimated for more than 700 individuals (Raczyński 2020). Such numbers affect the appearance near human settlements. Also low timidity resulting from getting used to local people and tourists allows for easier observation of animals.

In the case of the Knyszyńska Forest (Fig. 4), a total of 162 observations were made from January 2019 to the end of June 2021 (about 131 registered observations done in winter). During the vegetation season, the Knyszyńska population is living in the forest in small groups, avoiding people. However, in winter it is much easier to observe this herd. The animals form large groups (consisting of a dozen or so individuals) and forage in winter crops (Sobczuk & Olech 2016). The reports of the Knyszyńska population were registered mainly by users who are nature photographers and State Forests employees. Only a few reports were added by other people (e.g. local residents, tourists). Regular reports of this population (sometimes several observations during the week) made it possible to keep track the migration patterns and changes in the size of the main herd. Groups of more than 40 animals have been reported 39 times in this population. About 14 of them are observations of groups over 90 individuals (max 133 animals).

In other European bison populations up to a dozen observations were made. A total of 25 sightings were reported from the Augustowska Forest. All made by State Forests employees. The low popularity of the application was also the case in the Borecka Forest – only 13 observations (all from winter). Registered by one user, who is also the State Forests employee.

In the West Pomeranian population (Fig. 5) 38 observations were registered in the analyzed period. The number of reports is due to the app promotion in social media – 19 different users registered 38 observations. That wisent population is highly dispersed and consists mainly of small groups (from 2 to 7 individuals), which are either males or mixed groups. They were observed at a distance from the assumed range of this population, but not more than 90 km from the local herds home ranges. The European bison were also observed in the Notecka Forest (3 observations of a bachelor groups), near Stargard (1 observation of 2 bulls) and around Jastrowo and Poznań in Wielkopolska province (mixed group, 3 observations).

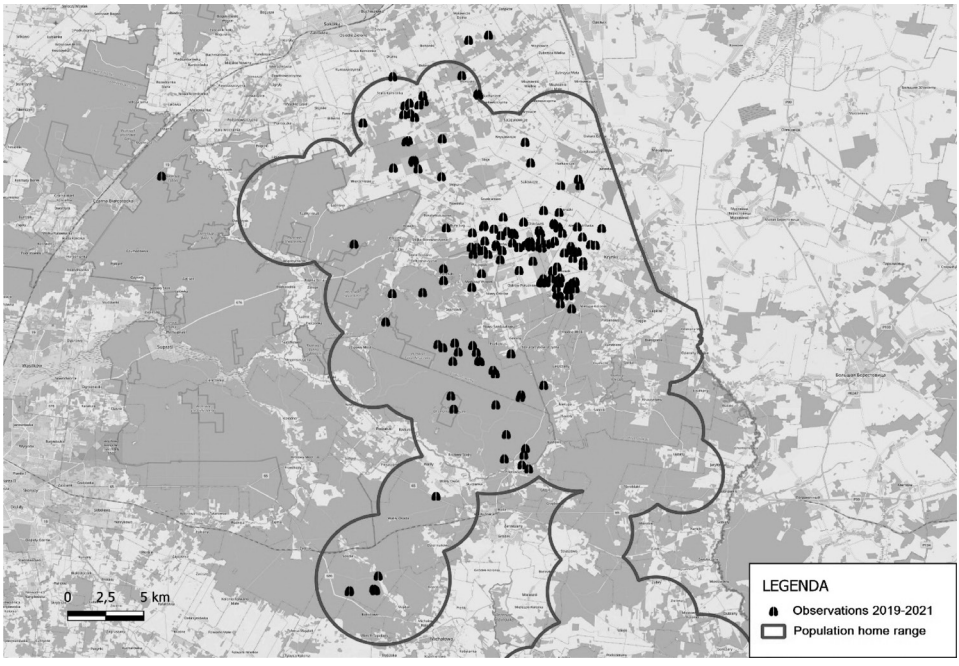

Figure 4. Registered observations of Knyszyńska population in the years 2019–2021

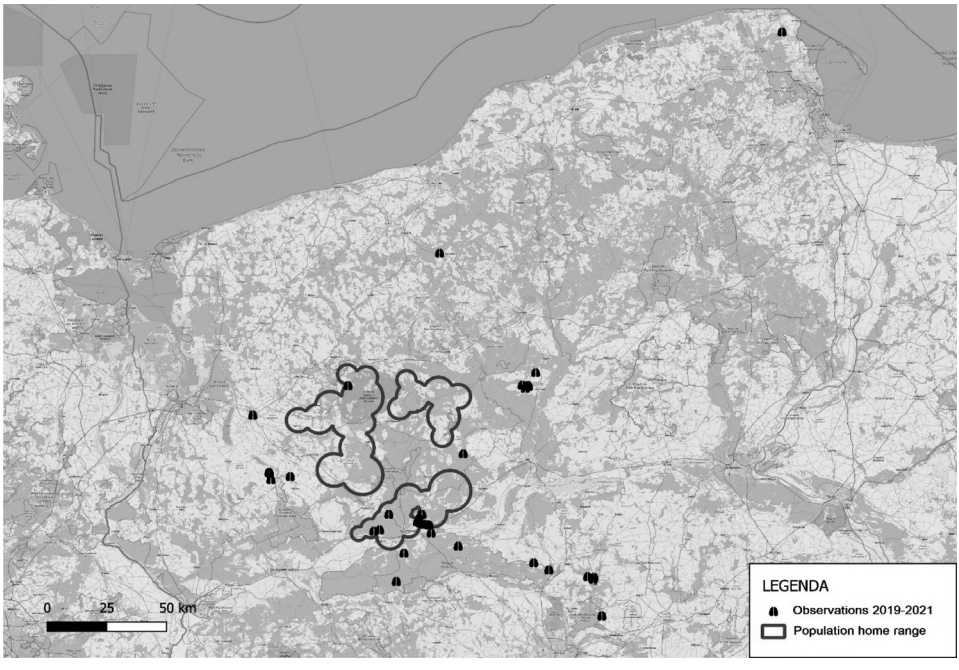

Figure 5. Observations of European bison recorded in 2019–2021 in West Pomeranian population with some migration of animals

The exception was the male, who moved away more than 190 km and was seen near Słupsk (Pomerania province).

The lowest number of observations was made from the Bieszczady population – only 9 reports (6 from eastern and 2 from the western population and one single bull near Przemyśl) (Fig. 6).

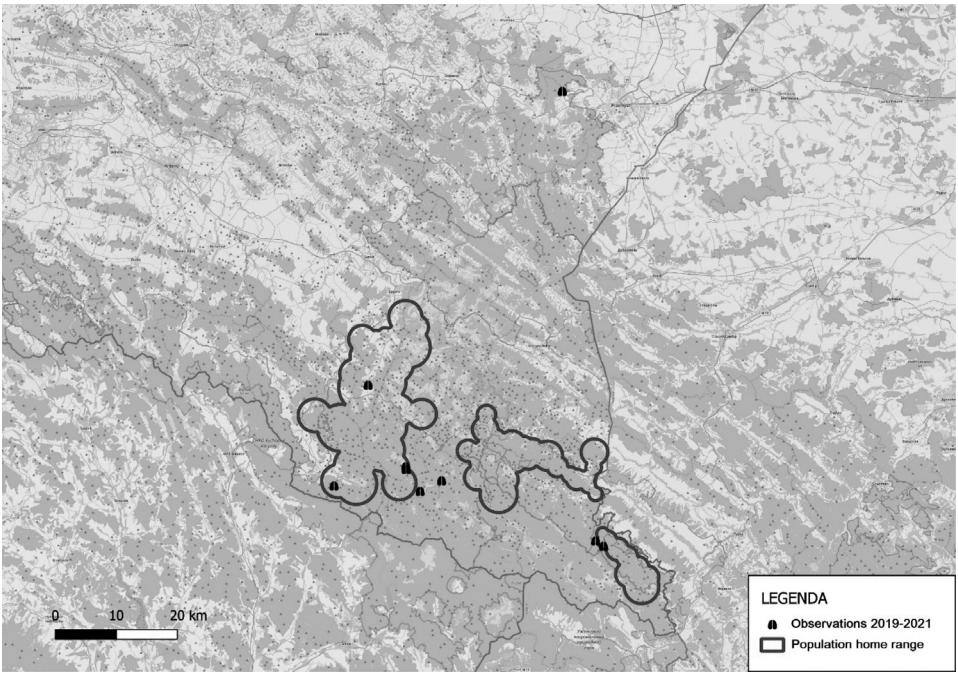

Figure 6. Observations recorded in the years 2019–2021 within the area of the Bieszczady population

In the future, the application may be irreplaceable in collecting the European bison appearances and will enable tracking of migrating animals in Poland. The application registered two male migrations outside the used area of the population. One concerned the mentioned migration of a bull from the Bieszczady population towards Przemyśl. The second, concerned an individual who left the West Pomeranian population and arrived into vicinity of Słupsk. Unfortunately, the animal disappeared in November 2019 (Fig. 5).

According to the information from the report on telecommunications in Poland, 100% of the country is covered by 3G or RG / LTE network (UKE 2020). Of course, there are local areas without network coverage, but they are uninhabited or sparsely populated places. This means that data collection is possible throughout whole area of Poland by now. The observations could be used, for example, to make inventory of herds. Currently, inventories of

each population are often conducted in an uncoordinated manner – data on the number of individuals living in forest (and often several forest districts) are collected for about a month. This situation creates a high risk of double counting of moving groups and the falsification of the result by overestimating the number of animals. GPS telemetry itself, allows for certain verification of data. However, transmitters are carried by less than 5% of animals. This allows for only some irregularities to be detected.

Popularization of the application will improve inventory work and animal monitoring throughout the year. Quick information on migrating individuals will enable a reaction to potentiall threats, e.g. a wisent approaching human settlements or a migrant who is not afraid of people and potentially aggressive. Another advantage of the application is the verification of the damage caused by wisents in agricultural crops. Reporting on grazing herds could be helpful in preventing such damage (possibility of intervention, e.g. organized disturbance of animals). Regular data provided by many users from different regions of the country will allow the observation of wisents from different populations, which will serve for a much more effective monitoring of the European bison in its natural habitat.

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Aplikacja mobilna – przydatne narzędzie służące monitorowaniu populacji żubra (*Bison bonasus*) w jego naturalnym środowisku

Streszczenie: Bezpłatna aplikacja „Obserwator żubrów" monitorująca występowanie żubrów została udostępniona użytkownikom na początku 2019 roku. Każdy użytkownik, po zaobserwowaniu żubra w jego naturalnym środowisku, może dodać swój raport za pomocą telefonu komórkowego. Każdy raport zawiera szereg informacji takich jak data, miejsce i rodzaj obserwacji, dane o konkretnych zwierzętach lub ślady ich istnienia – tropy, uszkodzenia, odchody. Dołączenie zdjęcia i dodatkowego komentarza umożliwia weryfikację wprowadzonych danych. Po 30 miesiącach działania aplikacji możliwe jest podsumowanie jej zastosowania i funkcje. W omawianym okresie zarejestrowało się 1050 użytkowników, którzy dodali ponad 640 obserwacji żubrów w Polsce. Pomimo dużej liczby zarejestrowanych użytkowników, tylko 8,9% było aktywnych i co najmniej 1 zgłoszenie. Częściej odnotowywano obserwację i identyfikację samców. Duży odsetek stanowiły obserwacje niesklasyfikowane. Użytkownicy prawidłowo szacowali wielkość stad żubrów. Spośród wszystkich populacji najwięcej obserwacji wykonano dla populacji białowieskiej, najmniej dla populacji bieszczadzkiej. Zgłoszono dwa przypadki zwierząt migrujących na duże odległości. Upowszechnienie aplikacji usprawnia monitoring stad żubrów przez cały rok. Ułatwia szybkie przekazywanie informacji, co może ułatwiać zapobieganie szkodom wyrządzanym przez żubry w uprawach rolniczych lub wczesne rozpoznanie potencjalnego zagrożenia (np. potencjalnie agresywny osobnik w pobliżu osiedli ludzkich).