

**CITIZEN SCIENCE SURVEY OF THE SNAKE'S HEAD
FRITILLARY (*FRITILLARIA MELEAGRIS*) IN THE VALLEY
OF THE RIVER ZALA IN HUNGARY**

Előd Búzás^{1,2} – Judit Bódis¹ – Bence Fülöp¹–Bálint Pacsai¹*

¹ *Hungarian University of Agriculture and Life Sciences, Georgikon Campus, H-8360 Keszthely, Deák Ferenc str. 16.*

² *Balaton-felvidéki National Park Directorate, H-8229, Kossuth str. 16*

**Corresponding author, buzaselod@gmail.com*

Abstract

The protected snake's head fritillary (*Fritillaria meleagris*) is an easily recognisable plant species, and therefore allows for botanical monitoring through socially based or community-based 'citizen science'. Agro-technical interventions for spring grassland management can cause severe damage to the species. It is therefore important to have as accurate and up-to-date data base as possible of the species' distribution and abundance. Our target area was the Alsó-Zala-völgy Special Area of Conservation (Natura 2000). Students, PhD students and lecturers of the Georgikon Campus of the Hungarian University of Agriculture and Life Sciences, along with the Association for Land and People NGO assisted the survey, which was carried out between 4 and 15 April 2022. In total 23 participants counted or estimated the number of flowering plants of fritillary in 1607 localities along the River Zala. They surveyed 1500

hectares of grasslands. The records from this survey were shown on a map of the species' current distribution in the area. That will be a great use for the Balaton-felvidéki National Park Directorate in its work. The students participating in the monitoring survey had the opportunity to gain experience in data collection and to understand the importance of extensive grassland management and the complexity of conservation work through the target species.

Keywords: *Fritillaria meleagris*, snake's head fritillary, grassland, citizen science

Összefoglalás

Bár a társadalmi alapú vagy közösségi részvételi ('citizen science') definíciója sokféle lehet, minden olyan tudományos tevékenység ide sorolható, amiben önkéntes amatőrök vesznek részt. A botanikai monitoringok esetében különösen a könnyen felismerhető fajoknál érdemes ilyen módon monitorozni a fajokat. A védett mocsári kockásliliom (*Fritillaria meleagris*) az ország északkeleti és délnyugati részén jellemző, legnagyobb egyedszámban Zala megyében található. A növény tavaszi virágzása kb. 2 hétig tart ez után már alig észrevehető. A fajnak kiemelt jelentősége van a Zala megyei réteken, ugyanis ez a régió legismertebb védett faja és a gazdálkodók is tisztában vannak természetvédelmi jelentőségével. Ugyanakkor a tavaszi gyepterületet szolgáló agrotechnikai beavatkozások erősen károsíthatják az egyedeket. Ezért fontos, hogy minél pontosabb és aktuálisabb képünk legyen a faj elterjedéséről és tömegességi viszonyairól.

Célterületünk az Alsó-Zala-völgy kiemelt jelentőségű természetmegőrzési terület (Natura 2000) volt. A Magyar Agrár- és Élettudományi Egyetem Georgikon Campus hallgatói, doktoranduszai és oktatói mellett a Táj és Ember Kulturális és Természetvédő Egyesület segítette a felmérést, melyet 2022. április 04 és 15 között végeztünk. Az összesen 23 fő a Zala folyó mentén, nagyságrendileg 1500 hektár gyepterületet vizsgálva, 1607 lokalitáson számolta meg, vagy becsülte a mocsári kockásliliom virágzó töveit. Ezzel sikerült az Alsó-Zala-völgy

Natura 2000 terület kockásliliomai számára potenciális élőhelyek megközelítőleg 80%-át áttekinteni és az itt rögzített adatok alapján elkészíthetővé vált a faj aktuális elterjedési térképe, ami segíti a Balaton-felvidéki Nemzeti Park Igazgatóság munkáját e gyeppek hosszútávú megőrzésében. A felmérésben résztvevő hallgatók számára lehetőség nyílt adatgyűjtési gyakorlatot szerezni, illetve a célfajon keresztül élményszerűen megérteni az extenzív gyepgazdálkodás jelentőségét és a természetmegőrzési munka komplexitását.

Kulcsszavak: kockásliliom, közösségi felmérés, Alsó-Zala-völgy Natura 2000 terület.

Introduction

There are several ways to define citizen science. We apply this term as 'scientific work undertaken by members of the general public often in collaboration with or under the direction of professional scientist' (Haklay et al., 2021). The very first mention of citizen science happened in 1989 in connection with an acid-rain campaign (Kerson 1989). Nowadays, citizen science is gaining more and more importance in many areas of science, as the method became an independent discipline (Vohland et al., 2021) and a special kind of citizen science is applied even in the social networks as a tool for biodiversity monitoring (Marceno et al., 2021). Citizen science is not only beneficial for science, but for citizens (participants) as well. In biomonitoring, the participants learn a lot about the observed organisms and experience the various methods that scientific studies employ (Bonney et al., 2009). In addition, which can even be more valuable, personal involvement in scientific investigations can also strive the participants' emotional appreciation of nature.

As the participants are usually not professionals, the range of living organisations to which citizen science can be applied is limited. Biomonitoring is possible for easily identifiable species that cannot be confused with other organism (Tweddle et al., 2012). Snake's head

fritillary (*Fritillaria meleagris*) is a very good object for a citizen science project: it is an easily and well identifiable plant which has an iconic character in its whole distribution area whether indigenous or not (Bódis et al., 2020; Tatarenko et al., 2022). There is a citizen science project on the dynamics of a large population of the *Fritillaria meleagris* in North Meadow Nature Reserve (Wiltshire, United Kingdom) since 1999. The dataset constructed by volunteers led by professional botanists from the Open University, Milton Keynes, UK (Tatarenko et al., 2013).

Fritillaria meleagris is a protected plant in Hungary (Anonim, 2012). Over the past centuries, much of its habitat has been drained and ploughed up, and some of the remaining grassland is dominated by invasive plants, resulting in a drastic reduction in suitable habitats. The species is found in the north-eastern and south-western parts of the country, with the largest numbers in Zala county, where *F. meleagris* is a characteristic species of the meadows along the rivers Zala, Kerka and Rába (Bódis et al., 2020). It is the best known protected species of that region and farmers are aware of its conservation importance, as well. However, agro-technical interventions for spring grassland management can cause severe damage to the species. It is therefore important to have as accurate and up-to-date data as possible on the distribution and abundance of the species. The citizen science survey of an extensive areas of meadows along the river Zala provides an excellent mapping opportunity of the eye-catching fritillaries.

Material and method

Study site

We investigated the *Fritillaria meleagris* populations in western part of Hungary, situated on floodplain meadows of river Zala. Target area was the Alsó-Zala-völgy Special Area of Conservation (HUBF20037 Natura 2000 site). Half of its territory of the total of 6500 hectares is covered by meadows and pastures (Figure 1).

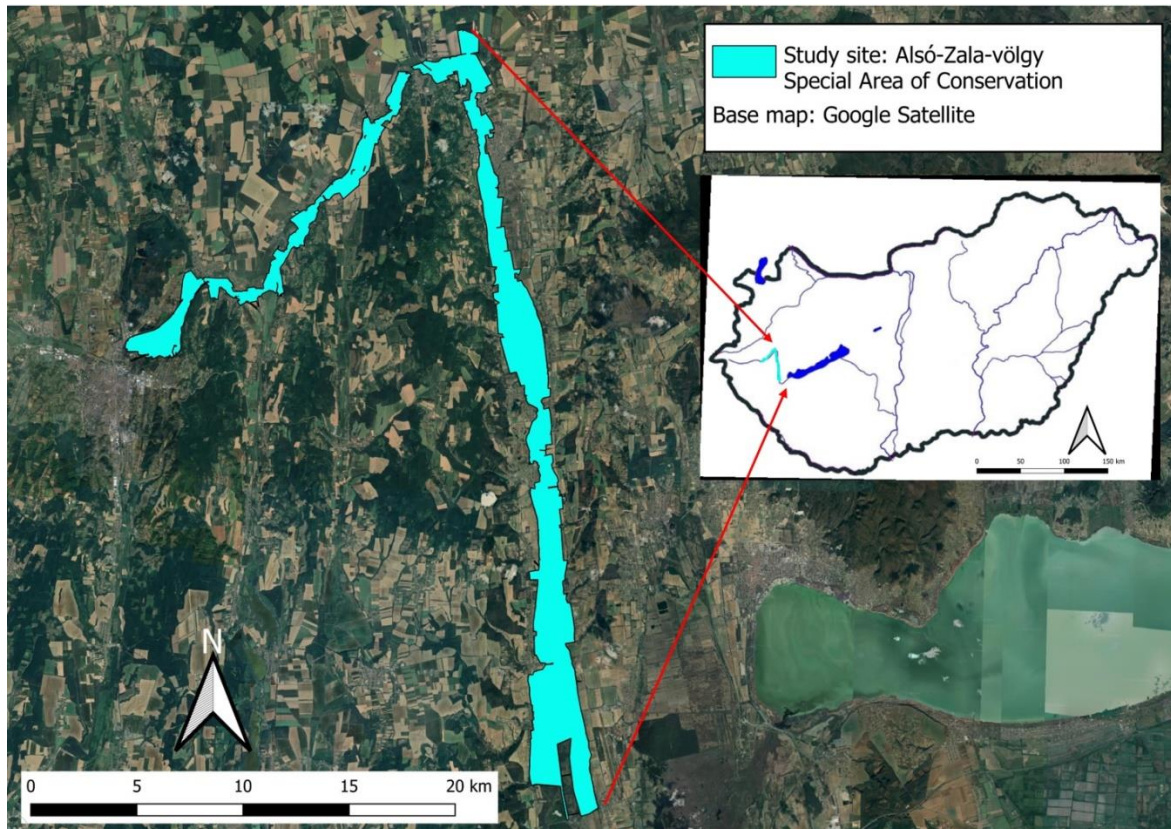


Figure 1 The study site was the Alsó-Zala-völgy Special Area of Conservation

Methods

The total of 23 people took part in the surveys between 04 and 15 April 2022. The survey was conducted by the groups of 3-4 people, each led by a person with botanical monitoring experience. During a systematic survey of the meadows, the number of *Fritillaria meleagris* individuals observed was counted, and in the case of larger numbers (>50) the number of flowers was estimated. GPS coordinates and numbers of *Fritillaria meleagris* individuals were

recorded in a pre-downloaded central data collection application. The survey data were assessed daily and locations for the next day surveys identified by the park ranger of Balaton-felvidéki National Park Directorate. All meadow areas were designated in the N2000 area, which was located along the river Zala. Pastures under grazing, that are surrounded by electric fences and had animals on were excluded from the monitoring.

All locations of *Fritillaria meleagris* were georeferenced by a special app on mobile phones provided by the Balaton-felvidéki National Park Directorate, so the data collected was directly entered into the national park database. The collected data were plotted out on the map using the Qgis 3.16 software.

The survey was carried out by undergraduate students of the Hungarian University of Agriculture and Life Sciences, Georgikon Campus, Keszthely, Hungary. Botanists of that university were also involved in the survey, which was financially supported by Association for Land and People NGO. The field survey method was coordinated by Balaton-felvidéki National Park Directorate.

Results

During the flowering period of the *Fritillaria meleagris*, we surveyed about 1500 hectares of grassland, counting or estimating the number of flowering plants at 1607 localities (Figure 2). In this way, approximately 80 percent of the potential habitat of the species in the Alsó-Zala-völgy Natura 2000 site was surveyed. Using the data collected, the current range of the species can be established in the surveyed areas (Figure 2-3).

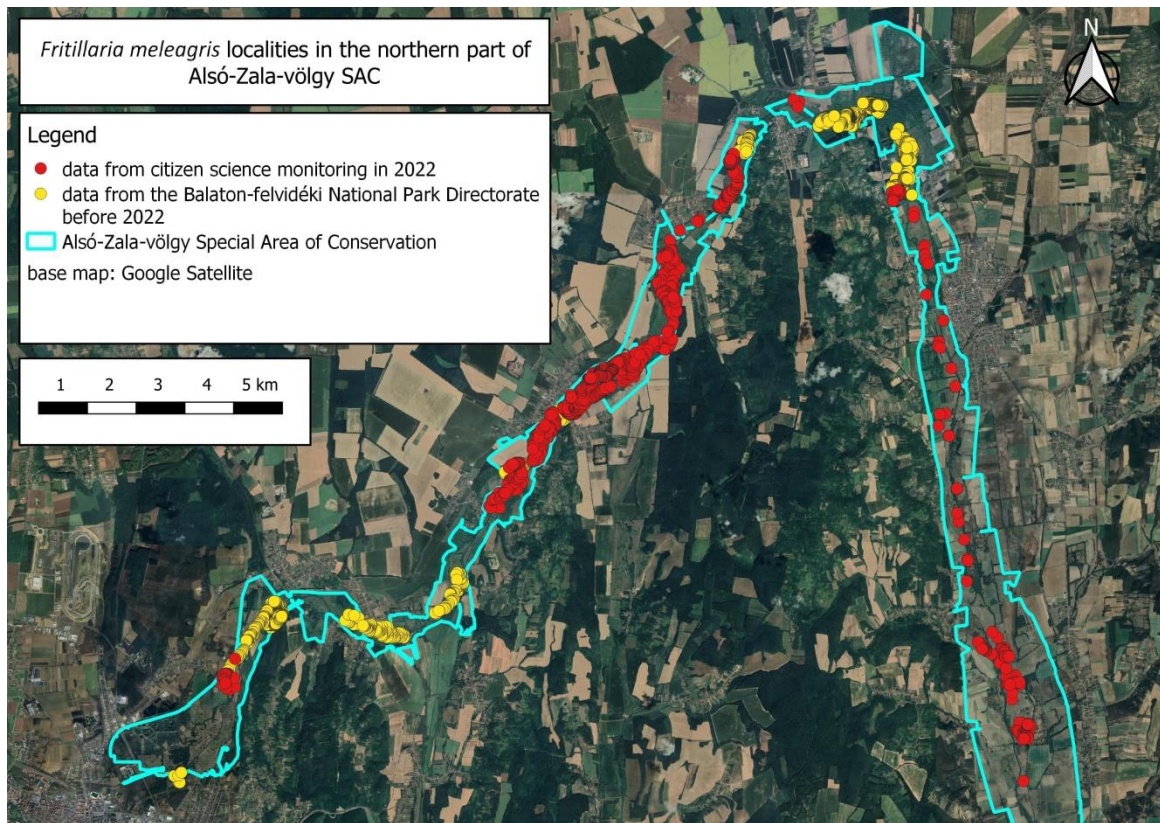


Figure 2 Fritillaria meleagris localities in the western and central part of Alsó-Zala-völgy SAC.

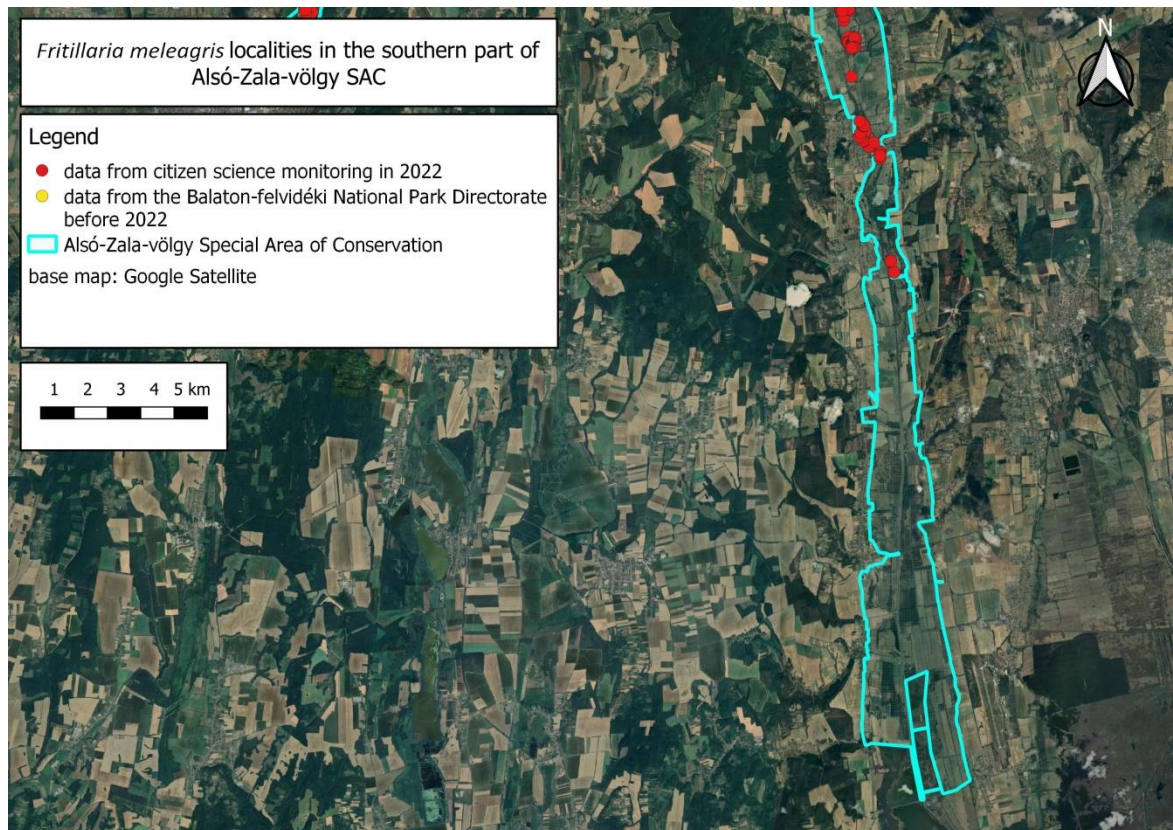


Figure 3 *Fritillaria meleagris* localities in the southern part of Alsó-Zala-völgy SAC.

For students studying agriculture, fritillary count in traditionally managed species-rich meadows provided a hands-on experience in conservation of biodiversity and the rationale behind the conservation legislation. These semi-natural habitats have evolved under a long-term traditional and sustainable management of vegetation by hay making and grazing by domestic animals. Without the removal of hay collected after mowing, or without the immediate absence of grazing, shrubs and trees are ingrowing grassland areas. Woody plants add diversity to the habitat in small areas, but if they become dominant, rare grassland-associated organisms may decline. Volunteers observed many other protected species while searching for fritillaries. The students also found small emperor moth (*Saturnia pavonia*). They saw common kestrel (*Falco tinnunculus*) started its nesting by occupying a crow's nest. Shells of the protected the thick shelled river mussel (*Unio crassus*) were found on the banks of the river Zala. The volunteers were also dealing with conservation problems associated with invasive species, as

abandoned grassland being rapidly taken over by the invasive *Acer negundo* and *Solidago gigantea*. The volunteers have also learnt that, although grassland management is necessary, some elements of it, if not carried out at the right time, can seriously damage the populations of fritillaries. Overall, the participants of this citizen science project have built up appreciation of the grasslands and their environments as a complex system, both socially and ecologically.

Discussion

The survey of *Fritillaria meleagris* distribution was carried out by 23 participants during two weeks. The citizen science method made it possible to survey a large territory during a single flowering period. Citizen science data collection has already precedent in Hungary, one of the largest being the Vadonleső (Wilderness ranger) (INTERNET 1) project, which has been started 11 years ago and in which data were collected on 18 protected plant species, which were submitted to the national database. However, project of Vadonleső as well as similar international data collection programmes, for example, inaturalist.org (INTERNET 2), observations.org (INTERNET 3) often lack a sense of community, a shared field experience, and a personal encounter between researchers and volunteers. There are good example, as for example, ispotnature.org (INTERNET 4). Our project provided a community field experience for the volunteers and personal interactions with a park ranger and also with botanists.

Conclusion

We have assessed the current distribution of *Fritillaria meleagris* in 80 percent of the Alsó-Zala-völgy N2000 area, using citizen science survey in 2022 and visualized in an up-to-date distribution map of the species. The data collected will directly help the Balaton-felvidéki National Park Directorate in the long-term conservation of the grasslands.

An even greater achievement was that the participants had opportunity to gain experience in data collection and to understand the importance of extensive grassland management and the complexity of conservation work through working with the target species.

Acknowledgement

The Authors express their many thanks to all of their surveyors and helpers: András Mészáros, Anikó Kausics, Anna Rác, Bálint Pacsai, Barbara Végh, Balázs Antal, Beáta Horváth, Bence Kiss, Boglárka Barca, Előd Kondorosy, Emese Bognár, Frida Szabó, Gellért Tóth, Hajnalka Nemes, Máté Pados, Rebeka Kiss, Réka Mikolacsek, Tamara Priegl, Viktor Schneider, Viktória Ványi, Vivien Lábadi, and also the member of Association for Land and People NGO. Special thanks to Irina Tatarenko for her review of an earlier version of the manuscript, her useful ideas and linguistic corrections. The publication is supported by the EFOP-3.6.3-VEKOP-16-2017-00008 project. The project is co-financed by the European Union and the European Social Fund.

References

- Anonim 2012. 100/2012 (IX.28.) VM rendelet „A védett és a fokozottan védett növény- és állatfajokról, a fokozottan védett barlangok köréről, valamint az Európai Közösségben természetvédelmi szempontból jelentős növény és állatfajok közzétételéről szóló 13/2001. (V. 9.) KöM rendelet és a növényvédelmi tevékenységről szóló 43/2010. (IV.23.) FVM rendelet módosításáról.” – Magyar Közlöny 128. 20903–21019 (in Hungarian).
- Billaud, O., Vermeersch, R. L., Porcher, E. (2021). Citizen science involving farmers as a means to document temporal trends in farmland biodiversity and relate them to agricultural practices. *Journal of Applied Ecology*. **58**(2). 261–273. <https://doi.org/10.1111/1365-2664.13746>

Bódis, J., Takács, A., Óvári, M., Virók, V., Kulcsár, L., Magos, G., Sulyok, J., Nótári, K., Molnár, A., Barna, Cs., Kuczkó, A., Biró, É., Gerencsér, B., Freytag, Cs., Tüdősné, Budai J., Molnár, V. A. 2020. Az év vadvirága 2016-ban: a mocsári kockásliliom (*Fritillaria meleagris*). – *Kitaibelia*. **25**(1). 79–100. <https://doi.org/10.17542/kit.25.79>

Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*. **59**(11). 977–984. <http://dx.doi.org/10.1525/bio.2009.59.11.9>

Haklay, M., Dörler, D., Heigl, M., Manzoni, M., Hecker, S., Vohland, K. 2021. The Science of Citizen Science, Springer, Cham, pp. 13–34. https://doi.org/10.1007/978-3-030-58278-4_2

Kerson, R. 1989. Lab for the environment. *MIT Technology Review*. **92**(1). 11–12.

Marcenò, C., Padullés Cubino, J., Chytrý, M., Genduso, E., Salemi, D., La Rosa, A., Gristina, A.S., Agrillo, E., Bonari, G., Galdo, G.G., Ilardi, V., Landucci, F., Guarino, R. 2021. Facebook groups as citizen science tools for plant species monitoring. *Journal of Applied Ecology*. **58**(10). 2018–2028. <https://doi.org/10.1111/1365-2664.13896>

Tatrenko, I., Dodd, M., Rothero, D., & Gowing, D. 2013. Citizen science in meadow studies: population dynamics in *Fritillaria meleagris* on North Meadow (Wiltshire, UK), pp: 95-99. *In*: Tatrenko, I., Walker, K., Dyson, M. 2022. Biological Flora of Britain and Ireland: *Fritillaria meleagris*. *Journal of Ecology*, **00**. 1–23, <https://doi.org/10.1111/1365-2745.13886>

Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. 2012. Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK. NERC/Centre for Ecology & Hydrology.

INTERNET 1: <https://vadonleső.hu/>

INTERNET 2: <https://www.inaturalist.org/>

INTERNET 3: <https://observation.org/>

INTERNET 4: <https://www.ispotnature.org/>