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Source: Journal of Vertebrate Biology, 73(24056)

Published By: Institute of Vertebrate Biology, Czech Academy of Sciences

URL: <https://doi.org/10.25225/jvb.24056>

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## Camelot RReport – free web application for analysing camera trap data

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► Received 24 May 2024; Accepted 17 July 2024; Published online 27 August 2024

**Abstract.** Scientists, protected area managers, hunters and wildlife enthusiasts use camera traps as one of the most important tools for wildlife research and management. However, due to a lack of analytical skills, thousands of wildlife photos are not analysed, and their usefulness for wildlife management needs to be properly exploited. *Camelot* is one of the most widely used software for managing camera trap images, while R packages are used for further statistical computing, but R poses a challenge for many camera trap users. To overcome this, we programmed a freely accessible web application (<https://rreport.vef.hr/>) with a user-friendly interface for analysing camera trap data previously processed in *Camelot*. The *Camelot RReport* application provides not only the outputs required for a basic overview of camera trap results but also some advanced features, including trap station intervals and activity and a graphical overview of species activity. *RReport* enhances data insights and visualisation capabilities beyond *Camelot's* native functionalities making it a perfect tool for camera trap data analysis for novice and advanced camera trap users.

**Key words:** temporal discretisation, trap station activity, trap station interval, species activity

### Introduction

Camera traps have become one of the most widely used wildlife research and management tools. Scientists, protected area managers, hunters and wildlife enthusiasts use camera traps for various purposes, including research on occupancy, abundance and behaviour. As technology improves and prices fall, thousands of photos of wildlife around the world are collected every day. However, placing a camera trap in a suitable location and retrieving photos is only the first step, as only proper data management and analysis can reveal the results. This step is a challenge

for many camera trap users, especially those not associated with research institutions.

Camera trap images can be inspected and managed using various software, with *Camelot* (Hendry & Mann 2018) being one of the most widely used. *Camelot* was developed as a first step in camera trap processing (classification of camera trap photos, keeping track of camera trap activity and positioning in the field, and management of recorded species data) and offers versatile outputs/reports (a tabular subset of the *Camelot's* database provided as CSV files) allowing subsequent analysis of the data. While *Camelot* does

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offer some calculated columns, it falls short in terms of comprehensive data analysis reporting, providing only sparse analytical insights compared to more advanced data analysis tools. Thus, users need to integrate *Camelot*'s data exports with other reporting solutions for a more thorough analysis of extracted data. While *Camelot* is user-friendly and can be used by someone without specific scientific or analytical knowledge, the next step in camera trap data management, most often statistical computing with software like R packages, requires quite specialised knowledge.

To facilitate and qualitatively improve the analysis of camera trap data for users without skills in statistical computing, we have programmed a freely accessible web application with a user-friendly interface to analyse camera trap data previously processed in *Camelot*. The *Camelot RReport* application provides the outputs required for a basic overview of camera trap results and some advanced features. *RReport* enhances data insights and visualisation capabilities beyond *Camelot*'s native functionalities.

## Implementation

*Camelot RReport* is available online for free at <https://rreport.vcf.hr/>; it does not need to be downloaded and installed on a device. The web application runs the R scripts and visualises the results using the R application Shiny (<https://shiny.posit.co/>). R scripts are available at GitHub [https://github.com/Gomercic/Camelot\\_RReport](https://github.com/Gomercic/Camelot_RReport). *RReport* is compatible with *Camelot* version 1.6.16 and the analysis starts with the upload of *Camelot* 'Full export'. The results are available online and can be downloaded. Tables can be downloaded as .csv and .xls, figures as .png files and maps are available as .gpkg files for GIS.

Reports include: trap stations – trap station location: map of camera trap locations – downloadable as a .gpkg file for GIS; trap station interval: interval within which each camera trap was continuously working in the field without interruptions; trap station activity per month: sum of active days per session followed by the number of active days per month.

Events/species – species list and count: species occurrence per camera trap per month; temporal discretisation: data filtered by species and temporal discretisation with the information on the moon illumination/solar time.

Abundance change/activity – graphs with species activity per month and year; graphs with species daily activity and activity per year.

The application was tested in a study with more than 50,000 photographs, proving it to be a robust and reliable tool for novice and advanced users.

## Data privacy

*Camelot RReport* employs several measures to ensure data privacy and security. Firstly, each user must create a unique login username associated with a specific folder that securely stores uploaded data, reports, tables, and graphs. This isolated storage approach prevents data from being accessed or altered by other users and guarantees the data will not be used for any other purpose. Furthermore, *RReport* limits each username to a single data upload. If a user wishes to generate a new report with a different dataset, they must create a new username, thus compartmentalising data and minimising the risk of data mixing or unauthorised access. To enhance data privacy, *RReport* includes an automatic data deletion feature. User data is automatically erased seven days after the last access. Additionally, users have the option to manually delete their data folders at any time, providing them with control over their own data lifecycle.

## Conclusion

*Camelot RReport* provides a user-friendly analysis of large amounts of camera trap data that cannot be performed in desktop spreadsheet programs (e.g. MS Excel, Libre Office Calc). It allows users to create basic ecological reports on species inventory, activity and seasonal trends without worrying about implementing complex code. The output files can be easily integrated into other R data processing and graphic editing pipelines. *Camelot RReport* reduces the processing time burden on scientists and lowers the programming knowledge necessary for users to produce their own analyses. *RReport* is currently compatible with the latest *Camelot* version (1.6.16) and will be updated alongside each new edition of *Camelot*. Additionally, application programmers are available to provide any assistance.

## Acknowledgements

Data collection was co-funded by the European Commission under the LIFE Programme (LIFE16 NAT/SI/000634; LIFE Lynx project).



## Author Contributions

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*T. Gomerčič and I. Topličanec wrote the script in R; T. Gomerčič and V. Šimunović developed the web application; I. Topličanec wrote the user manual; M. Sindičić and I. Topličanec wrote the paper.*

## Literature

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Hendry H. & Mann C. 2018: Camelot – intuitive software for camera-trap data management. *Oryx* 52: 15.