**Title:** An agent-based algorithm resembles behavior of tree-dwelling bats under fission-fusion dynamics

Title (SK): Agentové simulácie správania stromových netopierov pri fission-fusion dynamike

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**Type and number of the project:** APVV - 17- 0116, principal investigator P. Kaňuch, Institute of forest ecology, SAS

## Annotation:

The presented result in the field of modeling and simulation of a complex biological system is based on an interdisciplinary study of the behavior of tree bats of the Nyctalus Leisleri type. Based on the observation of bats, an interesting swarm behavior of a group of bats was described in search of a common shelter to survive the day. A group of bats leaves the hollow of a tree in the evening and starts hunting for food. During the hunt for food, the group is completely disintegrated, that is each bat hunts alone, independently of the others. During hunting, bats move in the area of several tens of km<sup>2</sup>. After several hours of hunting, the group meets in the morning in a seemingly randomly selected new cavity to survive the day.

A computer simulation agent model was developed based on real observation results. Several characteristics observed from the real world were implemented there. The created model has two basic goals: 1) to simulate the real behavior of bats as accurate as possible and to enable biologists to simulate the hypotheses about the mechanism of swarm behavior, 2) to apply swarm behavior mechanisms to other areas, for example to control a group of drones to search unknown areas. The most interesting features of the created model in terms of applicability in other areas include scalability, robustness and the ability to always find a solution in a limited time.

This model has been validated on a number of simulation experiments. The experiments focused on evaluating the effectiveness of simulations as well as the impact of changes in individual parameters on the results of simulations. All simulations were performed in close collaboration with colleagues in the field of behavioral biology (L. Naďo, P. Kaňuch).

The results of this integrated research have been published in conference proceedings and journals. The most important output is a publication in the Scientific Reports, from the Nature Research Journals.

## Main scientometric outputs:

ZELENKA, Ján - KASANICKÝ, Tomáš - BUDINSKÁ, Ivana - KAŇUCH, Peter. An agent-based algorithm resembles behaviour of tree-dwelling bats under fission-fusion dynamics. In Scientific Reports, 2020, vol. 10, art. no. 16793. (2019: 3.998 - IF, Q1 - JCR, 1.341 - SJR, Q1 - SJR, karentované - CCC). (2020 - Current Contents, WOS, SCOPUS). ISSN 2045-2322. Typ: ADCA

ZELENKA, Ján - KASANICKÝ, Tomáš - BUDINSKÁ, Ivana. A swarm algorithm inspired by tree-dwelling bats. Experiments and evaluations. In Advances in Intelligent Systems and Computing : Advances in Service and Industrial Robotics, 2020, vol. 980, p. 527-534. (2019: 0.184 - SJR, Q3 - SJR). ISSN 2194-5357. Typ: ADMB