PO.155

# Real-time bird detection and collision risk control in wind farms

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## Abstract

The constant expansion of wind energy requires fast and effective innovative solutions for bird detection and collision risk mitigation[1]. One proposed solution aimed at reducing mortality risk from wind turbines is a the bird collision avoidance systems (BCAS), designed by Volacom, which scans the a given area for bird activity using thermal cameras. One such system installed in the high-avian-biodiversity NATURA 2000-protected Kaliakra region of NE Bulgaria (Black Sea coast). The aim of this study was to assess the BCAS's capability to successfully detect birds within its field of vision, and register them as such in its database for two months. We found that the system registered 965 detections in August and 850 in October. Of those, true positives were 83.1% and 91.8% respectively, representing an average success rate (true positives) of 87.5% (two-month average). In our opinion this solution meets the requirements for use as a bird control tool at wind farms.

**Figure 1.** Volacom's BCAS, installed in the Kaliakra region, NE Bulgaria.

## Objectives

The main methods for bird registration, that meet the standards of international wildlife organizations and the European Commission, are radars day cameras and human visual detections[2].

We aimed to assess the precision of a novel tool: the thermal imaging camera, combined with appropriate detection software.

1. We analyzed the camera's reliability as bird and bat detection tool.
2. The system's detection recordings were assessed as a way of objectively analyzing the performance and accuracy of the detected objects.
3. The capacity of such a system to minimize the need for WTG stoppage, thus maximizing wind farms' production, efficiency was evaluated.

## Methods

We analyzed the detection rate efficiency of a ground-mounted bird collision avoidance system, based on thermal imaging with the following technical specifications.

- Vertical field of view: **26 °**
- Horizontal field of view per frame: **32 °**
- Total horizontal field of view: **192 °**

**Detection ranges:**

- **60 cm** wingspan: up to **350 m**
- **100 cm** wingspan: up to **600 m**
- **150 cm** wingspan: up to **1050 m**


**Figure 2.** Bird detections as seen by the Volacom thermal software user interface.

The experiment was carried out at an operating wind turbine park in NE Bulgaria during the months of August and October 2020, within the period of autumn bird migration. The system was equipped with a custom-built detection software providing live picture and video logs of each recorded detection. After the end of the experiment the video recordings were analyzed individually in order to assess the validity of each detection.

## Results

All data records were analyzed individually by two ornithologists, aiming to reach accurate and objective results.

- Birds were sometimes detected at 500+ meters

**August 2020:**

- Total detection: **965**
- True positive: **802** (83.1%)
- False positive: **163** (16.9%)

**October 2020:**

- Total detection: **850**
- True positive: **780** (91.8%)
- False positive: **163** (8.2%)

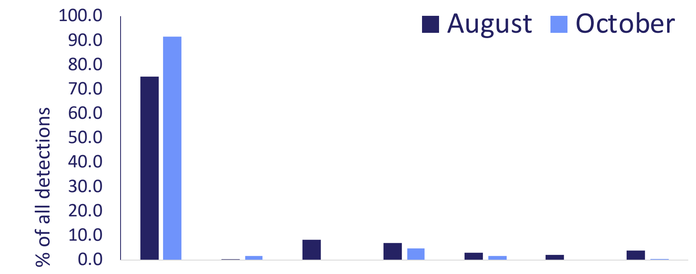


**Figure 3.** Structure of all detections for months August and October 2020.

**Notes & Observations:**

- False negative detections were not taken into consideration
- The sound emittance had persistent efficiency in deterring birds away from WTGs during true positive detections.
- Number of detections ≠ number of birds detected
- A single detection often contained multiple birds or flocks

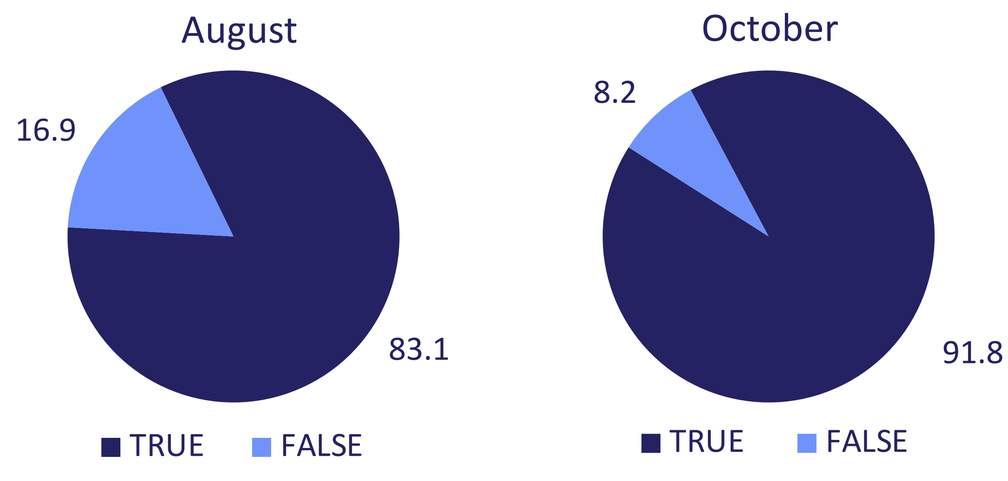


**Figure 4.** Percentages of true and false detections for months August and October 2020.

## Conclusions

Globally, bird collisions into with man-made structures cost the lives of millions of birds annually[3]. In the past this added mortality has largely been considered insignificant on population level but research in recent years shows selected species being particularly vulnerable, especially in protected wildlife areas[4].

1. The BCAS system successfully generated **1582** true positive detections. Considering the camera's field of view, we consider this to be a correct estimate of bird activity in the area.
2. The analysis of all **1815** detections revealed that the system had a success rate (true positive detections) of **83.1**% for **August** and **91.8**% for **October**
3. In our opinion the high sensitivity of the thermal sensor, combined with the high success rate of the detection algorithm: **87.5**% (two-month average) meets the requirements for use as a bird control tool at wind farms.

**Figure 5.** A flock of European starling *(Sturnus vulgaris)* passing a wind turbine generator with no bird deterrence systems installed.

## References

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