Effectiveness of Citizen Science vs Expert Observation in Classification of Nesting Bird Behaviors Captured on Camera

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Introduction

Cameras have been used as tools for many research studies that look at animal behavior. However, large amounts of data gathered from camera studies bring with them a "data deluge", requiring creative ways of data storage and analysis. Wildlife@Home (http://csgrid.org/csg/wildlife) is a tool that utilizes citizen scientists to aid researchers in the classification and filtering of events from nesting Sharp-tailed Grouse (*Tympanuchus phasianellus*; STGR), Piping Plovers (*Charadrius melodus*; PIPL), Least Terns (*Sternula antillarum*; LETE), and Blue-winged Teal (*Anas discors*; BWTL) captured on camera in North Dakota. Additionally, we hope to educate and bring awareness to ecological issues through the website. By utilizing citizen scientists for data filtering, management actions can be more rapidly implemented for time sensitive ecological issues.

Objectives

The objectives of this study were to determine:

1. who our citizen scientists are,
2. how they are watching videos, and
3. their proficiency compared to experts at classifying nesting events

Methods

Field Methods:

- 292 nests of 4 species were monitored via miniature 24 hour infrared surveillance cameras from 2012 – 2015 (Fig. 1).

Figure 1: We deployed cameras at (a) STGR, (b) PIPL, (c) LETE, and (d) BWTE nests using miniature surveillance cameras (e & f).

Demographic Analysis:

- Voluntary Registration Survey: gathered demographic information from citizen scientists.
- Questions explored age, level of education, location, interests (related to computer science and nature), how they discovered the project, and how they plan on participating.
- Data Analysis: Generated graphical analysis and summary information about citizen scientists.

Analysis of User Experience:

- Gold badge: Given after user has watched 1 full day (86,400 seconds) of video to determine how volunteers watched video, and if involvement has changed views on computer science and ecological interests or issues.
- Questions regarded level of participation, preferred species, viewing strategies (i.e., amount of time spent watching, browser used, etc.), and incentives for watching.
- Data Analysis: Generated summary statistics on experience and what was learned by project participation.

Proficiency Comparison:

- 2,268 videos of varying lengths were reviewed and nesting events classified by both researchers and citizen scientists and used in analysis.
- Data Analysis: Graphical analysis and summary statistics using segmentation correction equation to acquire overall correctness of citizen scientist vs. experts.
  - Segmentation uses algorithms to find matching events that may otherwise not be counted as a match because the event is marked a single event on one user's timeline and multiple events on the other user's timeline.

Permits:

- Surveys were conducted under UND IRB protocols (IRB permit no. IRB-201404-389).
- All nest monitoring followed UND IACUC and associated wildlife agency permits.

Results

Registration Survey

- Participants were from 15 different countries (Fig. 2).
- English was not the first language for 63% of survey participants (N = 46 participants).
  - 38% did not consider themselves fluent in English (N = 29 participants).
- 70% of participants were between the ages of 31 and 60.
- Only 9% of participants work in natural resources.
  - 7% were computer scientists.

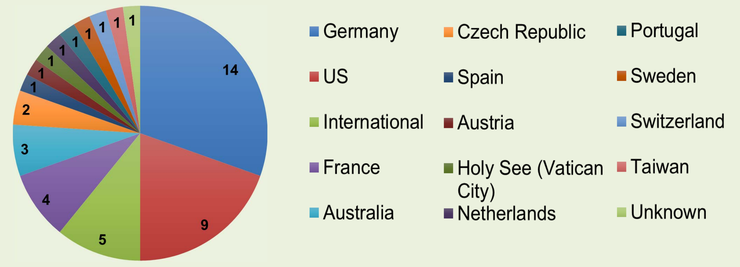

Figure 2: Number of Registration Survey participants by country (N = 46).

Gold Badge Survey

- 80% of citizen scientists expressed new knowledge gained about nesting ecology of birds (N = 5).
- 67% of citizen scientists felt project motivated them to become aware of natural resources' conservation and the outdoors in general (N = 9).
  - 22% had an interest in joining other citizen science projects (N = 9).
- 45% of participants watched > 5 hours of video/week (N = 9).

Proficiency

- > 200 volunteers have reviewed videos on Wildlife@Home.
- Citizen scientists accurately classified major events such as nest attendance and predator occurrence > 75% of the time (Fig. 3).
- Citizen scientists classified complex behaviors and rare events less accurately (Fig. 3).

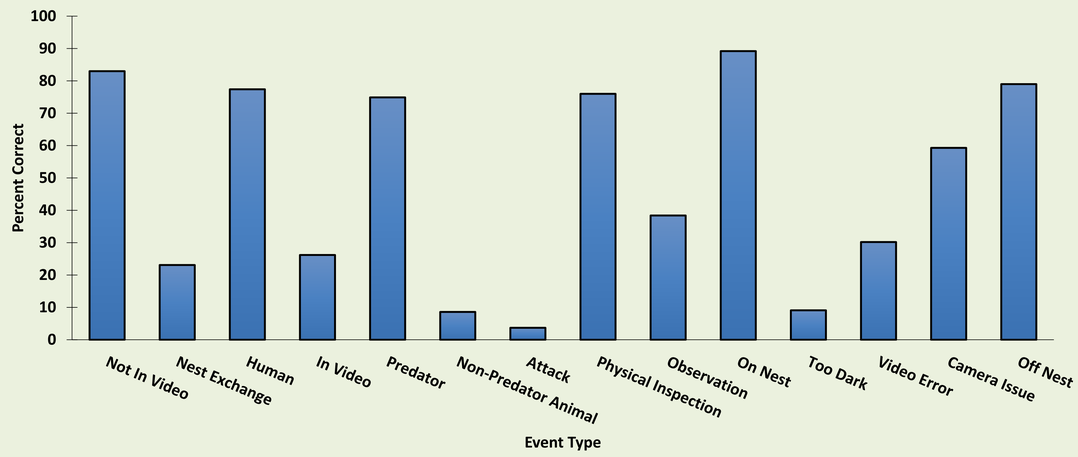

Figure 3: Overall correctness of 2,268 videos with expert and user timed observations.

Discussion and Management Implications

Who are they?

- Majority of participants are international with English as a second language; therefore, citizen science projects should carefully consider phrasing of certain definitions and collaborate with interpreters to provide translations.

How good are they?

- While there does appear to be some differences between expert and citizen classification of events, citizen scientists typically correctly classified basic recess events (e.g., on nest, off nest, not in frame).
  - Other events may be more difficult to observe or event definitions might be misunderstood/misinterpreted by citizen scientists.

Wildlife@Home as an educational tool: have things changed?

- Taught participants more about natural resources, avian ecology, and conservation.
- Increased awareness and desire to participate in conservation suggests this is valuable tool for conservation education.

How does this help wildlife ecologists?

- Citizen scientists can be effective at coarse-level filtering of large image/video datasets that are common in wildlife monitoring (e.g., nest cameras, trail cameras, and remote sensing).

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