

# Development of an automated yellowjacket nest monitoring station

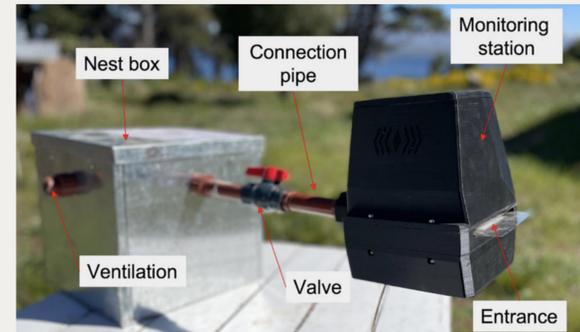
Masciocchi Maité<sup>1\*</sup>, Martínez Andrés<sup>1\*</sup>, Dreidemie Carola<sup>2,3</sup>, Inchaurreza Fernán<sup>2</sup>, Cucurull Agustín<sup>2</sup> & Basti Marian<sup>2</sup>

<sup>1</sup> Grupo de Ecología de Poblaciones de Insectos, IFAB-Instituto de Investigaciones Forestales y Agropecuarias Bariloche (INTA - CONICET), San Carlos de Bariloche, Argentina. Email: maimasciocchi@gmail.com; andmarv77@gmail.com

<sup>2</sup> LVCC Laboratorio de Visualización y Código Creativo, CITECCA Centro Interdisciplinario de Telecomunicaciones, Electrónica, Computación y Ciencias Aplicadas, UNRN Universidad Nacional de Río Negro, San Carlos de Bariloche, Argentina.

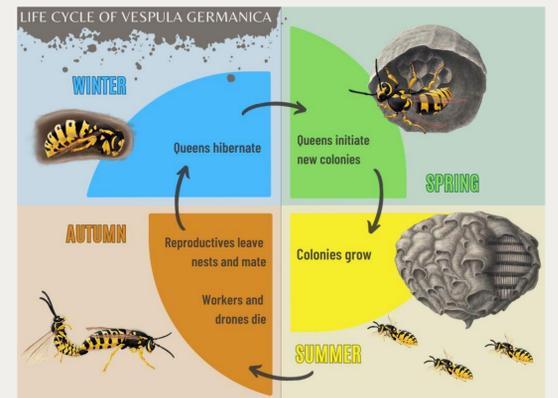
<sup>3</sup> Policémies, La Rochelle Université, La Rochelle, France

\* Both authors contributed equally to this work



## Introduction

- Invasive social wasps pose serious problems in natural and productive systems.
- Their management requires a solid understanding of their behavioural and ecological dynamics.
- Understanding their complex activity patterns can yield valuable insights into their growth, foraging patterns and reproductive behaviour.
- Recent advances in artificial intelligence and computer vision provide new tools for automated biological monitoring.



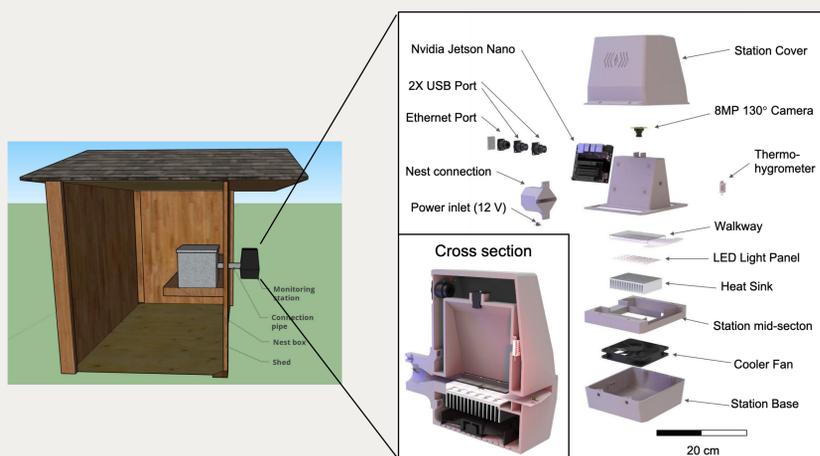
Our aim was to develop an automated monitoring system to study incoming and outgoing activity in social wasp (*Vespula germanica*) colonies, combining custom hardware and deep-learning-based ad-hoc software.

## Methods

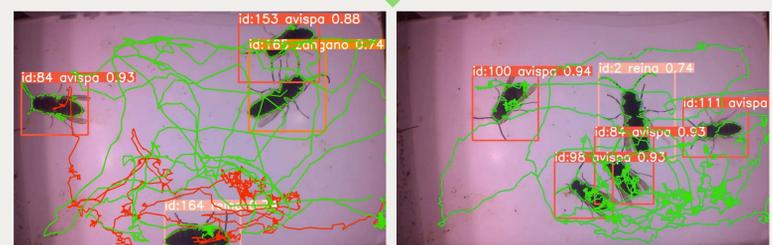
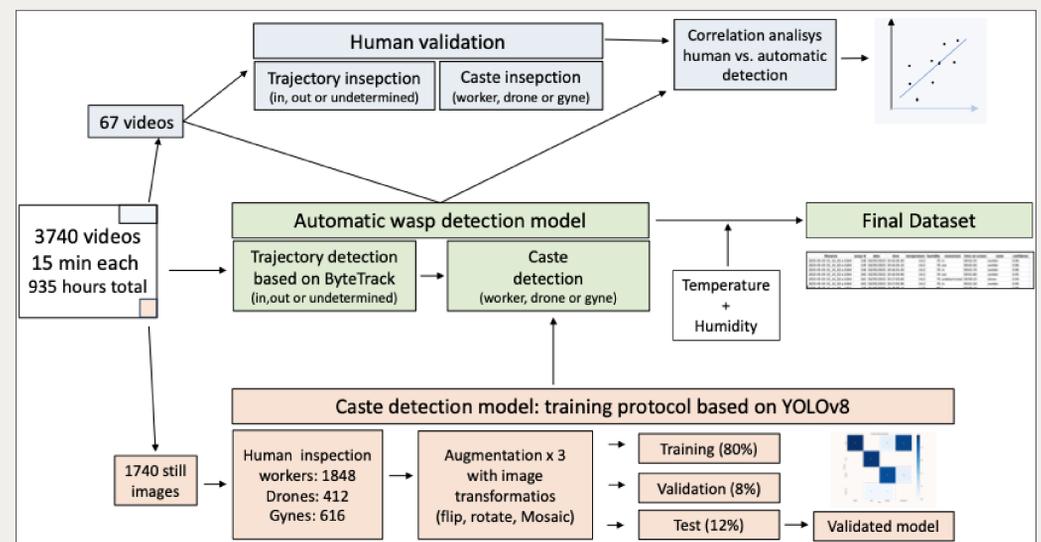
### 1- Removal of natural wasp nest and rearing



### 2- Instalation of monitoring station

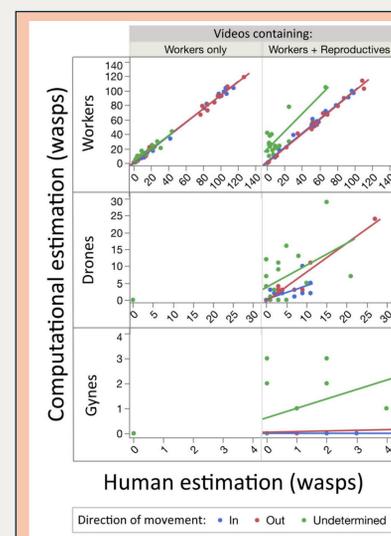


### 3- Development and validation of recognition software



## Results & Discussion

The model accurately detects all castes, while movement direction is reliably identified for workers and drones only. Further improvements in software and hardware are expected to enhance performance, particularly for reproductive individuals. Despite these limitations, this tool offers strong potential for ecological and behavioural research by providing rapid access to activity data, enabling insights into colony growth, foraging dynamics, and reproductive behaviour.



Linear correlations of wasps counted by human inspection compared to the computational algorithm considering their direction of movement (into the nest [in], exiting the nest [out] or undetermined direction [undetermined]) and castes.