

# MARK-RELEASE-RECAPTURE OF *Aedes albopictus* IN PORTUGAL: THE INFLUENCE OF CLIMATIC FACTORS

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## INTRODUCTION

*Aedes albopictus* mosquitoes spread diseases like dengue, Zika and chikungunya. The Sterile Insect Technique (SIT), which is based on production of male sterile mosquitoes through radiation and their release in target areas, can be used in an integrated vector management (IVM) strategy. Mark-Release-Recapture trials (MRR), in which mosquitoes are marked with fluorescent dye, released, and periodically recaptured may estimate native population density, dispersion patterns, flight distances and survival rate, but weather conditions can affect results. Thus, we aimed to understand the influence of climatic factors on an MRR field trial in a temperate region of Europe, South of Portugal.

## METHODS

The MRR trial was conducted from 11<sup>th</sup> to 31<sup>st</sup> October 2022 in Faro, Southern Portugal (Figure 1). The *Aedes albopictus* mosquito strain from Faro was shipped and established for mass-rearing and sterilization in Centro Agricultura Ambiente “Giorgio Nicoli”, Department of Medical and Veterinary Department, Crevalcore, BO, Italy, and shipped by DHL again to Faro in one batch per week (three batches). Mosquito sterilization, marking and transport followed protocols from the International Atomic Energy Agency. Six releases of sterile male mosquitoes marked with different colours were performed in three consecutive weeks. Two single-point ground releases were set within 50 meters apart and mosquitoes were collected by Human Landing Collections (HLC) in 40 HLC points, one, two, four and six days after releases. Climatic data, such as temperature, humidity, wind intensity (moderate – 15-35 km/h vs weak – <15 km/h) and precipitation, were obtained from the Portuguese Institute of the Sea and the Atmosphere (Table 1). Generalized linear models with a negative binomial family and log function to estimate factors associated with the number of captured mosquitoes were used in the analyses, along with estimated prevalence ratios (PRs), and 95% confidence intervals (CI).

Table 1. Climatic conditions in the three release events.

Date	11/10/2022	18/10/2022	25/10/2022
Release batch	1	2	3
Temperature	21.0	22.4	21.6
Humidity	79	80	88
Precipitation	0	0	0
Wind direction	NW	S	W
Wind intensity	Weak	Weak	Weak

## RESULTS

A total of 84,000 marked sterile male mosquitoes were released and 528 marked males (0.7%) were recaptured by HLC (Figure 2).

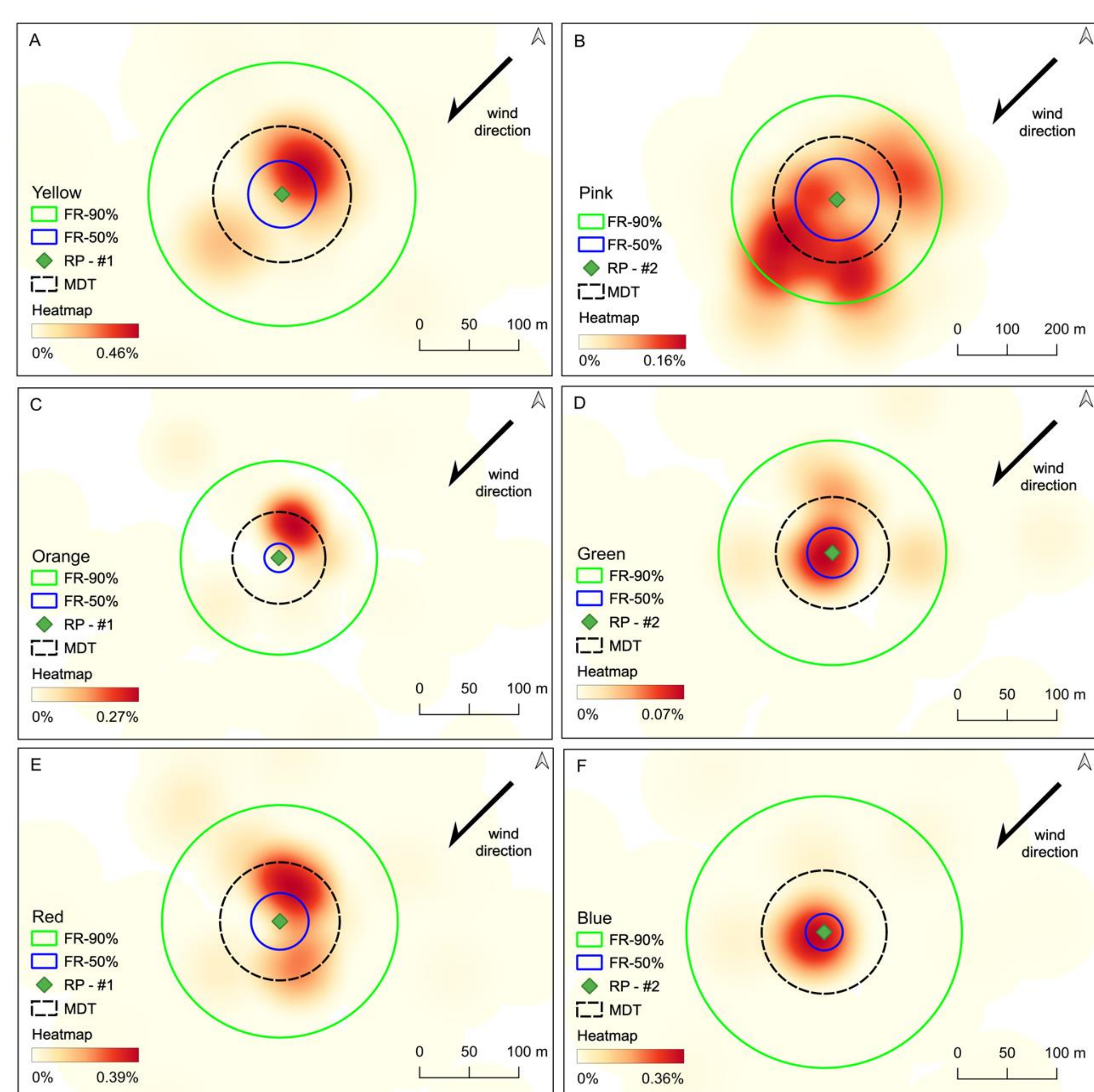


Figure 3. Spatial distribution of marked sterile *Aedes albopictus* in reference to its respective mean distance travel (MDT) and 50% and 90% flight range (FR-50% and FR-90%). A to F represent the spatial distribution pink, yellow, green, orange, red, and blue marked sterile males. The predominant wind direction during the collection period is indicated accordingly.

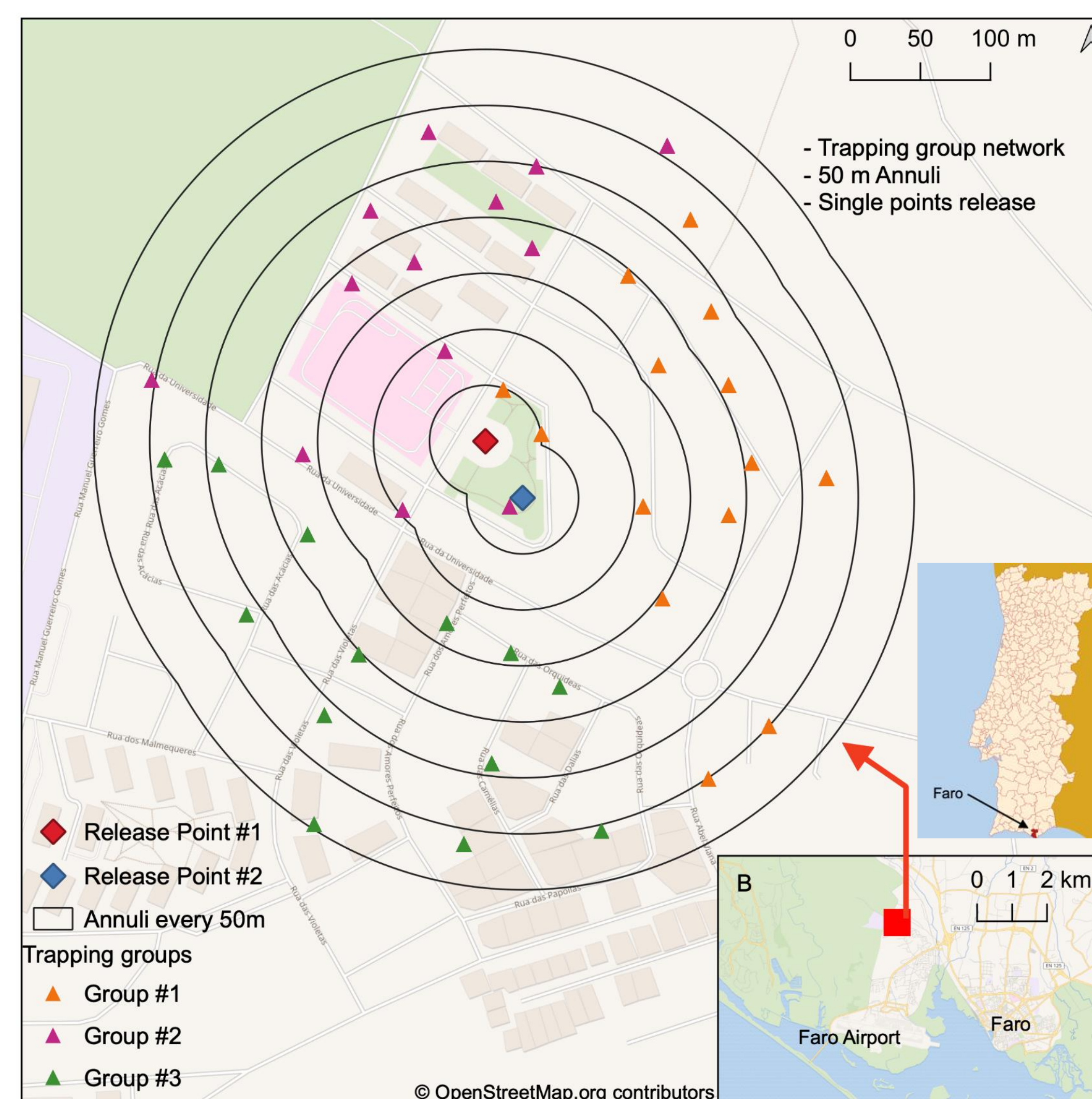


Figure 1. Location of the study area of Gambelas, close to Faro municipality. Two release points were set. From those points, sequential annuli with 50 meters distance of up to 350m, resulting into approx. 27ha, were estimated. Human Landing Collection (HLC) was the recapture method. Recapture points were divided among three groups and collections took place between 14:15 to 19:20.

The overall proportion of marked mosquitoes recaptured per colour varied between 0.18% and 1.06%. Sterile-marked males had an average mean distance travelled (MDT) of 88.7m, with a minimum of 58.7m and a maximum of 160.8m from the respective release point. The bootstrapped estimate for FR50 was 42.8 m (95% BCa CI: 27.6; 73.6), and the bootstrapped estimate for FR90 was 170.6 m (95% BCa CI: 143.7; 228.9).

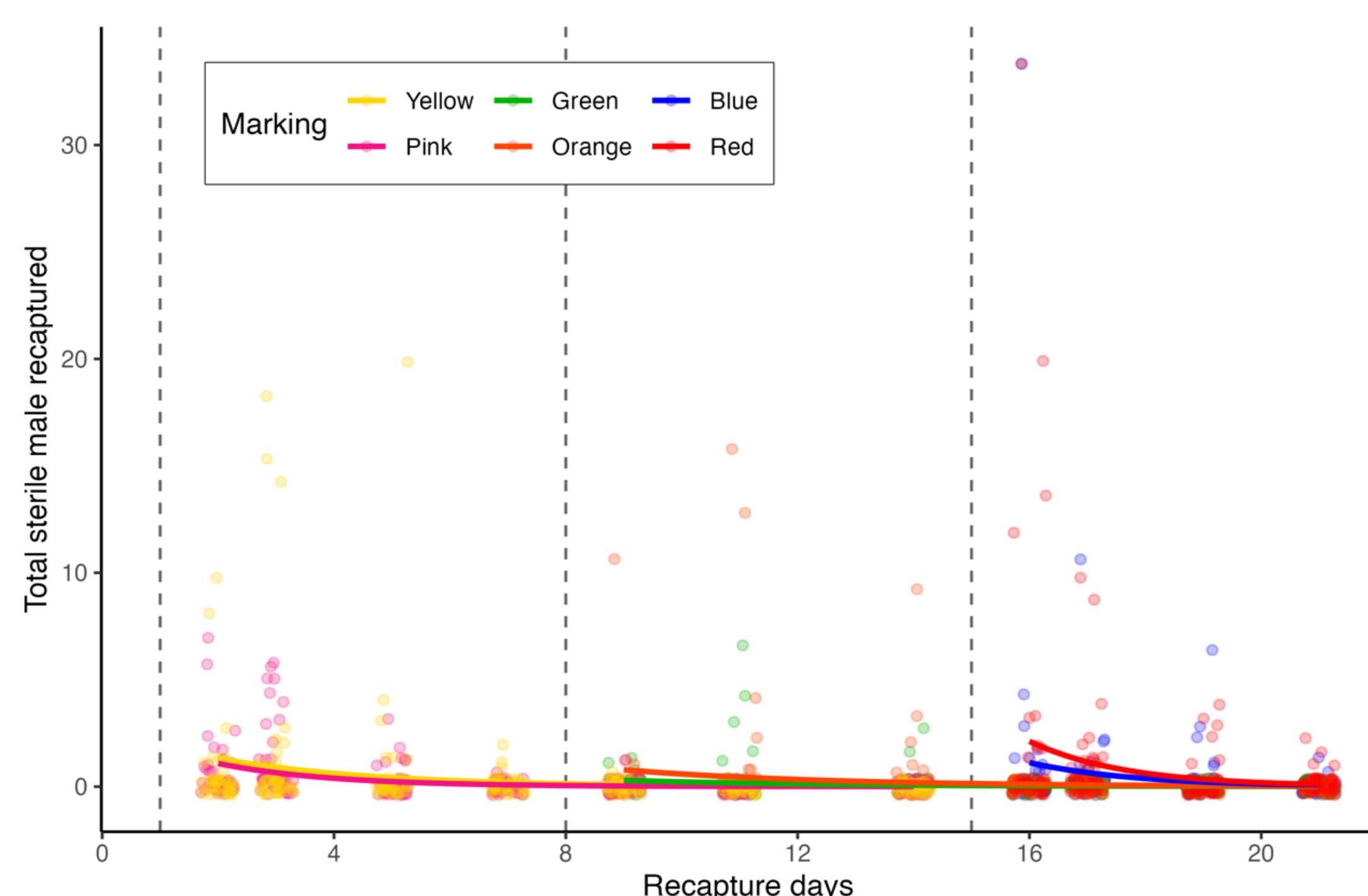


Figure 2. Sterile males marked with different colours recaptured during the 21 days MRR trial.

## DISCUSSION

The weather conditions may impact the recapture rate, which in our study, reached only 0.7% of the total release. This is a low recapture rate in comparison to a similar studies. The low recapture rate could have also been impacted by the collection method, which in our protocol was HLC for five minutes per station.

The mean wind direction did not directly affect the sterile male mosquito distribution. However, the moderate wind intensity has an effect on the recapture rate and can infer on mosquito dispersion since mosquitoes tend not to fly in these conditions. Although, the marked mosquitoes had a mean distance travel of around 59 to up 161 meters. These flight distances are similar to distances found in other studies.

Mean temperature during recaptures was 22°C and median (IQR) 21.80 (21.10-22.50). This small variation explains the lack of association between temperature and number of mosquitoes recaptured. The same can apply to the humidity parameter: mean 81%; median (IQR) 82% (71-89).

It is crucial to plan MRRs carefully considering weather conditions during their execution to avoid underestimating the population needed for the SIT and other parameters such as dispersion and survival rate compromising the effectiveness of this control method.

The spatial distribution in Figure 3 shows that mosquitoes tended to stay closer to the release point, and visually there is no indication that the primary wind direction had any influence on the mosquito dispersal. Climatic conditions during the second week were statistically significantly different concerning wind intensity and precipitation than the first and third weeks. The prevalence of captured mosquitoes was 23% lower when the wind intensity was moderate compared with a weak wind intensity (PR: 0.77, 95%CI: 0.61-0.98). We did not find a statistically significant association between the number of captured mosquitoes and humidity (PR: 0.98, 95%CI: 0.96-1.00), temperature (PR: 1.03, 95%CI: 0.83-1.28) and precipitation (PR: 1.07, 95%CI: 0.60-2.03).

## ACKNOWLEDGEMENTS:

