

Inferring the summer trend of *Aedes albopictus* in the Emilia-Romagna region (Italy)

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Climate-Sensitive Vector Dynamics Modelling
Workshop | Bologna | 19-20 September 2024

CAA | Centro
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EMILIA-ROMAGNA REGION

2,212,309 hectares

Mountains (25.1%)

Plain (47.8%)

Hills (27.1%)



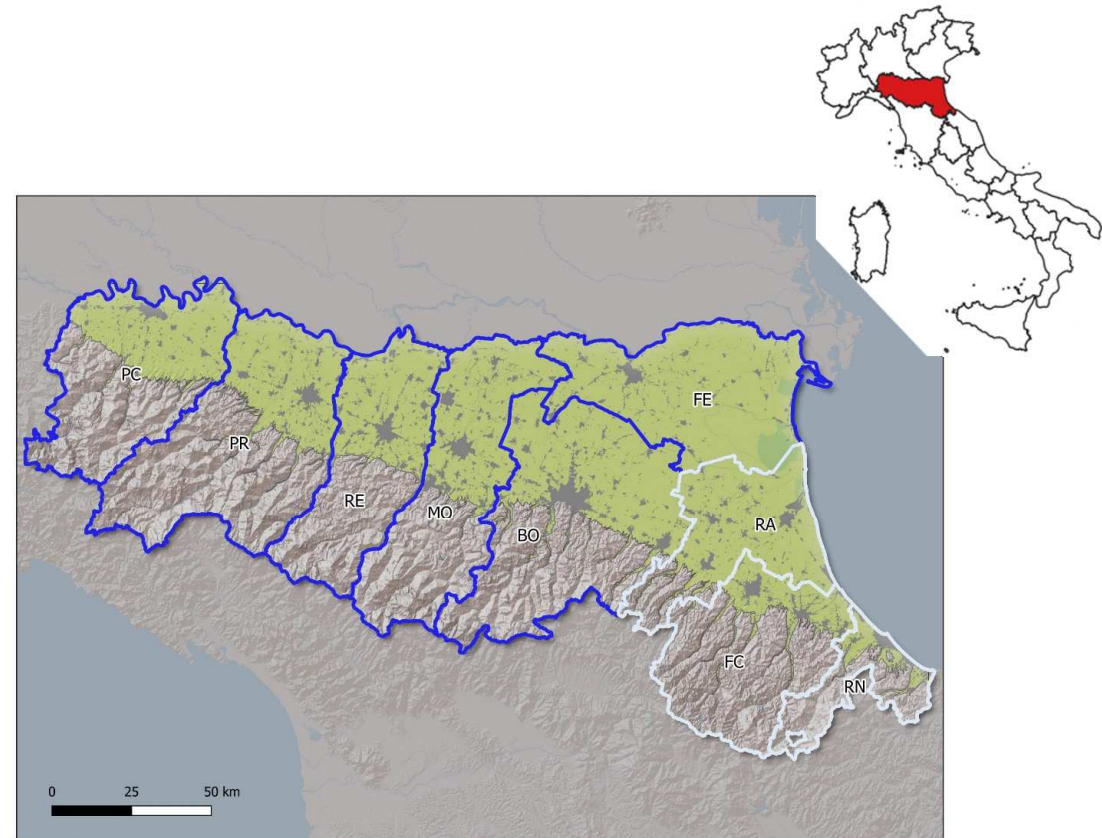
4.5 million inhabitants



328 municipalities
(80% in plain area and low hills)

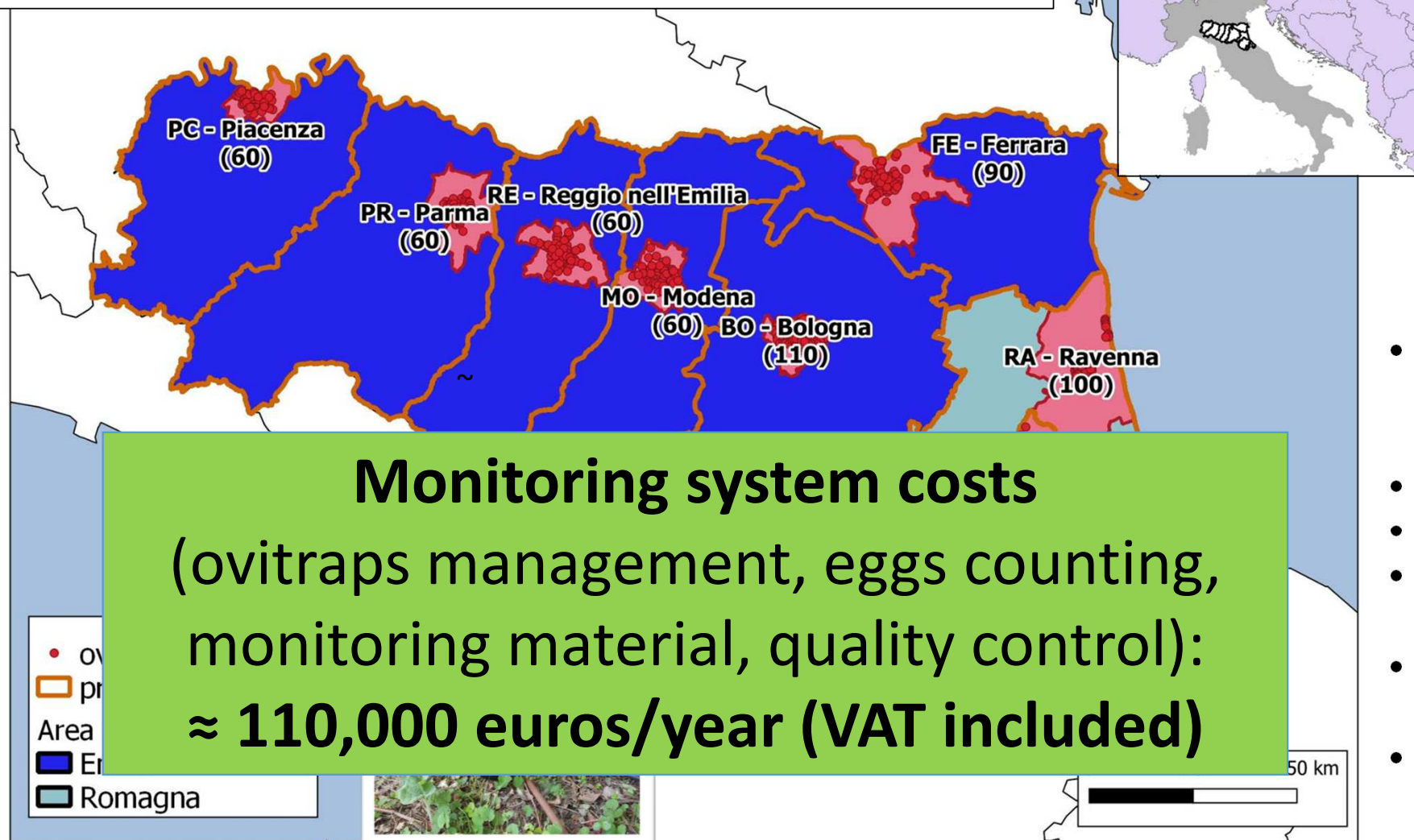


Continental temperate climate
(mediterranean towards the coast)



Map of E-R, in green plain area, in grey urban areas
Two macro areas (Emilia and Romagna)

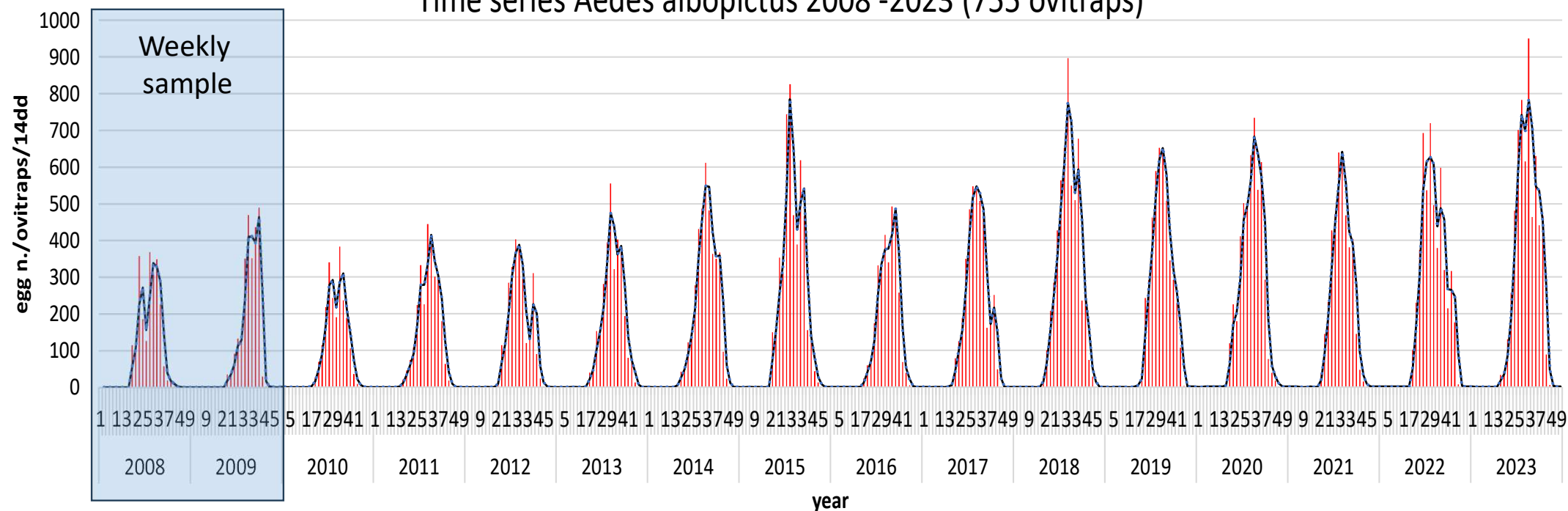
Monitoring system of *Aedes albopictus* implemented by the Emilia-Romagna Region



- 755 ovitraps during summer season and 110 in winter season
- 9 provinces
- 10 municipalities
- Specific ovitraps management protocol
- Quality control on monitoring data
- Data publication on www.zanzaratigreonline.it

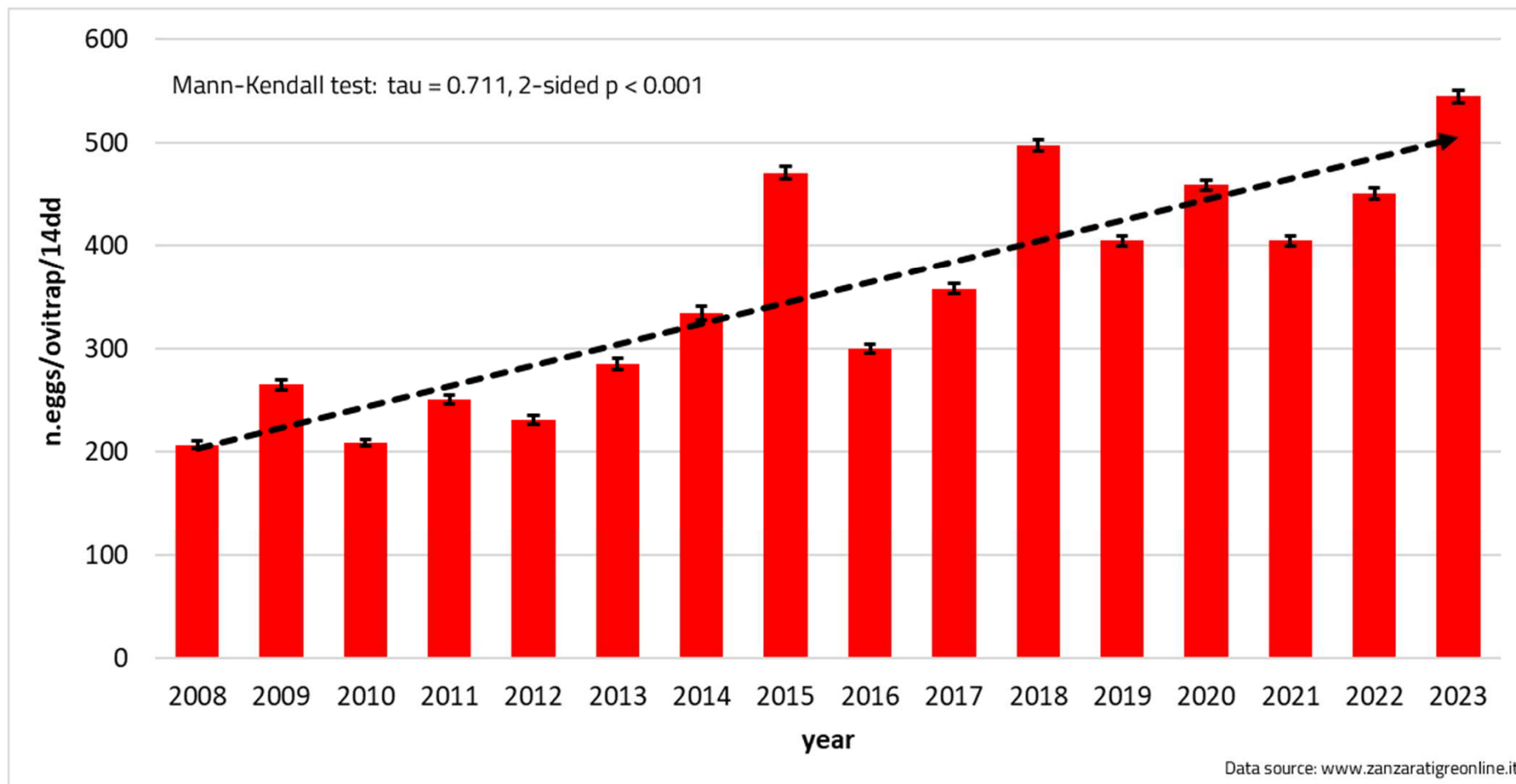
TIME SERIES 2008-2023

Time series *Aedes albopictus* 2008 -2023 (755 ovitraps)



Data source: www.zanzaratigreonline.it

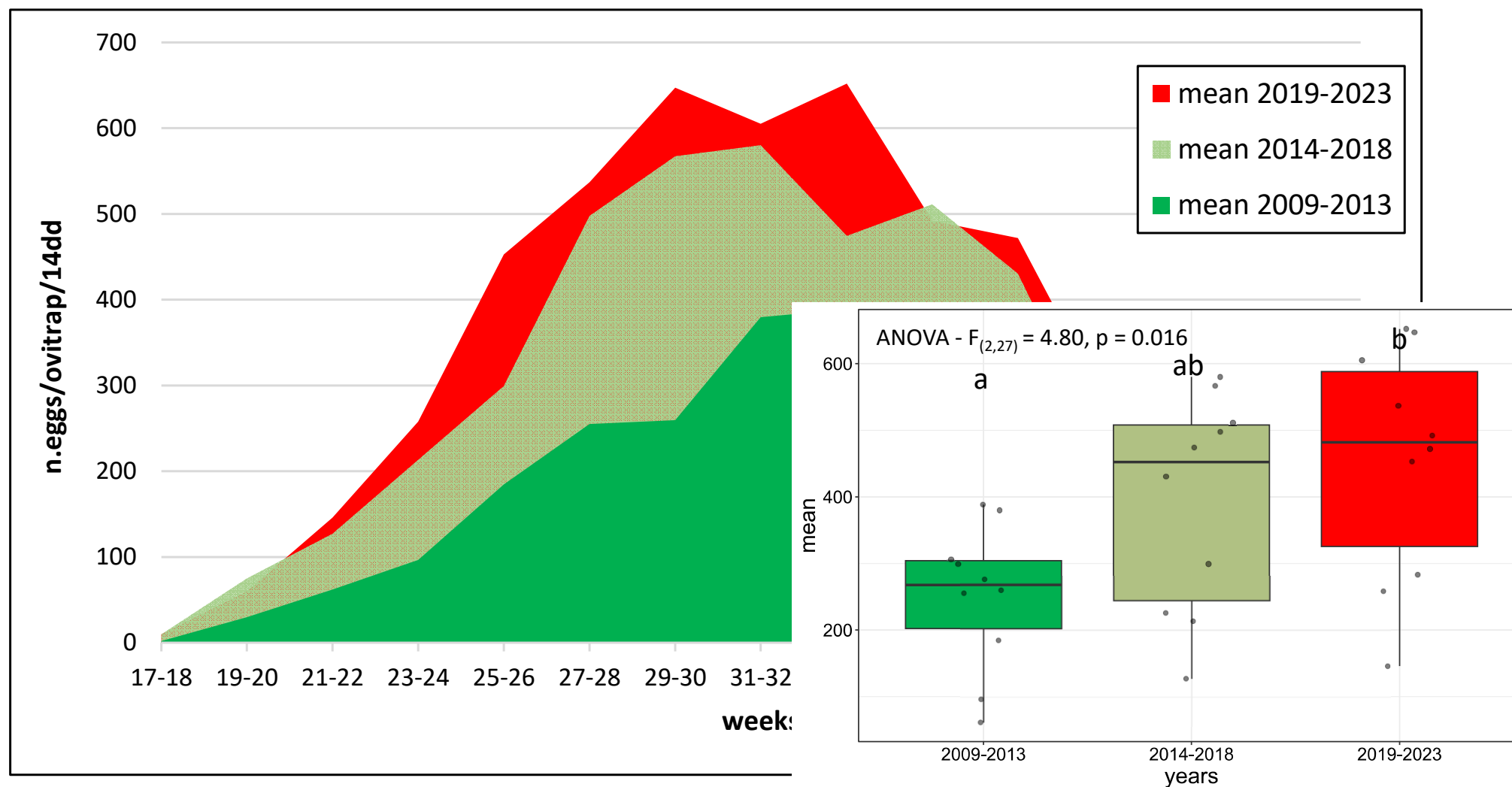
POSITIVE TREND OF THE AEDES POPULATION DENSITY



Piattaforma Nazionale Adattamento Cambiamenti Climatici:

<https://climadat.isprambiente.it/dati-e-indicatori/indicatori-di-impatto-dei-cambiamenti-climatici/aedes-albopictus/>

THE RISE OF AEDES POPULATION DENSITY

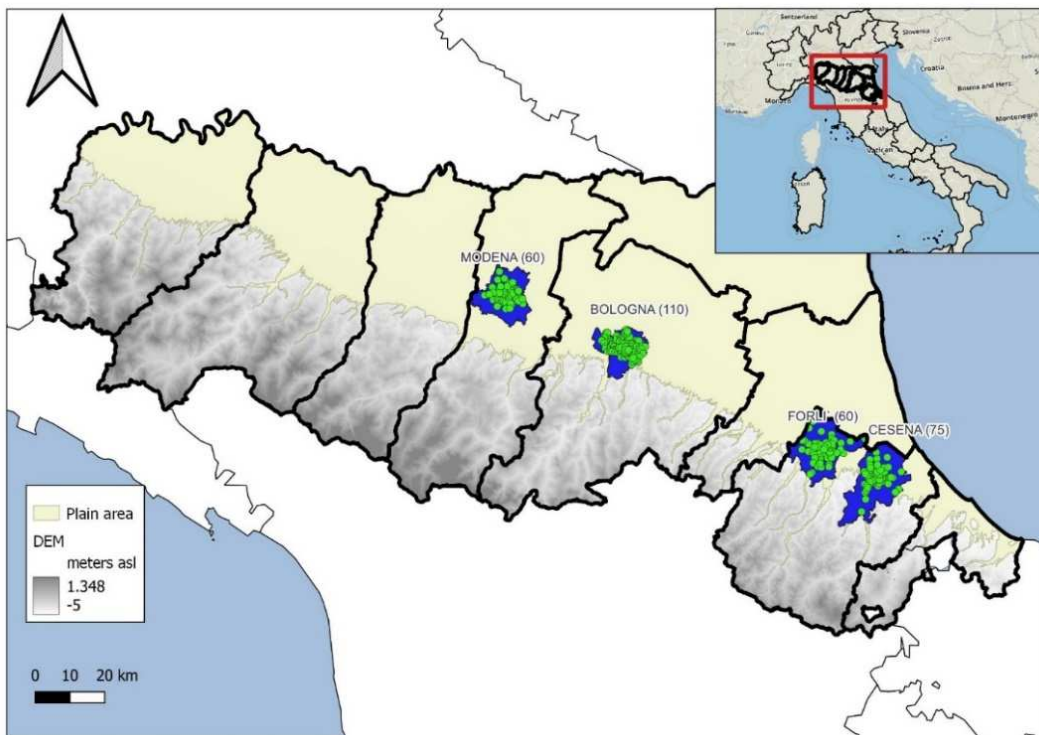


AEDES ALBOPICTUS ABUNDANCE MODEL IN E-R



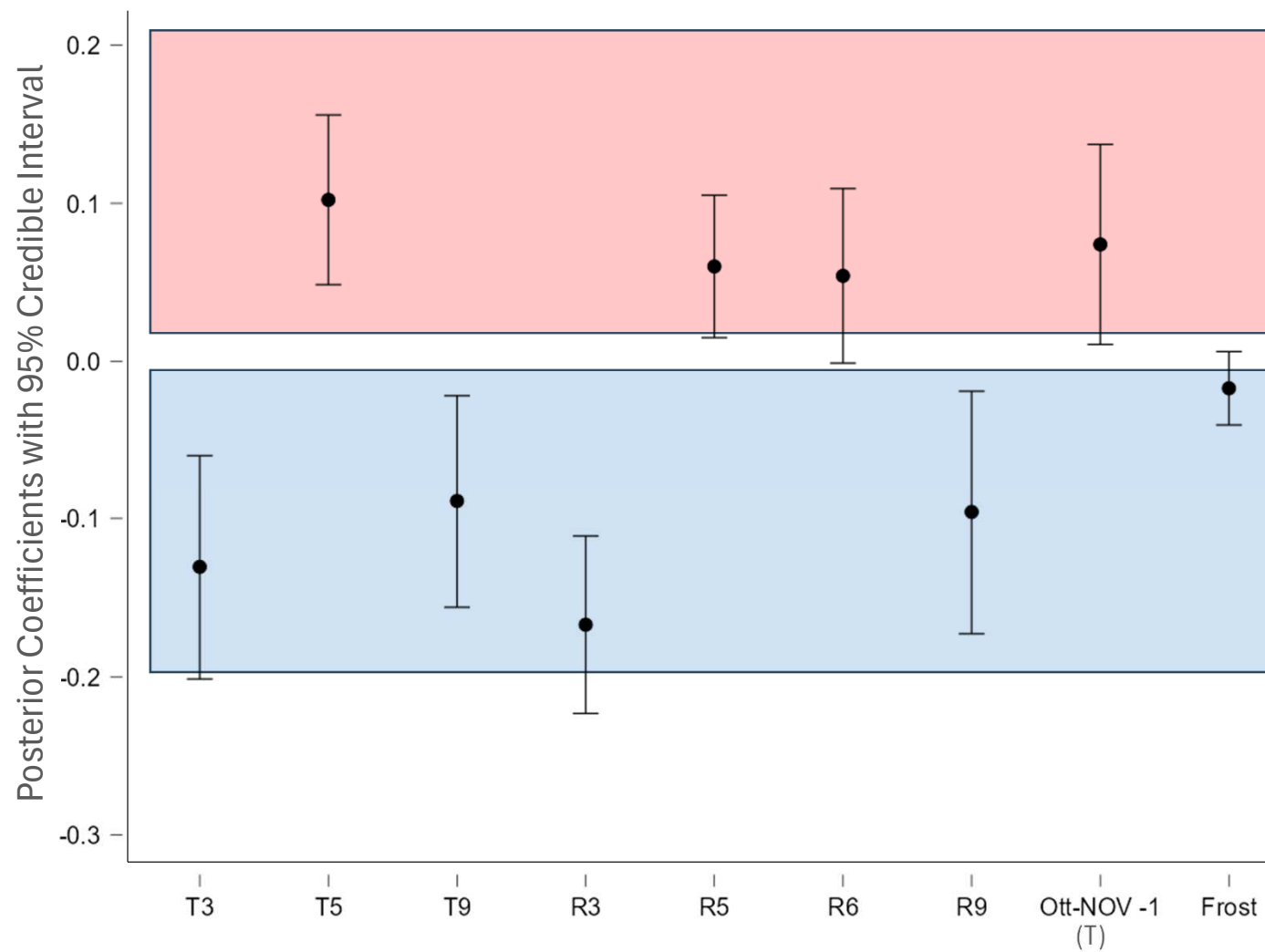
Article

Effects of the Weather on the Seasonal Population Trend of *Aedes albopictus* (Diptera: Culicidae) in Northern Italy



- 4 municipalities (305 ovitraps). 40% of total ovitraps activated in the region every year
- Data from 2010 to 2022 (13 years)
- $\approx 82\%$ avg percentage of activated ovitraps
- **Covariates:** meteorological data (ERG5 regional dataset):
 - Frost days (January-February-March)
 - Daily avg T
 - Daily avg RH
 - Daily cumulated precipitation (R)
 - Daily avg global radiation (RAD)
- **Method:** Bayesian multi-model linear regression

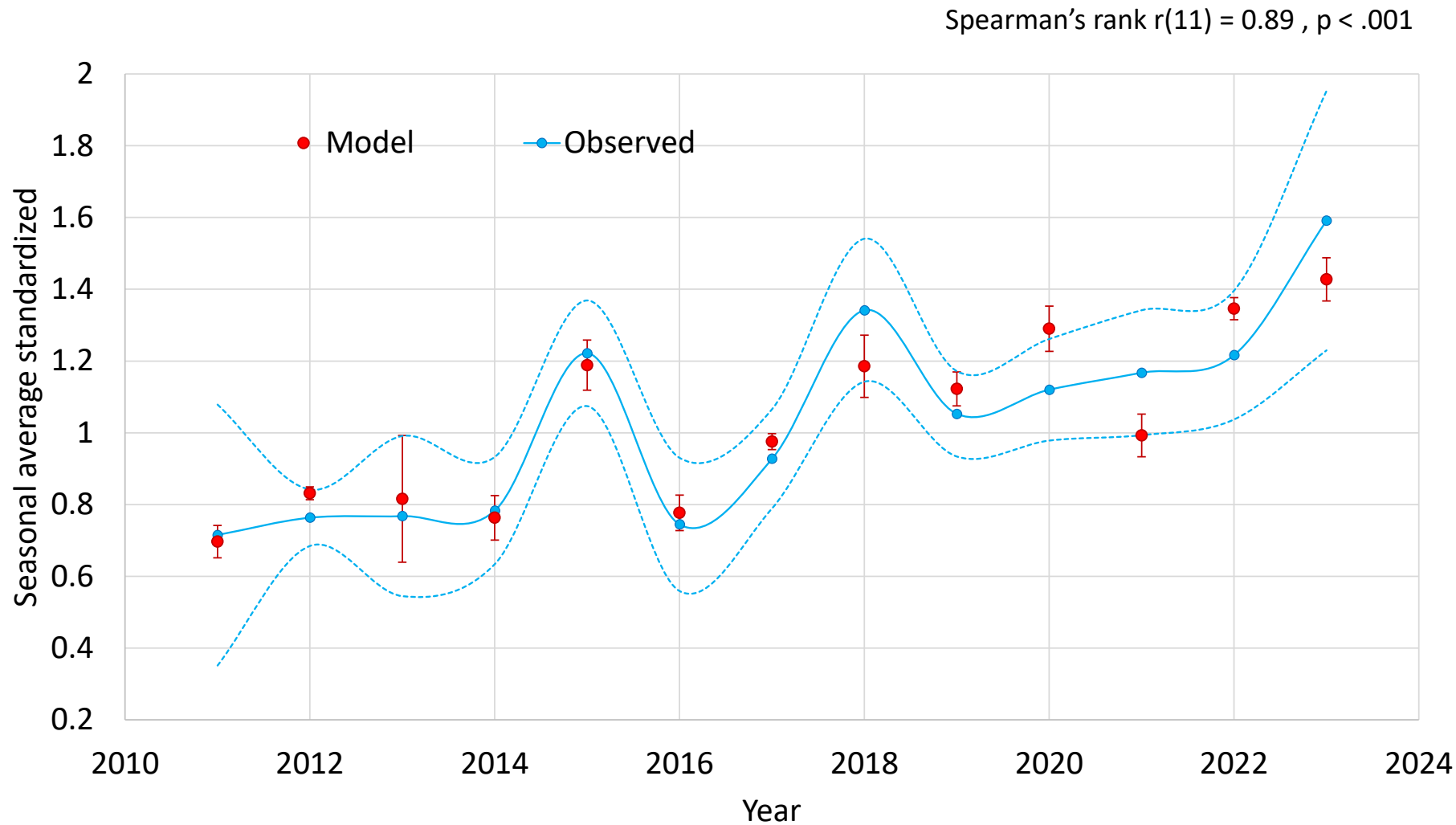
BEST METEOROLOGICAL VARIABLES FOR PREDICTION



Positive contribution

Negative contribution

E-R REGIONAL OBS VS MODEL 2011-2023 (AVERAGE \pm CONF.LIM. 95%)

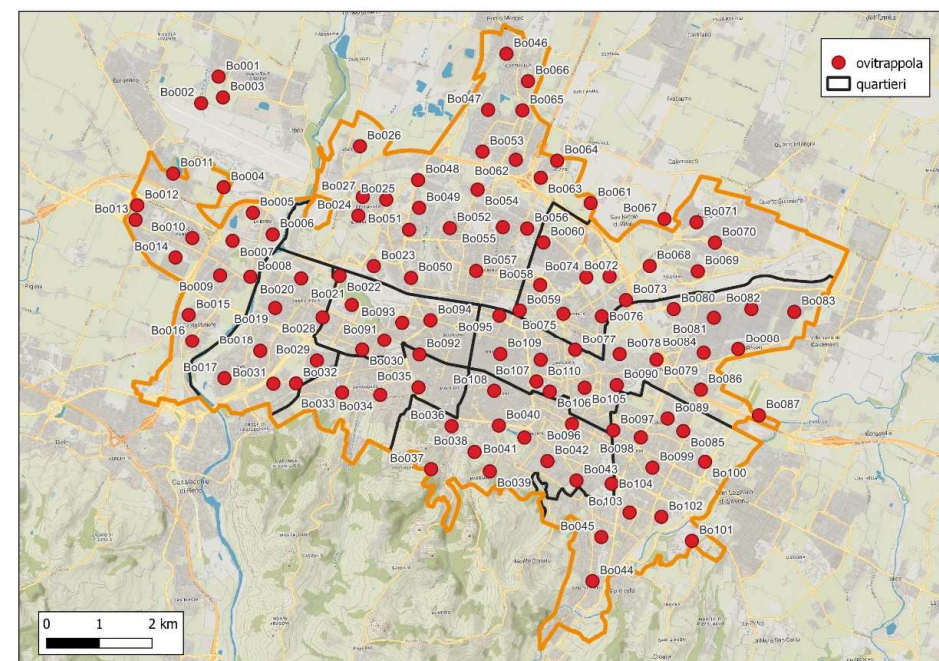


E-R REGIONAL MODEL MONTHLY RESULTS 2023 (BOLOGNA)

Month	Model	Obs	model fit	
			R	R ²
June	1.231	1.167	0.919	0.845
July	1.714	1.393	0.858	0.736
August	1.004	1.267	0.814	0.663
September	1.303	1.445	0.735	0.540
Season	1.360	1.314	0.746	0.556

Predictors

June	July	August	September	Season
T3	T3	T7	T5	T3
T5	R3	eggs(MJJ)	T6	T5
R3	RH4		T7	R3
RH3	RH5		R7	RH5
RH4	eggs(MJ)		RH5	T (Ott-NOV -1)
RH5			eggs(MJJA)	
T (Ott-NOV -1)				

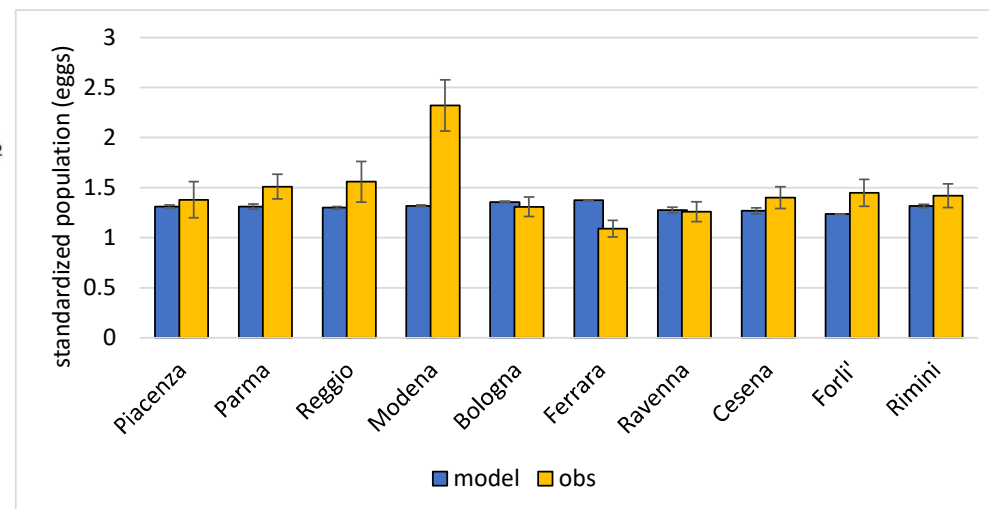
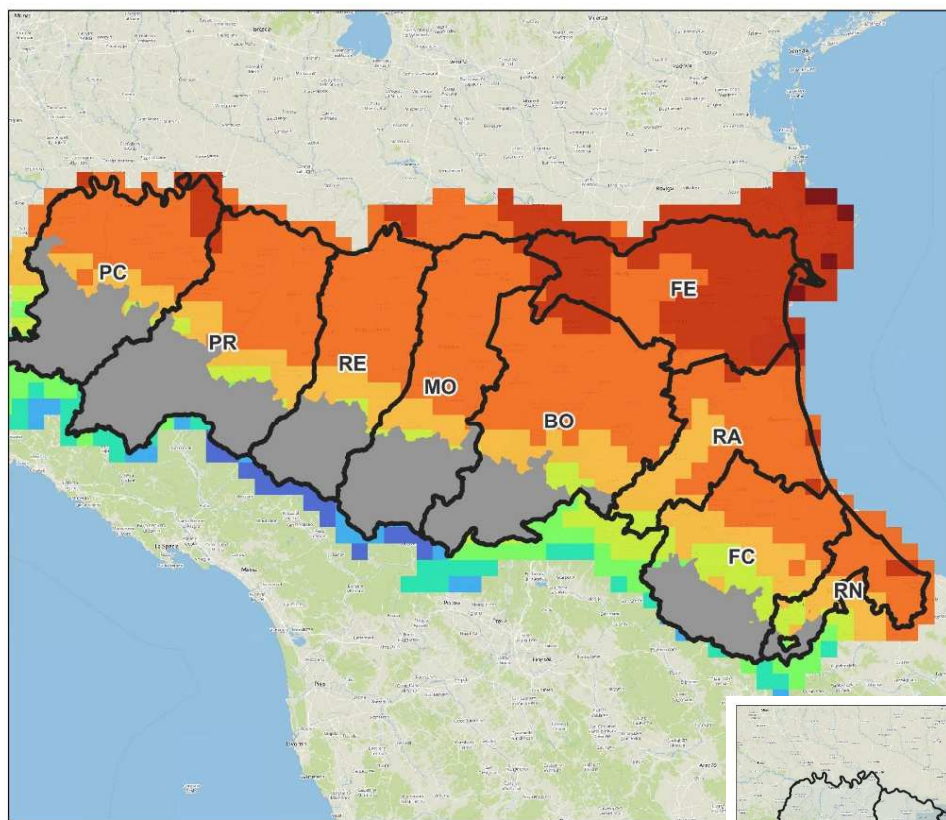


110 ovitraps

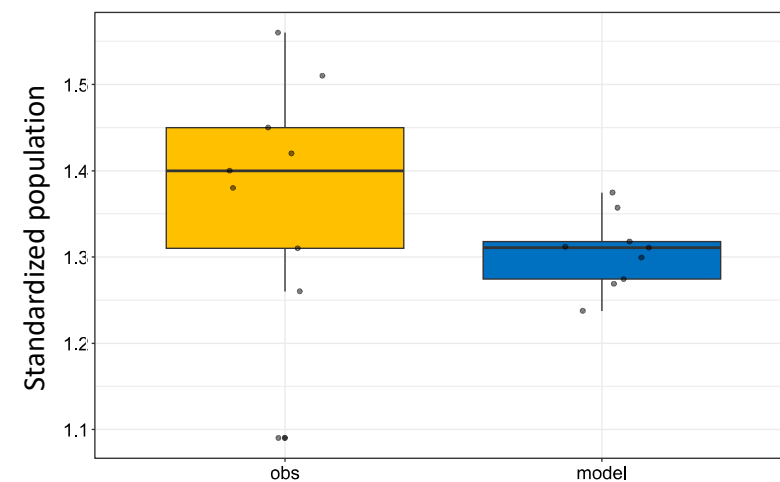
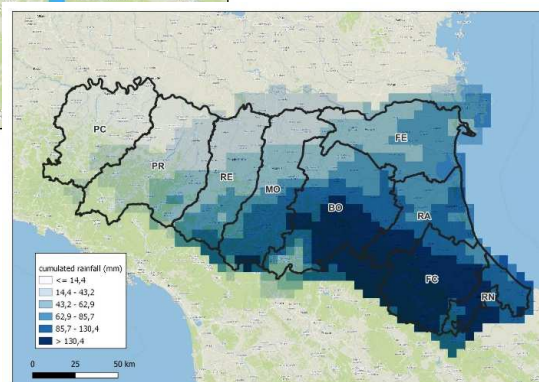
HOW CAN WE USE THIS MODEL?

- ✓ **Model has mainly an informative function.** At the beginning of the season we share results on the prevision for the current year in www.zanzaratigreonline.it
- ✓ Model confirms that the most important period to activate control activities is **April** (impact on the whole summer season)
- ✓ Results of the model can provide an **indication of the quality of control activities**; if a population variation is observed that contrasts with the forecast, this could indicate a change in the effectiveness of ongoing control activities compared to previous years.
- ✓ Results can be used for **quality control (validation)** on monitoring data.

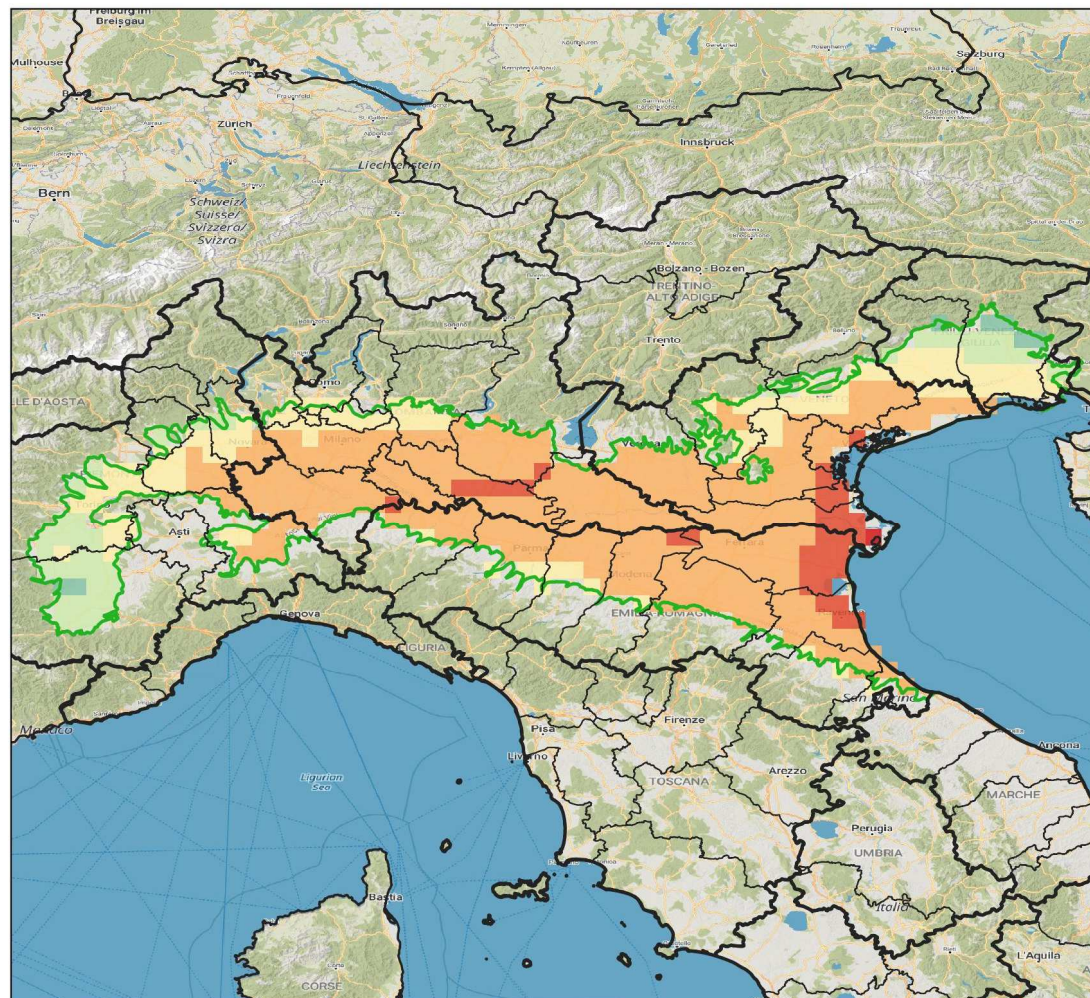
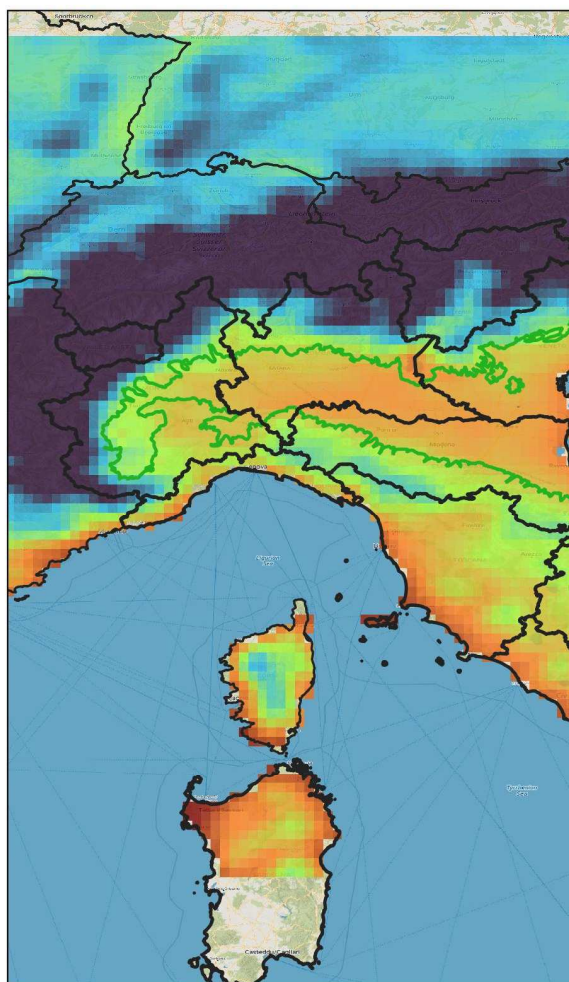
EMILIA-ROMAGNA MAP PREVISION 2023 (ARPAE DATA)



Map of cumulative precipitation of flood events from 15 to 17 May 2023 (ARPAE data)



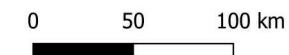
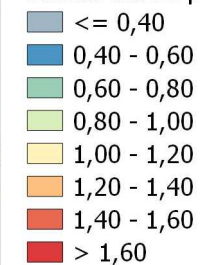
MAP PREVISION 2023 (COPERNICUS DATA)



Aedes albopictus population 2023

Population standardized on historical ovitraps
data from 2010 to 2022 of Emilia-Romagna
region, Italy.

standardized population



CONCLUSIONS AND TAKE HOME MESSAGES

- ⊗ Model shows **good accuracy** in predicting the seasonal mosquito population density in Emilia-Romagna region;
- ⊗ Winter and Spring weather parameters are relevant in the seasonal trend of *Ae. albopictus* in temperate regions and **April** is the best month to **begin larval treatments**;
- ⊗ It is **difficult to extend the results** of this study to urban environments with a **different road drain typology** (it can be extended, for example, to the urban areas of the Padana Plain, which are similar to Emilia-Romagna);
- ⊗ The relationship between population and climate parameters is closely linked to **the type of breeding sites** and the **environmental carrying capacity**.

AKNOWLEDGMENTS



Regione Emilia-Romagna



All the operators that work in the field for data collection



Thank you for the attention

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