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MODELLING THE TRANSMISSION DYNAMICS OF WEST NILE VIRUS IN EMILIA-ROMAGNA REGION (ITALY)

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West Nile virus (WNV) transmission was much greater in 2018 than in previous seasons in Europe. Focusing on Emilia-Romagna region (northern Italy), we analyzed detailed entomological and epidemiological data collected in 2013-2018 to quantitatively assess environmental drivers of transmission and explore hypotheses to better understand why the 2018 epidemiological season was substantially different than the previous seasons. In particular, in 2018 WNV was detected at least two weeks before the observed circulation in 2013-2017 and in a larger number of mosquito pools. Transmission resulted in 100 neuroinvasive human cases, more than the total number of cases recorded between 2013 and 2017.

We used temperature-driven mathematical models calibrated through a Bayesian approach to simulate

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mosquito population dynamics and WNV infection rates in the avian population. We then estimated the human transmission risk as the probability, for a person living in the study area, of being bitten by an infectious mosquito in a given week. Finally, we translated such risk into reported WNV human infections.

The estimated prevalence of WNV in the mosquito and avian populations were significantly higher in 2018 with respect to 2013-2017 seasons, especially in the eastern part of the region. The high mosquito prevalence resulted in a much greater predicted risk for human transmission in 2018, which was estimated to be up to four times higher than previous seasons. Our modelling results suggest that such greater WNV circulation might be explained by exceptionally high spring temperatures, which have likely amplified WNV transmission at the beginning of the 2018 season.

This study provides new important insights into the ecology of WNV in southern Europe and represents a first quantitative assessment of the dependency between temperature and infection that can explain why WNV circulation in 2018 was significantly higher than in previous years.

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