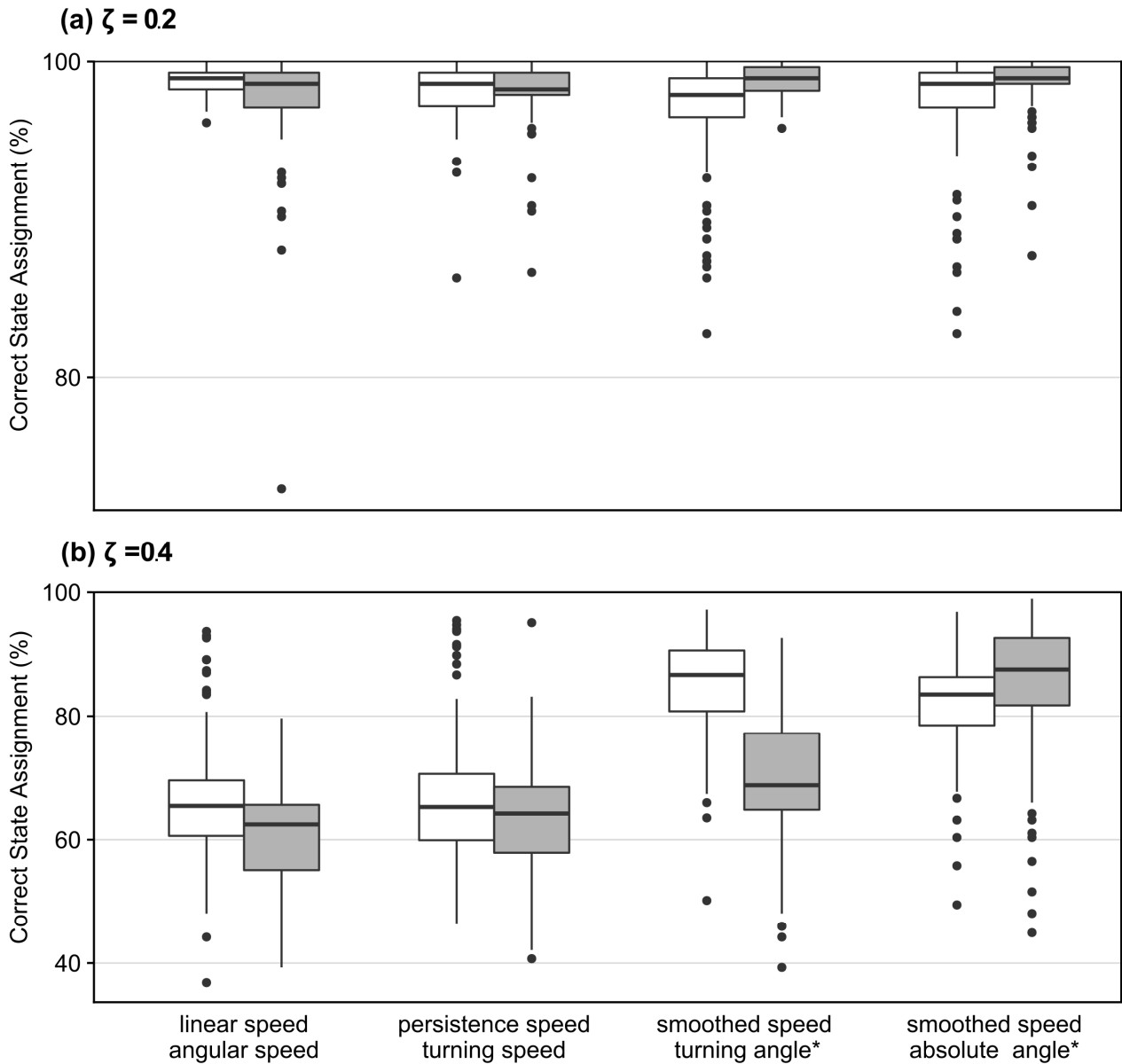# Supporting Information 3

Efficiency of segclust2d/segmentation-clustering for highlighting behavioural changes

1. Comparison with HMM for low (ζ = 0.2) and high (ζ = 0.4) noise levels

(a) ζ = 0.2

(b) ζ = 0.4

The boxplots show the proportion of correct state assignments, obtained for various bivariate signals when the true number of states is known ($M = 3$) with noise level ζ = 0.2 u (a) or ζ = 0.4 u (b), as estimated from 100 replicates. The star (*) indicates turning angles computed with a constant step length, in terms of arithmetic (α_i^*) or absolute ($|\alpha_i^*|$) values. The white boxplots show the results obtained with HMM-based R package momentuHMM (McClintock & Michelot 2018), with informative initial state-dependent probability distribution parameters set to their true values for the

various metrics in the different states (using the following distributions: Gaussian for persistence and turning speeds, $L_{i+1}\cos(\alpha_i)/\Delta t$ and $L_{i+1}\sin(\alpha_i)/\Delta t$, wrapped Cauchy for angular speed $\alpha_i/\Delta t$ and turning angle α_i^*, Weibull for linear speed $L_i/\Delta t$, smooth speed $(L_i+L_{i+1})/(2\Delta t)$, and absolute turning angle $|\alpha_i^*|$. The grey boxplots show the results obtained using the segclust2d/segmentation-clustering procedure with $L_{min} = 10$.

Reference: McClintock B.T. & Michelot T. 2018. momentuHMM: R package for generalized hidden Markov models of animal movement. *Methods in Ecology and Evolution* 9, 1518–1530. doi: 10.1111/2041-210X.12995

2. Estimation of the number of states
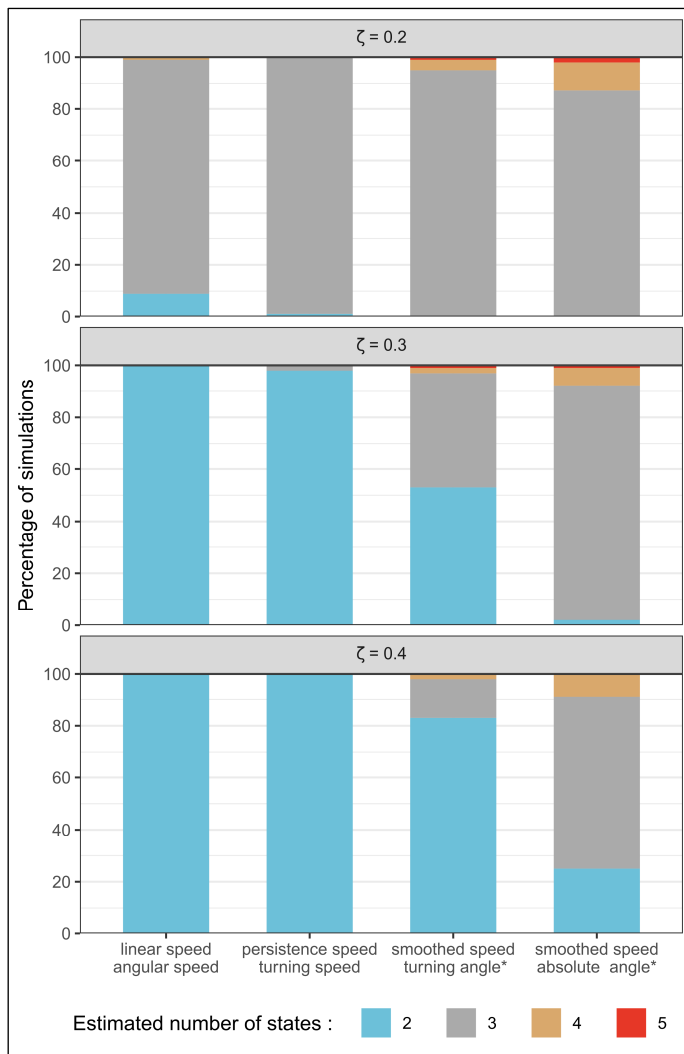
The various bars show the proportions of simulations resulting in a predicted number of states (i.e. behavioural modes) equal to 2, 3, 4, or 5, for the three noise levels considered ($\zeta = 0.2$ u, $\zeta = 0.3$ u and $\zeta = 0.4$ u) and the four types of couples of metrics considered. The true number of states is 3. The star (*) indicates turning angles computed with a constant step length, in terms of arithmetic (α_i^*) or absolute ($|\alpha_i^*|$) values. The couple of metrics leading to best segmentation when the true number of states is known – absolute turning angle computed with a constant step length and smoothed speed – also leads to the best estimation of the number of states, but this latter estimation is not fully satisfactory, and should be worse with actual data because of possible mixing of movement behaviours.