**Fig. S8. Model simulation of disorientation**. In the simulation, birds could transition between an undisturbed migratory state and a disoriented state. (a) Parameterizations of the distance-dependent disorientation probability $f$ (Equation 1). $a$ is the probability of disorientation. (b) Parameterizations of the angular Von Mises distribution $g$ (Equation 2) for the case of uniform ($\kappa = 0$), moderate ($\kappa = 0.2$) and weak ($\kappa = 0.1$) directed flight towards ALAN for birds in the disoriented state. $\kappa$ is the concentration parameter for disoriented flight, determining the extent to which birds fly towards ALAN when disoriented. When $\kappa = 0$, birds' flight paths follow a random walk; when $\kappa > 0$, birds fly toward the lights, with larger $\kappa$ implying a more directed flight towards the light source.