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Peer Review

Review of: "How Far from the Edge Does a Population Need to Be to Survive? A Probability Model"

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The author is interested in a Branching Random Walk (BRW) where an individual living at site x gives birth to an individual at a neighboring site y at rate λ. In addition, each individual dies at rate 1. The BRW is restricted to

$$I_N = \{-N, -N+1, \ldots, N-1, N\}$$

so that no births are allowed outside this finite domain.

It is shown that if $\lambda > \sqrt{2}/2$, the population on I_N survives for all $N \geq 1$, while if $\lambda \leq 1/2$, the population dies out for all N. The most interesting regime occurs when $1/2 < \lambda \leq \sqrt{2}/2$, where there exists a natural number N_c such that if $N < N_c$, the population dies out with probability 1, whereas if $N \geq N_c$, it has a positive probability of surviving.

In ecological terms, the author considers a population confined to a small, isolated habitat where no individuals can migrate in or out. This setting resembles a species living in a fragmented or non-contiguous environment. The results show that when the reproductive rate is high compared to the death rate, the population can persist in habitats of any size. When reproduction is too low, extinction is inevitable. Between these extremes, there exists a critical habitat size: populations in smaller patches

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eventually disappear, while those in sufficiently large habitats have a positive chance of surviving indefinitely. The study highlights how isolation and habitat size jointly determine long-term persistence.

The manuscript presents a clear and elegant analysis of a branching random walk with ecological interpretation. Its results are both mathematically rigorous and conceptually relevant, offering valuable insight into population persistence in fragmented habitats.

Declarations

Potential competing interests: No potential competing interests to declare.