The effect of demographic noise in MacArthur's resource-consumer model

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Abstract:

MacArthur's resource-consumer model aims to describe how the populations of different species evolve in time while competing for the same resources present in the ecosystem [1, 2, 3, 4]. The set of equations describing this dynamics have been treated as deterministic so far. We started looking at this dynamics from an individual-level point of view, introducing in the system the demographic noise and studying its effect in time [5].

We looked for the stationary solution of the deterministic model and we find that in a certain region of the model parameters the approach to the stationarity occurs displaying damped oscillations. We therefore analyzed the fluctuations due to the noise around the deterministic solution of the model and we found that the oscillations are no more damped but become persistent in time with a characteristic frequency.

In fact it was possible to compute analytically the powerspectrum of the fluctuations using standard techniques [6, 7] and we discovered that this has the usual bell-shape of the resonant phenomena. Hence the stochasticity introduced keeps alive the fluctuations leading to alternation of abundance of individuals in the population and a lack of resource followed by a reduction of the individuals and an increment of the nutrient concentration.

References

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