PUNCTUATED EQUILIBRIUM EVOLUTION: MATHEMATICAL MODEL

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Supplementary Information

**S1. Derivation of the evolutionary model of a transitive population.**

We have the following evolutionary model of a transitive population (see the main text of the article):



where *x*(*t*) is the density of transitive individuals and W and Y are the laws of self-production and mortality, respectively, which are determined based on the following equations:

 

where C and D are the maximum possible biota density and the rate of degradation of transitive individuals, determined by the internal laws of ecosystem functioning, respectively. Since , partial derivatives with respect to the parameters C and D have the following form:



where



 Thus, time derivative of the adaptability functional equals:



Define as follows:



As a result, we obtain an ordinary differential equation:



Let us find a particular solution to this equation in the form of a series



Derive *Z*.



As a result, we received a particular solution in the form of a series.



General system has the form



A more convenient form of the system describing the evolution of a transitive population: