Huillet, Thierry; **Möhle, Martin**

Population genetics models with skewed fertilities: a forward and backward analysis. (English) Zbl 1367.92074

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Summary: Discrete population genetics models with unequal (skewed) fertilities are considered, with an emphasis on skewed versions of Cannings models, conditional branching process models in the spirit of Karlin and McGregor, and compound Poisson models. Three particular classes of models with skewed fertilities are investigated, the Wright-Fisher model, the Dirichlet model, and the Kimura model. For each class the asymptotic behavior as the total population size N tends to infinity is investigated for power law fertilities and for geometric fertilities. This class of models can exhibit a rich variety of sub-linear or even constant effective population sizes. Therefore, the models are not necessarily in the domain of attraction of the Kingman coalescent. For a substantial range of the parameters, discrete-time coalescent processes with simultaneous multiple collisions arise in the limit.

MSC:

92D10 Genetics and epigenetics
92D25 Population dynamics (general)
60J10 Markov chains (discrete-time Markov processes on discrete state spaces)
60K35 Interacting random processes; statistical mechanics type models; percolation theory

Keywords:

ancestral process; Cannings model; compound Poisson model; Dirichlet model; Dirichlet-Kingman coalescent; duality; evolutionary processes; exchangeable coalescent; Karlin and McGregor model; Kimura model; Kingman coalescent; population dynamics; simultaneous multiple collisions; Wright-Fisher model

Full Text: DOI

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