

## Accepted Manuscript

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PII: S0022-5193(18)30297-2  
DOI: [10.1016/j.jtbi.2018.06.005](https://doi.org/10.1016/j.jtbi.2018.06.005)  
Reference: YJTBI 9500

To appear in: *Journal of Theoretical Biology*

Received date: 15 February 2018  
Revised date: 1 June 2018  
Accepted date: 4 June 2018

Please cite this article as: Kalle Parvinen, Hisashi Ohtsuki, Joe Yuichiro Wakano, Spatial heterogeneity and evolution of fecundity-affecting traits, *Journal of Theoretical Biology* (2018), doi: [10.1016/j.jtbi.2018.06.005](https://doi.org/10.1016/j.jtbi.2018.06.005)



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# Spatial heterogeneity and evolution of fecundity-affecting traits

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June 5, 2018

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## Abstract

2 It is widely recognized that spatial structure in a population has some,  
 3 and occasionally great, impacts on ecological and evolutionary dynamics.  
 4 However, it has been observed that in the homogeneous Wright's island  
 5 model with a certain standard demographic assumption, spatial structure  
 6 does not affect the fitness gradient of a fecundity-affecting trait. The loca-  
 7 tion and convergence stability of singular strategies thus remain unchanged.  
 8 Furthermore, evolutionary branching is impossible for small dispersal rates,  
 9 and for a wide class of fecundity functions, evolutionary branching is impos-  
 10 sible for any dispersal rate if branching does not occur in the corresponding  
 11 well-mixed model. Spatially homogeneous structure thus often inhibits evo-  
 12 lutionary branching. Here we study the impact of spatial heterogeneity  
 13 on evolutionary dynamics. We consider an infinite Wright's island model,  
 14 where different islands have different capacity and fecundity consequences,  
 15 and therefore the population is spatially heterogeneous. Through the anal-  
 16 ysis of metapopulation fitness, we derive its first-order and second-order  
 17 derivatives with respect to mutant's trait, which are explicitly represented  
 18 in terms of fecundity derivatives. The selection gradient turns out to be a

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