Metacommunity capacity of complex life-cycles in disturbed landscapes

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Addresses

Running title:

ABSTRACT

Keywords: Metacommunities, patch dynamics, dispersal dynamics, individual-based model, approximate Bayesian computing,

INTRODUCTION

Metapopulation models predict the survival of highly-disperse populations regardless local depletion of species (Hanski, 1999; Akçakaya et al. 2007). However, habitat loss and fragmentation may be so extensive that result in a massive species extinction (Montoya, 2008; Rybicki & Hanksi, 2013; Haddad et al. 2015). Model predictions have shown that a decrease in connectivity among assemblages, from continuous to sparsely-distributed populations is accompanied by species loss (Metzger et al. 2009; Niebuhr et al. 2015). The role of natural (e.g. stochastic events) and human-induced (e.g. pollution, harvesting) perturbations have been extensively studies in the last decades (Dornelas, 2010 and references therein) and it has been frequently studied in ecological theory (e.g. Volkov et al. 2007; Gardner & Engelhardt, 2008). The degree of anthropogenic pressure may be a capital factor for landscape connectivity, since directly affects the persistence or decrease of assemblages (Supp & Ernest, 2014). Besides perturbations, dispersal rates in disturbed landscapes need to be high in order to maintain viable populations (Provan et al. 2009). However, individual-based models (IBM) are needed to predict dispersal rates in species where small specimens, i.e. juveniles, are not reproductively active and even larger-sized adults harbor the highest reproductive potential (e.g. Hendricks & Mulder, 2008; Werner & Griebeler, 2011).

IBM simulate populations as being composed of discrete individual organisms (DeAngelis & Grimm, 2014; Van der Väart et al. 2016). In IBMs the actions of single individuals are simulated and they interact with other and the landscape they live in (DeAngelis & Mooij, 2005). They incorporate attributes vary among the individuals and can change through time such as, growth, foraging, dispersal and reproduction, among others (Martin et al. 2013; DeAngelis & Grimm, 2014). These models have been used as size-structured methods to integrate a high variety of data which output are pivotal for

management purposes (Punt et al. 2013) and conservation strategies (Nabe-Nielsen et al. 2014).

We herein develop metacommunity models based on individuals of two intertidal species. The first model assumes that dispersal rates between patches are distance-dependent, with low rates between highly-separated assemblages. The second model assumes that dispersal rates are positively correlated to individual density. The third model assumes that larger individuals have larger reproductive potential. The fourth model considers a low probability of dispersal to peripheral assemblages relative to central ones.

We confront the model with long-time series data (1994-2014) of two commercial limpet species (*Patella candei crenata* and *P. aspera*) in an overpopulated island (>500 inhab km^{-2}) with a high coastal pressure (Riera et al. 2016). TEXT ABOUT RESULTS AND CONCLUSIONS!!

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