Invasion dynamics of an amphibian with frequent human-mediated translocations on the Andaman archipelago

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Abstract

Island communities can be highly susceptible to invasions, but also provide unique opportunities to manage invasions. Post species introduction to islands, human-mediated translocations (HMT) can alter the course of invasions by accelerating invasive spread. Therefore, modelling of invading organisms requires accounting for HMT along with complexities in species demography, spatial context, and natural dispersal. We aim to disentangle these invasion dynamics for the Indian bullfrog, *Hoplobatrachus tigerinus*, on the Andaman archipelago (Bay of Bengal, India) to assess i) the effect of HMT on colonization rates, and ii) the efficacy of two potential management interventions in limiting invasive spread. We combined an age-structured demographic model allowing stage-based dispersal with a gravity model of human influence, in a spatially explicit modelling context. We parametrized the model using life-history and dispersal variables from *H. tigerinus* (or similar species), and remote-sensed variables describing spatial heterogeneity. The modelled invasion dynamics of *H. tigerinus* shows human influence can increase spread rates by a factor of three, as compared to invasion without human influence on spread. Such exacerbation of spread rates is driven by facilitation of both between and within island movements of *H. tigerinus* by humans. The model also predicted an overriding effect of HMTs on the origin of invasion. Of the two simulated management interventions, only constraining movement of *H. tigerinus* between islands was effective in limiting spread, but success was dependent on time elapsed since introduction. Based on model predictions, we find merit in recommending screening at points of entry (e. g. ports) for the hitherto uncolonized Baratang and Long Islands. Although the model provided insights into the human influence on invasive spread in an archipelago context, it did not perform optimally in estimating demographic dynamics and natural dispersal. We demonstrate the suitability of this modelling approach in understanding invasions with persisting human influence, especially in island systems.

Keywords: island invasive, Hoplobatrachus tigerinus, Indian bullfrog, management, invasive spread

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