Learning about colonization under an adaptive management framework

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Abstract: Adaptive management is a framework for resolving key uncertainties while managing complex ecological systems. Its use has been prominent in fisheries research and wildlife harvesting; however, its application to other areas of environmental management remains somewhat limited. Indeed, despite the considerable uncertainty surrounding metapopulation restoration, adaptive management has not been used to guide and inform such restoration actions. In this study, we determined how best to learn about the colonization rate when managing metapopulations under an adaptive management framework. We developed a mainland-island metapopulation model based on the threatened bay checkerspot butterfly (*Euphydryas editha bayensis*) and assessed three management approaches: adding new patches, adding area to existing patches and doing nothing. Using stochastic dynamic programming, we found the optimal passive and active adaptive management strategy by monitoring colonization of vacant patches. Under a passive adaptive strategy, increasing patch area was best when the expected colonization rate was below a threshold; otherwise, adding new patches was optimal. Under an active adaptive strategy, it was best to add patches only when the colonization rate was certain to be high. This research provides a framework for managing mainland-island metapopulations in the face of uncertainty while learning about of the dynamics of these complex systems.