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HARVESTING A TWO-PATCH PREDATOR-PREY METAPOPULATION

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ABSTRACT. A mathematical model for a two-patch predator-prey metapoplation is developed as a generalization of single-species metapopulation harvesting theory. We find optimal harvesting strategies using dynamic programming and Lagrange multipliers. If predator economic efficiency is relatively high, then we should protect a relative source prey subpopulation in two different ways: directly, with a higher escapement of the relative source prey subpopulation, and indirectly, with a lower escapement of the predator living in the same patch as the relative source prey subpopulation. Numerical examples show that if the growth of the predator is relatively low and there is no difference between prey and predator prices, then it may be optimal to harvest the predator to extinction. While, if the predator is more valuable compared to the prey, then it may be optimal to leave the relative exporter prey subpopulation unharvested. We also discuss how a 'negative' harvest might be optimal. A negative harvest might be considered a seeding strategy.

KEY WORDS: Fisheries, harvesting strategies, predator-prey metapopulation, seeding strategy.

1. Introduction. This paper studies optimal harvesting strategies for a two-patch predator-prey metapopulation. The dynamics of the predator-prey metapopulation is defined by four coupled difference

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