Supplementary Information

Come from (supplementFigs.R and sensitivityAnalysis\_Doc.Rmd scripts)

Increases in harvest can drive regime shifts.

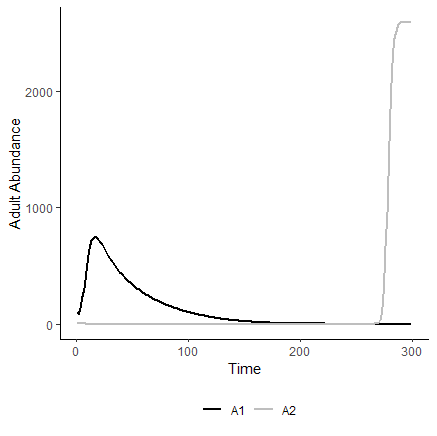


Figure S1. Increases in harvest over time can drive a regime shift in our system.

In the absence of harvest on either species, declines in refuge availability cause declines in abundance, but the initially dominant species is able to maintain dominance because both species juveniles are equally affected by loss of refuge (Fig S2).

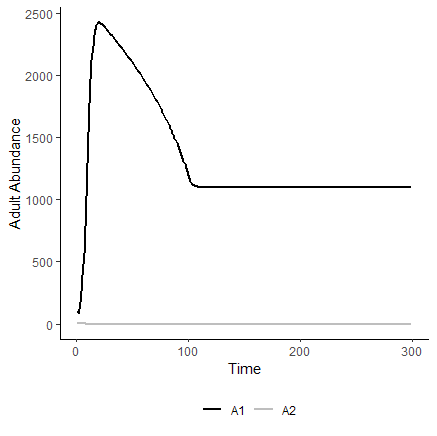


Figure S2. Declines in habitat over time cause declines in abundance but not a regime shift when no harvest is present.

Model dynamics for scenarios where the manager’s goal is to flip the system from species 2 to species 1 are similar to the maintain scenarios presented in the main text (Fig 2 and S3). The magnitude of management action necessary to achieve the desired outcome (species 1 dominance) is larger in the flip scenario in order to overcome the initial dominance of species 2.

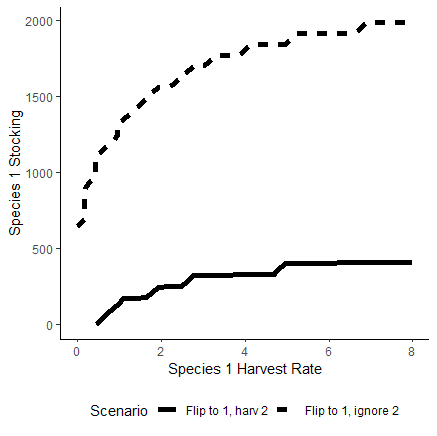


Figure S3. Isoclines here separate different outcomes for two management approaches. Species 1 dominates in areas above line. Areas below the isoclines represent outcomes where species 2 dominates. In this model experiment, species 2 is initially dominant and the management goal is to flip the system towards species 1. Solid line separates outcomes when the manager considers species interactions, while the dashed line separates outcomes where the manager only manages species 1.

Tradeoffs in managing species 1 or its competitor allow the similar outcomes to be achieved through different actions. The magnitude of action necessary to flip the system towards species 1 increases as harvest of species 1 increases.

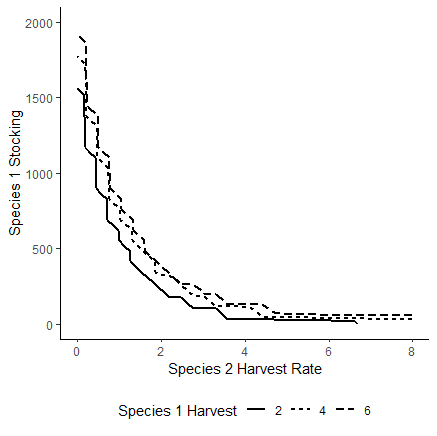


Figure S4. Stocking of species 1 and harvest of species 2 can, on their own, result in flipping to the desired stable state of a system (species 1 dominance). Tradeoff between stocking and competitor harvest are presented for various levels of harvest on species 1 (solid and dashed lines). Areas above/to the right of the lines represent positive outcomes (species 1 dominance), areas below/to the left represent maintenance of species 2 dominance. The negative relationship between stocking species 1 and harvesting species 2 allows managers to achieve similar outcomes through implementation of either strategy or a combination of both.