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We present a discrete-time model for a population of predatory cichlid fish known to exhibit frequency-dependent selection. We construct the model by incorporating both population genetic and population dynamic processes. We show the model predicts a temporal phenotypic oscillation in mouth-handedness, which coincides with field data and is driven by the defense mechanism of the prey species. Furthermore, our analysis indicates a previously unknown and, perhaps, unexpected feature of the oscillation. We will discuss the different routes to destabilizing a 1:1 phenotypic ratio and their biological implications. (Received September 16, 2008)