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We consider a chemostat model of n species of microorganisms competing for two or three growth-limiting resources. We show that the rock-paper-scissors (winnerless, or heteroclinic cycles) competition outcomes are not possible when there are only two limiting resources. However, when there are three resources, winnerless cycles do exist for up to six species. By introducing one new species into an existing winnerless cycle at a time, we are able to see if the new species invades the system. We conjecture that three resources cannot support winnerless cycles for seven species. This coincides with the numerical results by Huisman and Weissing [Nature, 402(1999), pp407–410] which strongly suggest that up to six species can be supported by three resources. (Received September 23, 2005)