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Rosenweig-MacArthur Questions

1. How dynamics different from Lotka-Volterra

The Lotka Volterra and Rosenweig MacArthur models are different because the Rosenweig-Macarthur model includes a carrying capacity for the predators and limits the amount of prey that the predators can kill per unit time. The positive factor of prey growth is represented by bH(1-αH**)**, rather than simply bH in the Lotka-Volterra. In the Rosenweig-Macarthur model, the birth rate is multiplied by the prey population, times one minus the current prey population divided by the carrying capacity. The RW model also replaces the simple attack calculation “a\*H” in the LV model with w(H/d+H). “w” replaces “a” and (H/d+H) replaces H. As H becomes very large then this quotient increases closer and closer to 1.

1. Role of each parameter, what causes different between L-V, R-M
   1. “b” is the birth rate for the herbivores. A high birth rate allows prey growth to outpace prey death from predators immediately, a low birth rate causes prey to decrease before rebounding when predators become low enough. “b”’s effect is not limited by carrying capacity in the LV model. “b\*H” is multiplied by zero when H = k in the RM model.
   2. “e” is the conversion efficiency from herbivores to predators. High “e” allows the predator population to recover cyclically as herbivore population increases in the RM model, vs. low “e” causes decrease to 0. “e”’s effect is limited by the limit of predator response via (H/d+H)
   3. “s” is the predator death rate. It functions identically in both models, having a negative effect on predator growth rate.
   4. “w” is the substitute for the “a” predator attack rate. Unlike in the LV model, the “w” is also affected by the (H/d+H) factors, which approaches 1 as H gets very large
   5. “d” modifies the predator attack rate along with the prey population.
   6. “α” is 1/k, or the inverse of the carrying capacity. Α limits the growth caused by prey birth rate. When H = α, bH(1-αH) = 0. This carrying capacity factor does not exist in the LV model.
2. Relationship between parameter values and predator abundance
   1. High “b” is beneficial for predator abundance, increasing the amount of prey available for the conversion expression or prey to predator.
   2. High “e” is beneficial for predator abundance, controlling how well predators able to grow given a certain number of prey
   3. High “S” is harmful for predator abundance, increasing the rate at which they die off.
   4. High “w” is beneficial for predator abundance, increasing attack frequency, allowing predators to grow and recover when prey increase
   5. High “d” is harmful for predator abundance. As “d” gets larger, it reduces the conversion of prey to predators associated with attack frequency
   6. Low “a” is beneficial for predator abundance. “a” is the inverse of carrying capacity, and a high carrying capacity allows enough prey growth to allow to conversion to predator population