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|  |  | .navigate |  |  | we don't need no .introduction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |
|  | [[home](http://docs.google.com/index.htm)]  [[abstract](http://docs.google.com/abs.htm)]  [[introduction](http://docs.google.com/intro.htm)]  [[hypothesis](http://docs.google.com/hypo.htm)]  [[experiment](http://docs.google.com/exp.htm)]  [[data](http://docs.google.com/data.htm)]  [[conclusion](http://docs.google.com/conc.htm)]  [[we recommend](http://docs.google.com/rec.htm)]  [[daily log](http://docs.google.com/log.htm)]  [[other](http://docs.google.com/other.htm)]  [[bibliography](http://docs.google.com/bib.htm)] |  |  | ***Predator-Prey Interaction***          There are several very famous predator-prey models that were derived to describe the interactions of predators and prey.          The Lotka-Volterra model was developed by Lotka in 1925 and by Volterra in 1926 independently.  It is the simplest way of modeling predator-prey interactions.          The basic equation of the Lotka-Volterra model is:          dH/dt = r\*H - aHP          dP/dt = bHP - mP          H is the prey density          P is the predator density          r is the rate of the prey population growth          a is the consumption rate of the predators (the rate the predators eat prey)          b is the reproduction rate of the predators per each prey eaten          m is the death rate of the predators   |  |  | | --- | --- | |  |  | | The only difference in the pictures above are the size of the initial values of the populations.  The Lotka-Volterra model does not crash; it simply cycles endlessly. | Most models are graphed parametrically, as seen here. |          The Lotka-Volterra model is a very simplistic way of simulating predator-prey interactions.  It doesn't take into account any other factors besides the basic predator-eats-prey interaction (Alexei).           Another model, the Nicholson-Bailey model (created in the 1930's), is a much more complex simulation of predator-prey interaction.  It was originally developed for simulating parasite-host interactions, but also works for predator-prey interactions.  The model is based on a ecosystem where predators search for their prey at random (i.e. no selection) and that predators and prey are distributed in a "clumped" fashion.  The basic equation for this is (also notice it's not a differential equation):         Nt+1 = L\*Nte-a\*Pt         Pt+1 = Nt\*(1 - e-a\*Pt)         the variables and constants:         Nt = at time t, the number of prey         Pt = at time t, the number of predators         L = the reproductive rate of the prey         a = the area of discovery         In order to derive the model, Nicholson-Bailey began with a simple equation that gave the number of encounters between the predators and the prey, Nencounter:         Nencounter = a\*Nt\*Pt         Earlier we said that "a" was "the area of discovery".  What that means is "a" is a constant rate describing the encounters between prey and a single predator.  Mathematically, this is:         a = Nencounter/Nt         Nicholson-Bailey used the following equation (the Poisson model) to approximate the probability of encounters:         P(x) = e-ax\*(axx/x!)         P(x) is the probability of x occurances         Ax is the average occurance of x         When solved for 0 occurences, or the probability of no attacks:         P(0) = e-ax\*(Ax0/0!) = e-ax         When substituting Ax = Nencounter/Nt         P(0) = e-(Nencounter/Nt)         Since we earlier defined Nencounter = a\*Nt\*Pt multiplying both sides by Nt gives us Nencounter/Nt = a\*Pt and through substitution, we get the probability of being encountered 0 times:         P(0) = e-a\*Pt         Therefore, the probability of being encountered more than 0 times is:         P(>0) = 1 - e-a\*Pt         Which is how Nicholson and Bailey derived:         Nt+1 = L\*Nte-a\*Pt         Pt+1 = Nt\*(1 - e-a\*Pt)  The Nicholson-Bailey model is very unstable.  It is only stable when Nt+1 = Nt and Pt+1 = Pt at all other times (when the population size of predators or of prey change) the system becomes unstable and the populations become extinct (Sharov).  [[prev](http://docs.google.com/intro.htm)]|[[next](http://docs.google.com/intro3.htm)] |  |
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