

HW#3

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1. (6.1) Concepts of stability of mathematical models, are I feel likely to be useful in understanding observations of communities in nature because they provide us with an expectation of what we should observe under certain parameters. Deviation from these expectations (e.g. variation in birth rate, population size after t years, etc) can provide ecologists with information not immediately observable that would explain parameter deviation. For example, smaller population sizes than those predicted by a mathematical model could suggest competition parameters not previously observed. Thus, although often idealized and not always a perfect match to actual trends, in population ecology, models still relay useful information.

(6.3) When there is competition between species 1 and 2, both dF_1/dN_2 and dF_2/dN_1 will be negative.

When there is a predator-prey dynamic between species 1 and 2, dF_i/dN_j will be positive for the predator (i) and dF_j/dN_i will be negative for the prey (j).

When there is competition between species 1 and 2, we could expect either negative values for one (who is being out-competed) or positive values < 1 for both when the better competitor has yet to be determined.

2) In Chapter 6, α_{ij} describes the "community matrix", which is used to quantify the effect that a specific species has on itself and another species, in terms of growth rate.

In Chapter 7, α_{ij} also denotes the effect of species j on species i (in terms of growth rate).

However, in Chapter 6, α_{ij} can be expanded as:

$$\alpha_{ij} = \frac{dF_i}{dN_j}, \text{ where } dF_i \text{ and } dN_j \text{ are partial derivatives}$$

of the two species' growth rates which will be used to solve for an equilibrium point between the two species at which there is population stability.

In Chapter 7, α_{ij} is used in the logistic model to solve for the growth rate of each species in the form of an isocline. I think it would have been best for Hastings to simply use a different variable in one chapter, like γ .

3) The ultimate outcome of increasing the parameter p is that the overall population of New York City gradually decreases with time.