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Research Article

Ecological Connection and Food Web of Prey and Predator: Mathematical Modeling

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ABSTRACT
A model is just a simplified representation of part of the real world. Part of the skill in modelling is in choosing the components to model, including the things which will be necessary but not putting in everything you can think of**.**

In the growing changes in mathematical application day by day, various models have been applied for the study of ecology some can be unfolded by true ecological situation models in the vast spread found on the surface of earth, every living animal it is therefore said that survival of strong animal eat the small or weak animals.

The nature is verily divided into a major group of models can be applied for the in-depth study of the ecological connection and the food cycle. In this research paper an attempt has been made to untold the grater mysterious of nature by using study. It is the also attempt in this paper to pt some models where the parameters of the biological growth models systematic ally change in the course of time the growth rate of the predator depends upon predation on the models and alternate prey. There are five growth models taken for this study as sample.

Keywords: Mathematics, Ecology, Models, Application, prey, predators.

INTRODUCTION:

A model is a representation of a system (or object, or phenomenon).The model is called an adequate one if it is appropriate for the purpose (or goal) in the mind of the model builder. Otherwise it is called an inadequate model.

The purpose in mind of the model builder. Otherwise, it is called an inadequate Mathematical model. This implies that in model building one needs to define the purpose of modelling and also the criterion for testing the adequacy of the model. The abstract formulation, involving symbols, makes no sense outside of mathematics.

The relationship between predators and their prey has provided a lively topic of discussion for groups of humans ever since they began gathering around the fire or, now, the seminar table. Historically, people have seen large predators not only as dangerous to themselves and their families, but also as competitors for the prey they were seeking. The large number of fables and fairy tales involving wolves, lions, and tigers attests to their prominent role in human culture

The competition and predator–prey equations of Lotka (1925) and Volterra (1926, 1931) stimulated the laboratory work of Gauss (1932, 1934), Park (1948, 1954), Huffaker (1958), and others. Elton (1924), Erdington (1946), Lack (1954), Connell (1961a, 1961b), Paine (1966), Krebs et al. (1995), and many others brought population ecology into the field, where its theoretical underpinnings are constantly tested.

We shall derive the biological models, and then we do the non-dimensional analysis to reduce the model to a simple model with fewer parameters. We shall only do the elementary analysis, for example, the linearized stability analysis or heuristic argument for the models. The usage of the word model is large and varied in both the everyday sense as well as in the technical sense. The sense in which it is used in the books discussed in this paper is given by the following definition:

The representation always contains less information than the system it represents. This is important, for the representation should contain only relevant information that is appropriate for the purpose in mind. As such, a model can be viewed as a simplification or idealization of the system. Models are of many different types and we shall not go into their taxonomy. We focus our attention on two types: (i) system characterization;

(ii) Mathematical models.

A system characterization is a descriptive model of the system. The description is done in terms of variables and relationships between variables. The system characterization can be either verbal or in terms of a flow diagram. It can be either adequate or not depending on the purpose. A mathematical model is a symbolic representation involving an abstract mathematical formulation.

Sun is the very important for all living thing without the sun the plants would not grow, without plant there would be no animals. A food is something math provides nutrients energy for activity gravity of all functions of body such as breaking, digestion food and keeping worm, material for the growth and repaired of the body and for keeping the immune system health.

All living things need food for them the energy to grow and move. A food chain shows such living things gets is good its food. It shows who beating who a food web consist of many food chain. A food chain only follows just one as animal find good. A good web sow the many different path plants and animals are commercial gross is eaten by grasshopper is easterly by toad is eaten by snake is eaten by it hawk.

The Lotka–Volterra equations

The first well-known models of predator–prey interactions can be traced to Lotka (1925) and Volterra (1926). Although the Lotka–Volterra model has been critiqued on many grounds (May 1975a, 1976c), it is still well respected, and forms the basis for models still in use today. As Hudson and Bjørnstad (2003) put it, the fundamental theory of predator–prey interactions encapsulated in the worthy Lotka–Volterra model predicts cycles in prey and predator abundance.

The Lotka–Volterra model, like most predator–prey models, consists of two parts. The prey population grows according to a simple exponential or logistic model. Subtracted from these are losses due to predation. These losses are due to the overall predation rate, which it self consists of two parts. The numerical response of the predator is a function of an increased rate of reproduction, an increase in immigration, or both. The second factor, which increases the overall predation rate, is the rate of consumption of prey per individual predator, the functional response. In the prey equation, the rate of growth is decreased by the overall predation rate, which is a function of both the numerical and functional responses of the predator. The predator equation also consists of two parts. The growth of the predator population is a function of the overall predation rate, and is similar to the negative part of the prey equation. The growth rate of the predator is then decreased by a mortality factor, which can be either density-independent or density-dependent.

Limitations of Mathematical Models

From the wide-spread use of mathematical models, it is evident that Western culture has placed a significant amount of trust in the mathematical modelling process. Often this trust is bolstered by achievements in areas like engineering, medical imaging, automobile designing, etc. Mathematical modelling has had less success in areas such as ecology, human behaviour, long-term weather forecasting, and in systems where predictability is limited to statistical descriptions. In these areas, however, there seems to be an increasing reliability on the predictive power of mathematical modelling and simulation, as the modelling process iterates closer to the "true" model. Is it really possible to iterate toward the true model?

Some key concepts

Community:

Community is the worth gently, into the even merits and entire rematch, the show understand how to pair content with.

Trophic level

The concept of tropic level was developed Raymond Lindeman (1942), based on the terminology of August Thienemann (1926).Tropic level of an organism is the position it occupies in a food web. A food web chain is a succession of an organism that eats other organism and many, in turn, be eaten themselves. The trophies level of an organism is the number of steps it is the form start of the chain.A tropic is the group level of organism within an ecosystem which occupies the same level in a food chain.

Ecological interaction:

The relation between species that live together in community, especially the effect in an individual of a one species may be exerting on an individual on another species.

Importance of interaction:

Individual organisms live together in an ecosystem and depend on one another. Infarct they have many different types of interaction with each other and many of these interaction are critical for there description the different way of an organism obtain their food and energy.

Organism occupies what are called niches. Niche includes the physical space in which prey they lives, how they use the resources that one in that space, and how they interact with other organism to that spaces the interaction among organism in that space the interaction among niches can be characterized into five types of relationship.

The different types of interaction have different effects on two participants which may be positive (+) negative (-) or natural (0)

Predation, Completion, commensalism, Mutualism, Parasitism

Predation and competition can also be considered as form of symbol. Systems refer to a close relationship in which one or both organisms obtain a benefit. Last three substance are classically defends relationship extorting symbiosis.

(C) Commensalism: Commensalism is a relationship in which one organism benefited while the other is neither helped her harmed. (+/0 interaction).

(D) Mutualisms: Mutualisms is a relationship in which both species beneficial mutualisms interaction matters occurs in three forms obligate mutualism is which one species cannot survive a part form the another. (+/+ interaction).

(E) Parasitism: Parasitism is a relationship in which harmed, but not always killed the organism that benefit is called the parasite and one that is harmed is the host parasitism is the host is different from parasitism, which is when the host is always killed, such as when one organism lays its egg another organism that is later eaten by the hatchings. Parasite can be eaten by the hatching (+/-interaction).

Models are everywhere

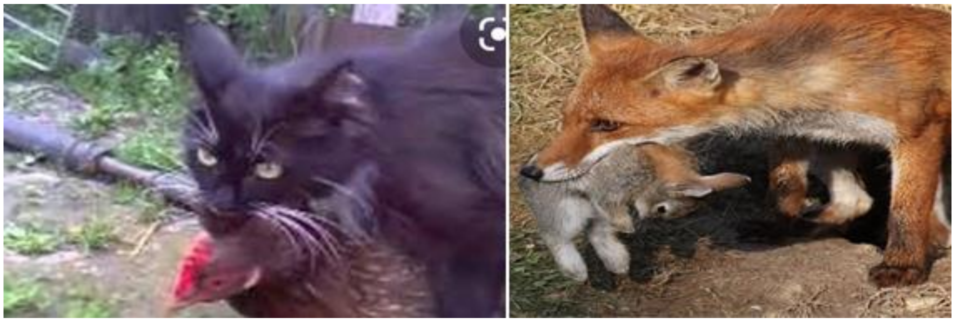
(A) Predation: Predation is which one organism eats another organism to obtain nutrients the organism that is eaten is called the prey (+/-interaction).

This figure shows a prey –predator system where the predator species is commensally on the prey species. In this model, in the absence of the predator (B) ,the prey specie (A) follows density dependent logistic growth with g as its intrinsic growth rate, and C is the carrying capacity of the environment. In the presence of the predator, the growth of prey is reduced due predation of B on A. In the absence of prey, the predator species dies out exponentially at a rate p.On predation the rate at which this food adds to the growth of the predator population is given by the conversion rate β.The rate of change of the prey (dA/dt) and predator (dB/dt) population with time are governed by equations. This interaction follows of hyperbolic function, the hyperbolic function are defined as combination of exponential function. The derivative of hyperbolic function can be easily found as these function in terms of exponential function.

$$\frac{dA}{dt} = gx\left(1 - \frac{A}{c}\right) - \frac{\alpha xy}{\gamma + x}$$

$$\frac{dB}{dt} = y\left(-p - \frac{\beta\alpha x}{\gamma + x}\right)$$

$$\frac{dA}{dB} = \frac{gx\left(1 - \frac{A}{c}\right) - \frac{\alpha xy}{\gamma + x}}{y\left(-p - \frac{\beta\alpha x}{\gamma + x}\right)}$$



(B) Completion: Competition is which individual population for the same resources and can our which or between species. When organism complete for a resources (such as food or building materials) it is called consumptives or exploitative competition it is called consurmrive or exploitative competition. Which they complete for terrority, it is called interference completion, when they complete for new territory by arriving there first it is called preemptive completion an example is lion and Hypnos that complete for prey. (-/- interaction)

A host parasite model: Explores the interaction of an insect parasite (predator) and an insects host prey. One example of such an interaction is the adzuki been weevil (Callosobruchus chinesis) host with a larval (Heterrrospilus prosopidis) parasite. This model is an example of what we term a theoretical model which means its purpose is to explain observed behavior rather then to predict accurate numbers. This models purpose is to see if oscillating population are predicted from reasonable and standard assumption or whether further mechanism are required. Here we observe the logistic used as a component in a more completed model.

The first assumption is that in the absence of Predation, the prey population follows a logistic equation by using system of recurrence relation.

$$P(n+1) - P(n) = L\left(1 - \frac{P(n)}{M}\right)P(n) \qquad (1)$$

Where P(n) is the population of the prey in year or year or generation n, L is the length rate when P(n)<M and M is the carrying capacity.

In the presence of predator equation (1) must be modified to take predation into account. The predation term is a significant part of the process. It is common to assume that the prey lost due to the predation is proportional to the product and the number of prey. We see it here, but again emphasize that is an assumption not a law with predation term the prey equation becomes.

$$P(n+1) = L\left(1 - \frac{N(n)}{K}\right)P(n) + P(n) - CP(n)N(n) \qquad (2)$$

Where p(n) is the size of the predator population at time n and C is a proportionality constant which can be through of as a measure of predator efficiency.

Another common assumption in predation-prey models is to assume that the predator population is proportional to the product of the prey population. In other words, the growth rate of the predator population is proportional to the number of prey killed.

Thus

$N(n+1) = QP(n)N(n)$ (3)

Where Q is a proportional constant which can be through of as measuring the efficiency of utilization of prey for reproduction by predators.

$P(n+1) – P(n) = l\left(1 - \frac{P(n)}{M}\right)P(n) - CP(n)N(n)$ (4)

$N(n+1) = QP(n)N(n)$ (5)

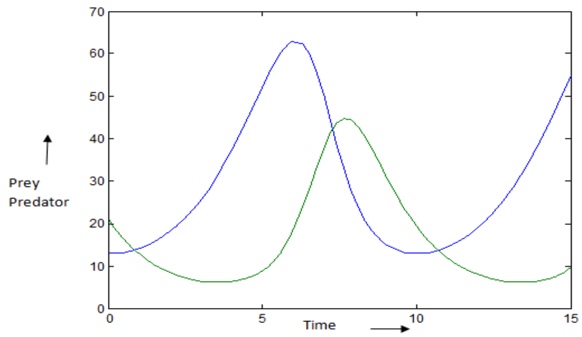
Replacing all P's and N's by P's and N's yields

$\overline{P} = L\left(1 - \frac{\overline{P}}{M}\right)\overline{P} + \overline{P} - C\overline{P}\overline{N}$ (6)

$\overline{N} = Q\overline{P}\overline{N}$ (7)

This is a nonlinear system of equation.

The complexities of parasite–host interactions rival those of mutualisms. Parasites range from endoparasitic viruses to ectoparasitic ticks, and we lack an understanding of the life cycle of most parasites in organisms other than humans. What we do know is often based on models of human diseases and their modes of transmission. Parasitism can also involve complex behavioural interactions such as brood parasites or slave-making ants.



CONCLUSION

Be a mathematician, or even very good at using mathematics, to make effective use of Models in your research. A mathematical model is a set of equations that represent interconnections in a system and can be worked out either by hand or by using a computer.The meaning of mathematical knowledge ultimately comes from physical realizations of mathematical assumptions and extensions of observations. Confidence in the correspondence assumption and human insight is the foundational element of mathematical modelling.

A functional response by the predator which includes a significant handling or digestion time (energy) component can stabilize a predator–prey interaction if the prey population is kept at low densities. Once the prey population escapes and becomes so large that the functional response of the predator has reached the plateau, the effect is destabilizing. Unless there is also a numerical response by the predator population, the overall predation rate would become inversely density dependent.

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