Ecological Archives **E090-115-A1**

Abhyudai Singh, William W. Murdoch, and Roger M. Nisbet. 2009. Skewed attacks, stability, and host suppression. *Ecology* 90:1679–1686.

Appendix A: Different interpretations of risk

We introduced the discrete-time model (4)-(5) in the paper by assuming that host larvae face different mortality rates depending upon the attack rate of the parasitoids. An alternative way to introduce variability is to assume that all larvae have same mortality rate, i.e. same value of c, but are exposed to the parasitoids for different durations. Hence, risk is now defined in terms of T, the length of time a larva is exposed to attack. In such a case we have the discrete-time model

$$H_{t+1} = RH_t \int_{x=0}^{\infty} p(x) \exp(-xcP_t) dx \tag{A.1}$$

$$P_{t+1} = k(RH_t - H_{t+1}) \tag{A.2}$$

where now $p(x)$ represents the distribution of time exposed to parasitoids, T, across the larval population. Another way to define risk would be through the product cT. Hence not only do the host larvae face different mortality rates but also this mortality rate acts for different durations T. In this scenario we have the following discrete-time model

$$H_{t+1} = RH_t \int_{x=0}^{\infty} p(x) \exp(-xP_t) dx \tag{A.3}$$

$$P_{t+1} = k(RH_t - H_{t+1}) \tag{A.4}$$

where now $p(x)$ denotes the distribution of cT values across the host larval population.

A general way to define risk, which will also lead to the discrete-time model (A.3)-(A.4) would be by $\int_{\tau=0}^{T} c(\tau) d\tau$ where now $c(\tau)$ represents the attack rate that a host larva faces at a time instant τ in the larval stage and $\tau = 0$, $\tau = T$ correspond to start and end of the larval stage, respectively. All the above ways of defining risk are special cases of this. As in the Nicholson-Bailey model both c and T appear together, so all these different ways to define risk lead to the same form of the discrete-time model, give or take some constants.