

Equilibrium

The equation for change in population size is:

$$dN/dt = (b + i) - (d + e).$$

In words, this equation states that the change in the population size (dN) over time (dt) is equal to the number of births (b) plus the number of immigrants joining the population (i) minus the number of deaths (d) plus the number of emigrants leaving the population (e). In short, a population change is determined by subtracting the total number of individuals leaving the population (by death or emigration) from the total number of individuals entering the population (by birth or immigration).

For most populations, immigration and emigration have negligible effects on overall population size and can be ignored unless evidence exists to the contrary. Thus, the equation reduces to:

$$dN/dt = b - d$$

Steady state or equilibrium occurs when $dN/dt = 0$ (i.e., when population size does not change).

This outcome occurs on three occasions:

1. When the number of births equals the number of deaths
2. When the population is extirpated ($N = 0$)
3. In sexually reproducing organisms when the sole surviving individual has no mate ($N = 1$)

At all other times, if births outnumber deaths ($b > d$), the population is increasing, and if births are fewer than deaths ($b < d$), the population is decreasing.

