

### 3.2 Ecosim Basics

The basics of Ecosim consist of biomass dynamics expressed through a series of coupled differential equations. The equations are derived from the Ecopath master equation (see Eq. 1 in [Mortality for a prey is consumption for a predator](#)), and take the form

$$dB_i/dt = g_i \sum_j Q_{ji} - \sum_j Q_{ij} + I_i - (MO_i + F_i + e_i)B_i \quad \text{Eq. 50}$$

where  $dB_i/dt$  represents the growth rate during the time interval  $dt$  of group ( $i$ ) in terms of its biomass,  $B_i$ ,  $g_i$  is the net growth efficiency (production/consumption ratio),  $MO_i$  the non-predation ('other') natural mortality rate,  $F_i$  is fishing mortality rate,  $e_i$  is emigration rate,  $I_i$  is immigration rate, (and  $e_i B_i - I_i$  is the net migration rate). The two summations estimates consumption rates, the first expressing the total consumption by group ( $i$ ), and the second the predation by all predators on the same group ( $i$ ). The consumption rates,  $Q_{ij}$ , are calculated based on the 'foraging arena' concept, where  $B_i$ 's are divided into vulnerable and invulnerable components (Walters et al., 1997 Figure 1), and it is the transfer rate ( $v_{ij}$ ) between these two components that determines if control is top-down (i.e., Lotka-Volterra), bottom-up (i.e., donor-driven), or of an intermediate type.

The set of differential equations is solved in Ecosim using (by default) an Adams-Bashford integration routine or (if selected) a Runge-Kutta 4th order routine.

Further reading: Walters et al. 1997; Walters et al. 2000