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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

$$dB_i/dt = g_i \sum_j Q_{ji} - \sum_j Q_{ij} + I_i - (MO_i + F_i + e_i)B_i$$ **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), $M0_i$ the non-predation ('other') natural mortality rate, F_i is fishing mortality rate, e_i is emigration rate, Ii is immigration rate, (and $e_i \cdot B_i - I_i$ 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_{ji}, are calculated based on the 'foraging arena' concept, where Bi'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