

# Competing Species

Consider an ecosystem consisting of two species which compete for a common food supply. Denote by  $y_1(t)$  and  $y_2(t)$  the sizes of the two populations at time  $t$ . If food is plentiful, then each member of population number  $i$  causes, on average, a net increase of  $b_i$  per unit time in the size of its population. That is  $\frac{dy_i}{dt}(t) = b_i y_i(t)$ . As the sizes of the populations grow the amount of food available per member decreases and consequently the net birthrates also decrease, say to  $b_1 - f_1 y_1(t) - g_1 y_2(t)$  and  $b_2 - g_2 y_1(t) - f_2 y_2(t)$  respectively.

Hence

$$\frac{dy_1}{dt} = b_1 y_1 - f_1 y_1^2 - g_1 y_1 y_2$$

$$\frac{dy_2}{dt} = b_2 y_2 - g_2 y_1 y_2 - f_2 y_2^2$$