

Result 3.1. If $\hat{N}_p > 0$ at equilibrium and $R \neq \hat{r}$, then

$$L_u(\hat{u}_r, \hat{r}) = \frac{\delta - R}{\hat{r} - R}. \quad (1)$$

Result 3.2. If $R < \delta$, then there is one nonzero $\hat{u}_r, \hat{r}, \hat{N}_p$ equilibrium if $\beta > 0$ and

$$\pi_C(1 - R) + (\delta - R)(1 + R) \left(\frac{2K}{1 + \delta} - 1 \right) > 0. \quad (2)$$

Result 3.3. If $R > \delta$, then there exist two equilibria with $\hat{r} > 0$ provided $Q_r''(r) > 0$, $-\delta Q_r''(r) < Q_r'(0) < 0$, and

$$(Q_r'(0))^2 - 2Q_r''(r)Q_r(0) > 0. \quad (3)$$

Otherwise, no $\hat{r} > 0$ equilibria exist.

Result 3.4. If $\hat{r} = 0$ then $\hat{u}_r = 0$, assuming $\pi_C > 0$, and if $R < \delta$, then $\hat{N}_p = 0$.

Result 3.5. If $\hat{N}_p = 0$ and $\hat{r} = 1$, then there is one possible equilibrium frequency $\hat{u}_r > 0$ of predators hunting the CP.

Result 3.6. $E0$ is only stable along the nullcline $r = 0$ if $R < \delta$. Any point near the nullcline $r = 0$ will go to the nullcline if $R < \delta$, $R > -\frac{1-K}{1-2Ku_r}$, and $1 - \beta N_p K u_r < 0$.

Result 3.7. Without a time delay, $E1$ is stable if

$$R - \delta + (1 - R)L(\hat{u}_r, 1) < 0 \quad (4)$$

and

$$2K(1 - \hat{u}_r(1 - R)) < 1 + R + (1 - R)\frac{\pi_C}{1 + R} \quad (5)$$

where \hat{u}_r is the larger root of (??).

Time Delay Stability Results:

Result 3.8. Result 3.6 holds when there is a delay, i.e. $E0$ is unstable except along the $r = 0$ nullcline.

Result 3.9. When there is a time delay, $E1$ is unstable under the same conditions as in the situation with no time delay (Result 3.7).

Irrespective of time delay:

Result 3.10. The resource depletion constant β does not affect the social-learning cut-off s^* that maximizes \hat{N}_p for any combination of the parameters μ, δ, R .

Result 3.11. If $s = 0$, i.e. all predators are individual learners, then social learning evolves if $R < \delta$.