

8 Lecture - Predation Variations

Density-dependent Prey, type I

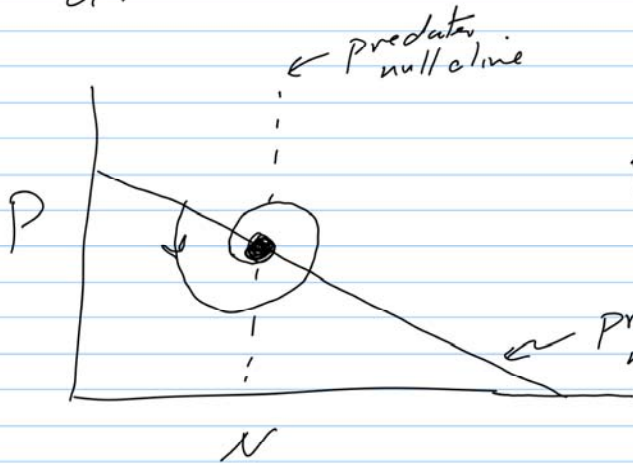
$$\frac{dN}{dt} = r \left(1 - \frac{N}{K}\right) N - aNP \rightarrow \frac{dN}{dt} = 0 \text{ prey nullcline}$$

carrying capacity

$$\frac{dP}{dt} = caNP - mP$$

$$0 = rN - \frac{r}{K} N^2 - aNP$$

$$0 = r - \frac{r}{K} N - aP$$



$$\hat{P} = \frac{r}{a} - \frac{r}{aK} \hat{N} = \frac{r}{a} - \frac{rm}{ack}$$

$$\hat{N} = \frac{m}{ac}$$

$$F = rN - \frac{r}{K} N^2 - aNP$$

$$\frac{dF}{dN} = r - 2\frac{r}{K} N - aP$$

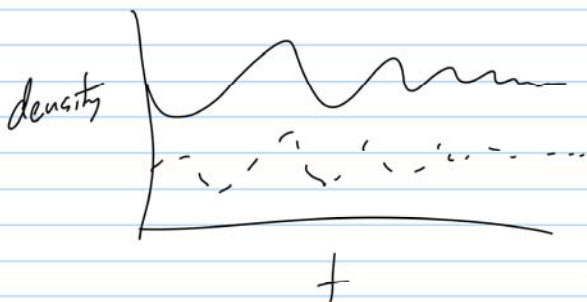
$$G = caNP - mP$$

$$(1) \begin{pmatrix} r - 2\frac{r}{K}\hat{N} - a\hat{P} & -a\hat{N} \\ ca\hat{P} & ca\hat{N} - m \end{pmatrix}$$

$$(2) \begin{pmatrix} r - 2\frac{rm}{ack} - r + \frac{rm}{ack} & -r + \frac{rm}{ack} \\ cr & 0 \end{pmatrix}$$

$$(3) \begin{pmatrix} -\frac{rm}{ack} & -a\hat{N} \\ cr & 0 \end{pmatrix}$$

$$(4) \begin{pmatrix} - & - \\ + & 0 \end{pmatrix}$$

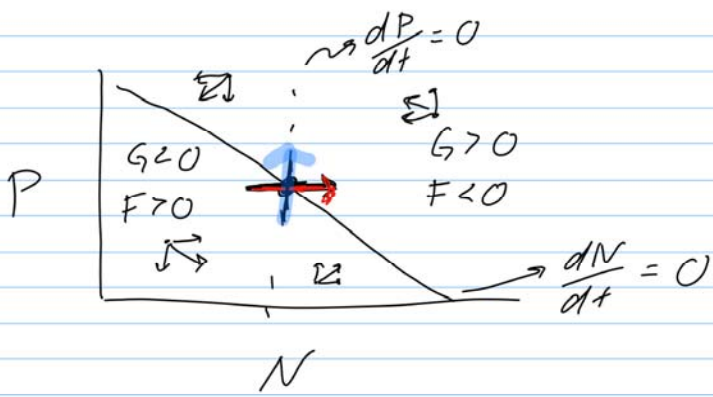


$$\text{tr} = - + 0 < 0$$

$$\text{det} = 0 - (-) > 0$$

\therefore stable

iA take Eigenvalues with find imaginary part



$$\frac{dN}{dt} = F(N, P)$$

$$\frac{dP}{dt} = G(N, P)$$

$$\begin{pmatrix} - & - \\ + & 0 \end{pmatrix} \leftarrow \begin{pmatrix} \frac{\partial F}{\partial N} & \frac{\partial F}{\partial P} \\ \frac{\partial G}{\partial N} & \frac{\partial G}{\partial P} \end{pmatrix}$$

Density-dependent prey, type II

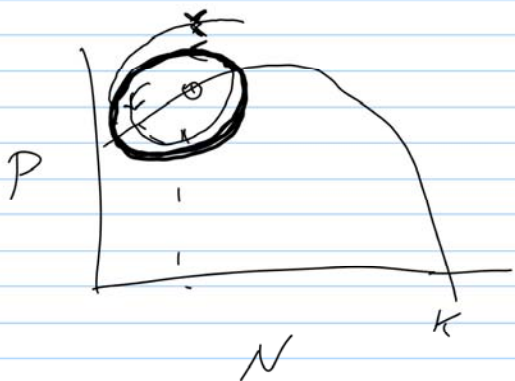
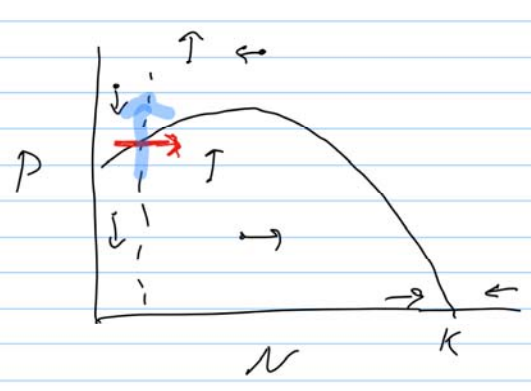
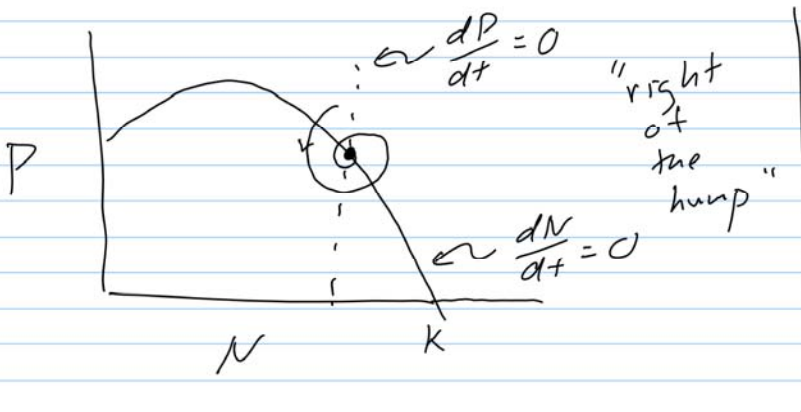
Rosenzweig - MacArthur

$$\frac{dN}{dt} = r N \left(1 - \frac{N}{K}\right) - \frac{a N P}{1 + h a N}$$

$$\frac{dP}{dt} = c \frac{a N}{1 + h a N} P - m P$$

(1) nullclines

"left of the hump"



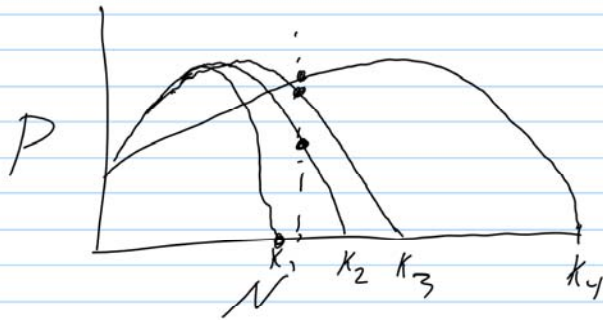
$$\begin{pmatrix} + & - \\ + & 0 \end{pmatrix}$$

tr = + ∴ unstable

"Paradox" of enrichment

What is the effect of fertilization in R-M system?

↳ prey D-D, type II



k_2 damped equil.

k_3 damped equil.

k_4 period cycles

increase K
 average # of N average # of P

same }
 ↓ increases

	<u>name</u>	<u>prey</u>	<u>function</u>	
(A)	classic L-V	D-I	type I	⇒ neutral cycles
		D-D	type I	⇒ damped cycles to an equilibrium
R-M		D-D	type II	⇒ damped cycles or sustained periodic cycles