Jamie Campbell
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BI 471 Homework 5

$$\frac{dH}{dt} = rH - bHP$$

$$\frac{dP}{dt} = cHP - kP$$

1) (a) It seems that to make the predation rate (in either equation) an increasing function of the number of predators (P), we would need to integrate the left side of each equation with respect to P, so that $\int dP/dt > 0$.

$$\int dP/dt = c\int HP - \int kP$$

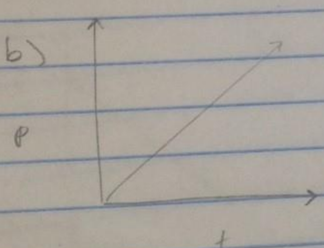
$$= c\int HP\,dp - \int kP\,dp$$

(I'm just not certain how to solve this)

Similarly, we would have

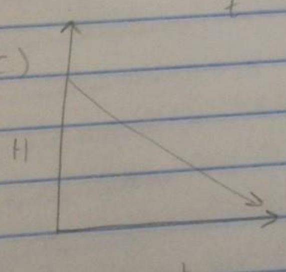
$$\int dH/dt = r\int H - b\int HP.$$

(b)



dP/dt should be independent of H.

(c)



It seems, from the integral in part (a), that dH/dt would depend on P.

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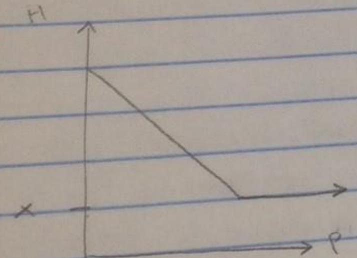
3) Given $dH/dt = rH[1 - H/k] - bHP$ and
$dP/dt = cHP - kP$
it seems that adding a term, which describes the effect of a pesticide, before k, the per capita death rate of the predators would work to predict an increase in the number of prey, H, and a decrease in the number of predators, P. Let's call this term "z":

$dH/dt = rH[1 - H/zk] - bHP$ and
$dP/dt = cHP - zkP$.

4) Given $dH/dt = rH - bHP$ and $dP/dt = cHP - kP$,
(a) $dH/dt = (rH - bHP) - x$, where x is the fraction of prey free from predation. This would give us $dH/dt = rH - bHP - x$, which seems similar to but perhaps not exactly mathematically equivalent to $dH/dt = rH[1 - H/k] - bHP$

(b)



(assuming refugee population is constant)

(c) Having refugees free from predation would, it seems, keep the isocline from crossing the x-axis in a phase plane of H vs P. In other words, H would never equal zero, despite the number of predators, because of the refugee population.