a)

$$H_{t+1} = \frac{\alpha H_t}{\alpha H_t + k} N_t$$

$$N_{t+1} = N_t + r(N_t - H_t)$$

b)

$$H^* = \frac{\alpha H^*}{\alpha H^* + k} N^*$$

$$N^* = N^* + r(N^* - H^*)$$

From the second equation $N^* = H^*$. Then from the first one

$$H^* = \frac{\alpha H^*}{\alpha H^* + k} H^*.$$

Either $H^* = 0$ or $\alpha H^* + k = \alpha H^*$. $H^* = 0$, $N^* = 0$ is the only equilibrium.

c) Find the Jacobian:

$$\begin{pmatrix} \frac{\alpha k N_t}{(\alpha H_t + k)^2} & \frac{\alpha H_t}{\alpha H_t + k} \\ -r & 1 + r \end{pmatrix}$$

at (0,0):

$$\begin{pmatrix} 0 & 0 \\ -r & 1 + r \end{pmatrix}$$

$\lambda = 0, (1 + r)$. Since $1 + r > 1$ the point is unstable.