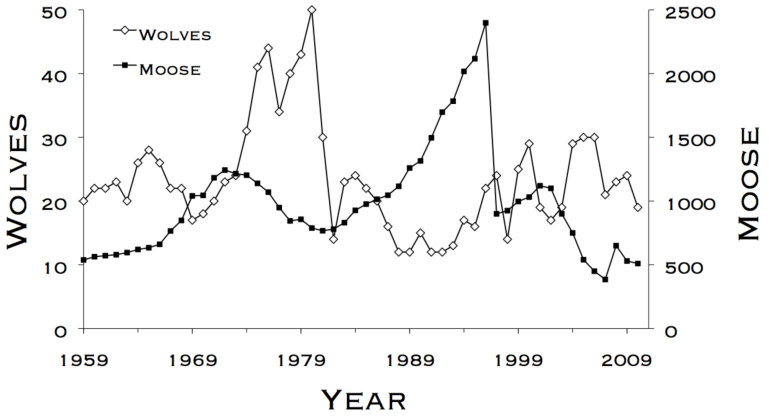
Math 3280 Worksheet 42: Population dynamics

Group members (2 to 4): _____



We will consider a model of the populations of moose (m) and wolves (w) on Isle Royale. In the absence of wolves, assume the moose population will follow the logistic equation ($m' = km(P - m)$) with some carrying capacity P. The wolves will deplete the moose population at a rate proportional to their product (amw for some $a > 0$). The wolf population will die off at a rate $-dw$ for some $d > 0$ in the absence of moose, and increase at a rate bmw for some $b > 0$. So the model is

$$\frac{dm}{dt} = km(P - m) - amw$$
$$\frac{dw}{dt} = bmw - dw$$

If t is in years, then k is approximately $\frac{1}{5000}$.

(1) Find the equilibria of the system in terms of k, P, a, b, and d.

(2) Estimate reasonable values of P, a, b, and d based on the data shown above.

(3) For your choices of parameters, is the equilibrium with positive m and w stable or unstable?