12.2 Competitive Hunter Model

MOTIVATION

- Suppose we have two species living in a habitat.
- Each species will survive on its own.
- When another hunter species is introduced to the habitat, the two species will compete for food.

EXAMPLE

- Examples of situations that might be modeled with this model include:
  - trouts v. bass
  - owls v. hawks
  - Pizza Hut v. Dominoes

MODEL

- A model for such situation is the following:

$$\frac{dx}{dt} = ax - bxy$$
$$\frac{dy}{dt} = my - nxy$$

- In this model, the equilibrium points are called coexistence states, namely the solutions, (0,0) and (c/d,a/b).

MATLAB

- % Competitive Hunter Model
- Np=11;[x,y]=meshgrid(linspace(0,1,Np),linspace(0,1,Np));
- a=.2;b=.25;c=.6;d=.75;% parameters
- dx=(a-b*y).*x;dy=(c-d*x).*y;%phase portraits
- xo=[0 c/d];yo=[0 a/b];% fixed points
- figure(1);clf;quiver(x,y,dx,dy);hold on;plot(xo,yo,'r*');axis tight;hold off;
- title(['Competitive Hunter (a=' num2str(a) ',b=' num2str(b) ',c=' num2str(c) ',d=' num2str(d) ')'])

HW

- Section 12.2 # 5, 6, 7