PREDATOR PREY MODEL FOR LARGEMOUTH BASS AND CHANNEL CATFISH

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- Over 7,000 lakes, and 800,000 private ponds in Texas.
- Bass and Catfish are most popular/common sport fish.
- Model could be used to estimate fish population, without using test instruments.

IMPORTANCE

INTERACTIONS/DIETS

Bass

- 60.5% Fish
- 39.5% Insects or larvae
- Growth ~ .7 lbs/yr

Catfish

- 8% Fish
- 92% Insects or larvae
- Growth ~ .5 lbs/yr

ASSUMPTIONS

- Similar sizes of each fish.
- Constant water level.
- ½ Acre Pond ~ 15 ft deep.
- Ample amount of Insects.
- No predators.
- Natural Mortality is included.
- Quality of Water is adequate.

VARIABLES

Variable	Description	Parameter
g_i	Annual growth of fish	≈ .7lbs Bass per year ≈ .5lbs Catfish per year
k_i	Carrying capacity ~ Biomass	≈ 25lbs Bass ≈ 65lbs Catfish
f_i	Competition Factor	

$$Catfish' = Cg_1\left(1 - \frac{C}{k_1}\right) - f_1CB$$

$$Bass' = Bg_2\left(1 - \frac{B}{k_2}\right) - f_2CB$$

EQUILIBRIA

(C,B)	Stable Equilibrium
$(0,0)$	$0 > g_1 + g_2$
$(k_1, 0)$	$f_2 > \frac{g_2}{k_1}$
$(0, k_2)$	$f_1 > \frac{g_1}{k_2}$
$\left(-\frac{-g_1 g_2 k_1 + f_1 g_2 k_1 k_2}{g_1 g_2 - f_1 f_2 k_1 k_2}, \frac{(-g_1 g_2 + f_2 g_1 k_1) k_2}{-g_1 g_2 + f_1 f_2 k_1 k_2}\right)$	$0 < f_2 \leq \frac{g_1}{k_1}$ &$(0 < f_1 < \frac{g_1}{k_2}$ $\|\|f1 > \frac{g_1 g_2}{f_2 k_1 k_2})$ $\|\|$ $\frac{g_1}{k_1} < f_2 < \frac{g_2}{k_1}$ & $(0 < f_1 < \frac{g_1}{k_2}$ $\|\|f_1 > \frac{g_1 + g_2 - f_2 k_1}{k_2})$ $\|\|$ $f_2 > \frac{g_2}{k_1}$ & $\frac{g_1 g_2}{f_2 k_1 k_2} < f1 < \frac{g_1}{k_2}$

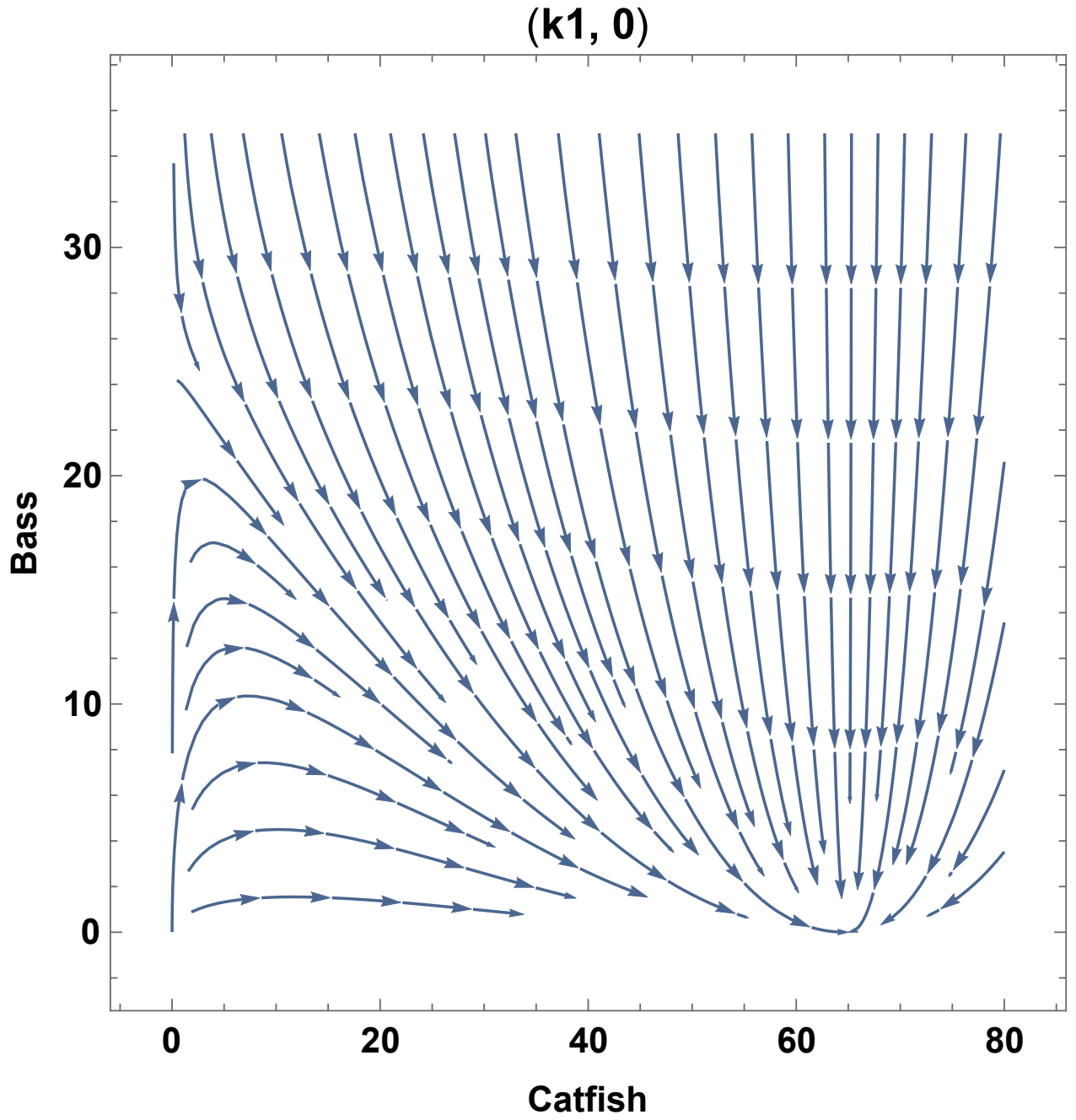
CATFISH WIN

$$f_2 > \frac{g_2}{k_1}$$

$$C' = .5C\left(1 - \frac{C}{65}\right)$$

$$B' = .7B\left(1 - \frac{B}{25}\right) - .0108CB$$

$$(C \to 65\ lbs, B \to 0)$$



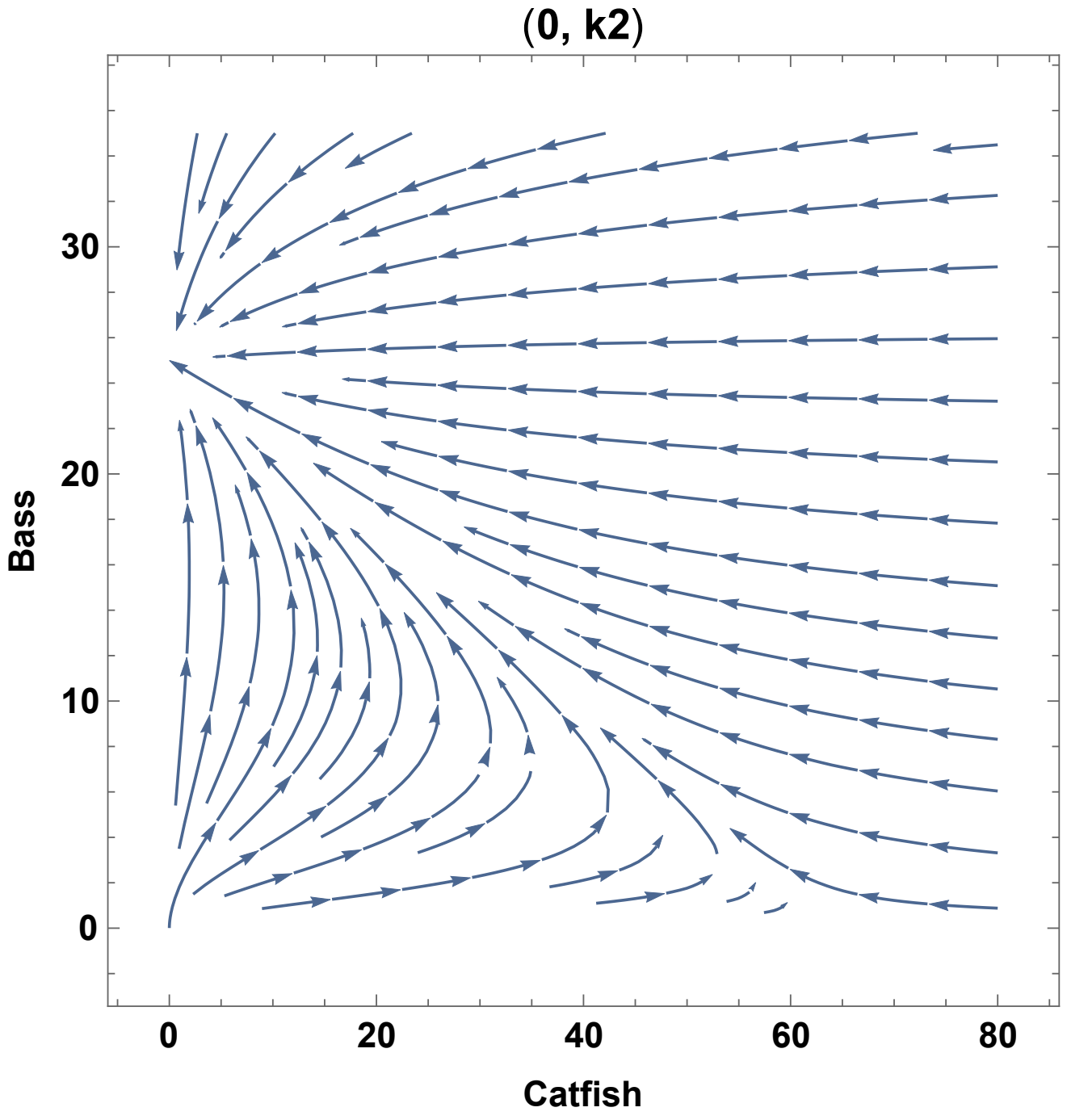
BASS WIN

$$f_1 > \frac{g_1}{k_2}$$

$$C' = .5C\left(1 - \frac{C}{65}\right) - .02CB$$

$$B' = .7B\left(1 - \frac{B}{25}\right)$$

$$(C \to 65\ lbs, B \to 0)$$

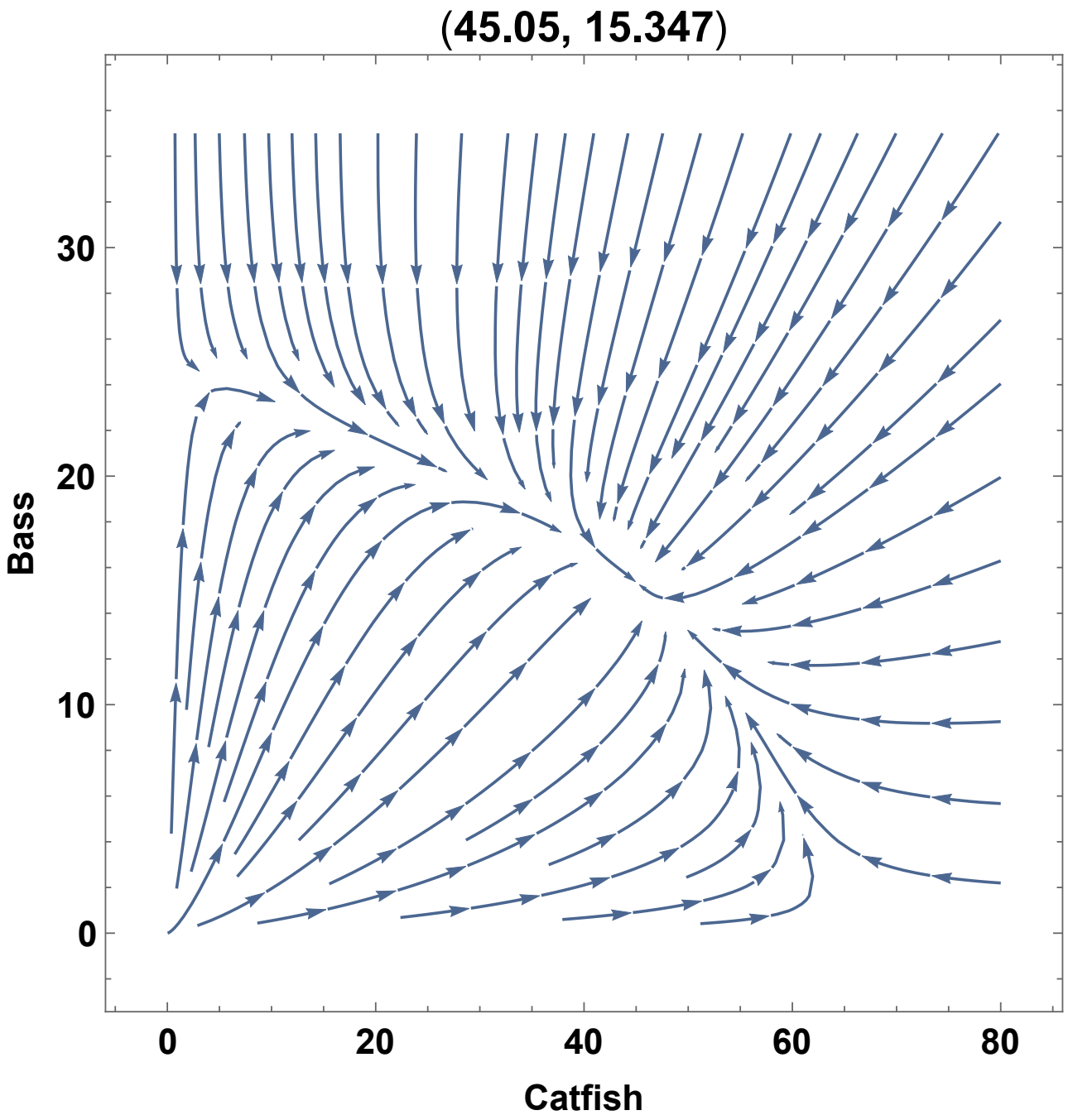


CO-EXISTENCE

$$0 < f_2 \leq \frac{g_1}{k_1} \;\&\; 0 < f_1 < \frac{g_1}{k_2}$$

$$C' = .5C\left(1 - \frac{C}{65}\right) - .01CB$$

$$B' = .7B\left(1 - \frac{B}{25}\right) - .006CB$$

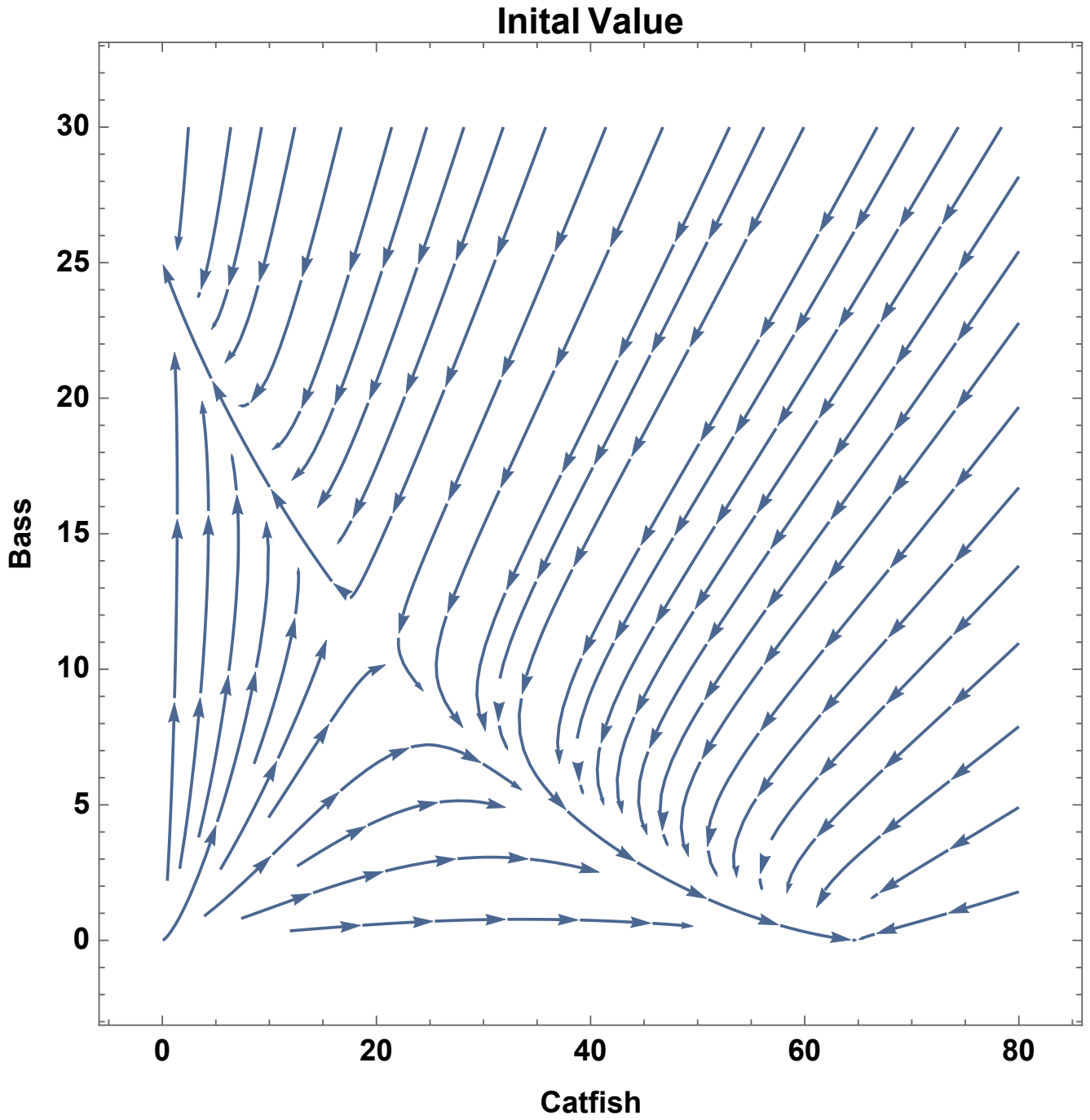


INITIAL VALUE MATTERS

$$f_1 > \frac{g_1}{k_2} \& f_2 > \frac{g_2}{k_1}$$

$$C' = .5C\left(1 - \frac{C}{65}\right) - .03CB$$

$$B' = .7B\left(1 - \frac{B}{25}\right) - .02CB$$

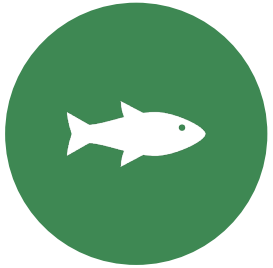


IMPROVEMENTS/FUTURE WORKS

WATER LEVEL

HARVESTING RATE

FEEDING BENEFITS



EXPANDED TO LAKES

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THANK YOU! QUESTIONS?

$$Catfish' = Cg_1\left(1 - \frac{C}{k_1}\right) - f_1CB$$

$$Bass' = Bg_2\left(1 - \frac{B}{k_2}\right) - f_2CB$$