1.6.1 Summary Quiz: A General Predator-Prey Phase Plane

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Question 1

1/1 point (graded)

Let's look at the general predator prey system with constants $\mathbf{a}, \mathbf{b}, \mathbf{c}, \mathbf{d} > 0$ and

$$\frac{dS}{dt} = \mathbf{a}S - \mathbf{b}SM$$

$$\frac{dM}{dt} = -\mathbf{c}M + \mathbf{d}SM$$

There are two nullclines on which $\frac{dM}{dt} = 0$. One of these is the line $M = 0$. What is the equation of the other line?

- $S = 0$
- $S = \frac{\mathbf{a}}{\mathbf{b}}$
- $S = \frac{\mathbf{c}}{\mathbf{d}}$ ✔
- $M = \frac{\mathbf{a}}{\mathbf{b}}$
- $M = \frac{\mathbf{c}}{\mathbf{d}}$
- None of the above.

Explanation

Factoring $\frac{dM}{dt}$ we get $\frac{dM}{dt} = 0$ if $M = 0$ or $(-\mathbf{c} + \mathbf{d}S) = 0$. Thus the other nullcline equation is $S = \frac{\mathbf{c}}{\mathbf{d}}$.

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You have used 1 of 3 attempts

Answers are displayed within the problem

Question 2

1/1 point (graded)

Let's look at the general predator prey system with constants $a, b, c, d > 0$ and

$$\frac{dS}{dt} = \mathbf{a}S - \mathbf{b}SM$$

$$\frac{dM}{dt} = -\mathbf{c}M + \mathbf{d}SM$$

There is one equilibrium point at $(0, 0)$ (meaning no sardines and no marlin). There is one other equilibrium point. What is it?

- $(\mathbf{c}/\mathbf{d}, 0)$
- $(0, (\mathbf{a}/\mathbf{b})$
- $(\mathbf{c}/\mathbf{d}, \mathbf{a}/\mathbf{b})$ ✔
- $(\mathbf{a}/\mathbf{b}, \mathbf{c}/\mathbf{d})$
- None of the above.

Explanation

The other equilibrium point is $(\mathbf{c}/\mathbf{d}, \mathbf{a}/\mathbf{b})$. We can solve for these by finding where $\frac{dS}{dt}$ and $\frac{dM}{dt}$ are both zero. This the same as finding the points at which the nullclines for S intersect the nullclines for M.)

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Answers are displayed within the problem

Question 3

1/1 point (graded)

The nullcline you found above is separated into two parts by a nullcline on which $\frac{dS}{dt} = 0$. On the part of the $\frac{dM}{dt}$ nullcline closest to the S axis, how is the value of S changing with time? (Hint: Think about values of M very close to 0.)

- (selected) S is increasing. ✔
- S is constant.
- S is decreasing.

Explanation

S is increasing, and if $M \approx 0$, then $\frac{dS}{dt} \approx \mathbf{a}S$ so the population of sardine would be increasing almost exponentially.

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Answers are displayed within the problem

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