2.2.6 Quiz: Average Value of Sardines and Marlin

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Question 1

1/1 point (graded)

We computed that the average value over a cycle of the marlin population is the value $\frac{\mathbf{a}}{\mathbf{b}}$, regardless of the length of the cycle. If we do the analogous computation for the sardine population, we find the average value over a cycle is

$$\overline{S} = \frac{\mathbf{c}}{\mathbf{d}}.$$

Recalling that

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

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

how are the populations of marlin and sardine changing when both populations are at their average population value, $M = \frac{\mathbf{a}}{\mathbf{b}}$ and $S = \frac{\mathbf{c}}{\mathbf{d}}$?

- a. both populations are increasing
- b. both populations are decreasing
- c. M increasing, S decreasing
- d. S increasing, M decreasing

e. neither population is changing; the system is at an equilibrium point ✔

f. Other

Explanation

Choice e. When we substitute $M = \mathbf{a}/\mathbf{b}$ and $S = c/d$ into the differential equations we see that $\frac{dM}{dt} = 0$ and $\frac{dS}{dt} = 0$. So neither population is changing; we say the system is at an equilibrium point.

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Answers are displayed within the problem

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