1.2.2 Making Sense of the Graph of dP/dt versus P

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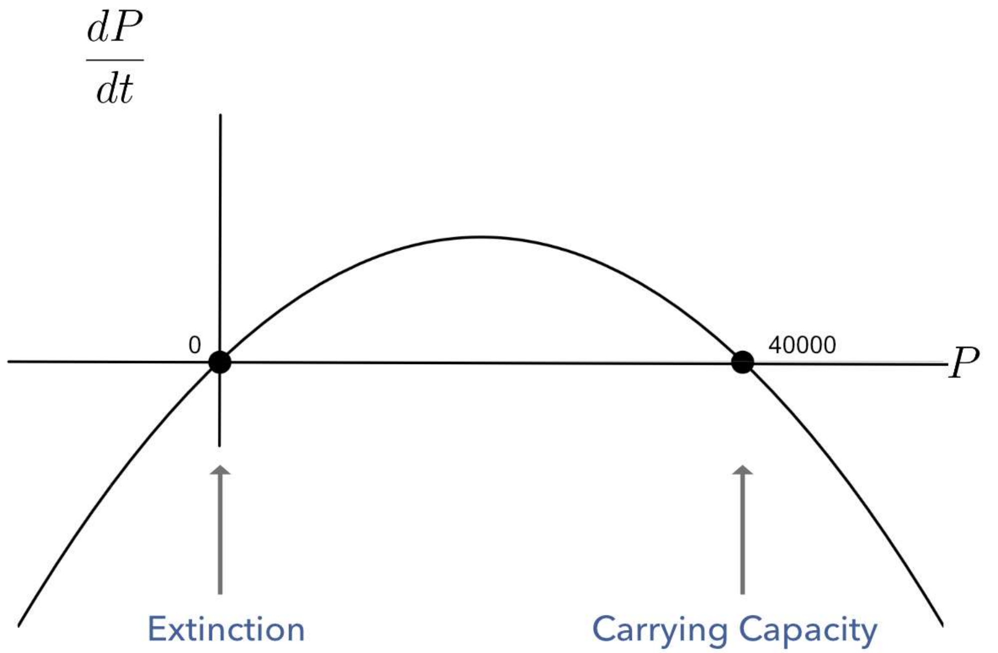
Here is the model without fishing:

$$\frac{dP}{dt} = \frac{1}{10}P\left(1 - \frac{P}{40000}\right)$$

Here:

- t is time in number of years
- P is the population size in number of fish.

Here is a graph of $\frac{dP}{dt}$ as a function of P, the population, as Wes showed. Let's take another look.



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There are a few things to notice:

- Time t is not explicitly represented in this graph. Rather, this shows what the rate of change of the population $\frac{dP}{dt}$ will be for specific values of the population size P(as opposed to specific values of t, time).

- Wes mentioned two equilibrium solutions, $P = 0$ and $P = 40000$. These are represented by the horizontal intercepts of the graph of dP/dt versus P. At these two points $\frac{dP}{dt} = 0$ so the value of P is unchanging which corresponds to an equilibrium.

- We show the second and third quadrants in this graph to emphasize that $\frac{dP}{dt}$ is quadratic with P, but the graph only makes biological sense for $P \geq 0$ (non-zero populations).

- Consider the portion of the graph below the P-axis, in the fourth quadrant. Does this make biological sense? This graph is of the rate of change $\left(\frac{dP}{dt}\right)$ and **not** of the population P itself. When the graph is below the P-axis, this means $\frac{dP}{dt} < 0$. In other words, the population decreases for these population values.

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