

Model of a Stocked Pay Fishing Lake

A stocked pay fishing lake is a commercial enterprise where fishermen pay to fish at a lake that is stocked with attractive species of fish (catfish, carp, trout, bass, etc.). In this project, you will develop a basic model for the dynamics of both the fish population in the lake and the number of fishermen. Does the model predict a stable steady fish population? How does stocking fish change the dynamics?

Some Model Requirements

- In the absence of fishermen, the fish population grows logistically.
- Fishermen remove fish from the lake at a rate proportional to the size of both the fish and fisherman population at the lake.
- Fishermen are attracted to the lake at a rate proportional to the size of the fish population in the lake. More fish means more fishermen.
- The number of fishermen at the lake is suppressed by a rate proportional to the number of fishermen already there. A busy lake is not as attractive to fishermen as a quiet lake with few other fishermen to compete with.
- Fish are added to the lake at a constant rate.

Some Questions to Answer

- How does the fish population behave if there are no fishermen and there are no fish added to the lake after the initial stocking?
- What happens to the fish population when there are fishermen and no additional fish added after the initial stocking?
- Under what conditions can the fishermen reduce the fish population of the lake to zero?
- How does adding fish to the lake at a constant rate affect the dynamics of both the fishermen and fish populations?
- What is the smallest rate of fish added to the lake to ensure that the lake is always stocked?
- Is there an optimal rate of adding fish to maximize the fishermen population?
- How could you use this model and its results to maximize the profits for the owner of the pay lake?