**HW 6 – Simulation**

**Step 1** - **Think of a pattern that is a apparent in your system. Ideally, this will be a pattern that can be described quantitatively using one or more metrics**

The system we have chosen to investigate comes from an ecosystem-experiment in large experimental ponds that were stocked with yellow perch and bluegill. Over the 100 days of the experiment, zooplankton and macroinvertebrate abundance both fell due to predation by yellow perch within the experimental ponds. For macroinvertebrates, their abundance rose and fell in regular intervals across the summer but decreased from 700 to 400 individuals per square meter. Zooplankton, on the other hand, steadily decreased from 100,000 to 20,000 square meters over the course of the experiment. While it is important to note bluegill were also present within the ponds, we are focusing on yellow perch behavior here.

**Step 2 – Formulate two or more alternative hypotheses describing a potential mechanism that might generate such a pattern**

We have two hypotheses for yellow perch behavior that may explain our systems pattern of the pattern and eventual biomass for both zooplankton and macroinvertebrates

**Hypothesis 1:** Yellow perch choose macroinvertebrates and zooplankton randomly.

*Yellow perch prey on whatever is in front of them and do not actively select between macroinvertebrates and zooplankton. Prey choice is randomly determined by whatever is in front of the individual perch*

***Hypothesis 2:*** Yellow perch preferentially choose macroinvertebrates.

*Yellow perch preferentially choose macroinvertebrates over zooplankton due to their higher energy content and more ‘bang-for-their-buck’. Prey choice is more often macroinvertebrates rather than zooplankton*

**Step 3 – Go to code**

In the github repository in the code folder:

Established starting abundances for both zooplankton and macroinvertebrates than coded a simulation model where perch randomly select zooplankton and macroinvertebrates over time as well as one where macroinvertebrates are preferentially choses (60% of the time).

**Step 4 – Compare key metrics from your simulation model with the patterns defined in step 1.**

The dynamics of macroinvertebrate abundance and zooplankton biomass were like the patterns described in step 1. As we were modeling a single perch’s choices, it is plausible that with 15 individuals, as there were in the experiments, we would observe similar abundances for zooplankton and macroinvertebrates after 100 days. The second model showed an increase in zooplankton abundance and a sharp decrease in macroinvertebrate abundance, which did not describe the patterns described in Step 1.

**Step 5 – Draw conclusions**

Given the results of the simulation model, it is clear that the random selection of either a zooplankton or macroinvertebrate by a yellow perch was the most agreeable model to observed patterns. It makes sense that yellow perch are randomly selecting prey as what organisms that the perch sees while foraging is random depending on where they swim. Perch may congregate or return to areas with lots of food, like shallow areas with more macroinvertebrates, but in the shallow experimental ponds, there was a small spatial distribution. Thus, an individual yellow perch was just as likely to run into a zooplankter or a macroinvertebrate while foraging.