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Predator-prey game to maintain stable fish population for Ecotoxicological studies

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COMPUTER SCIENCE

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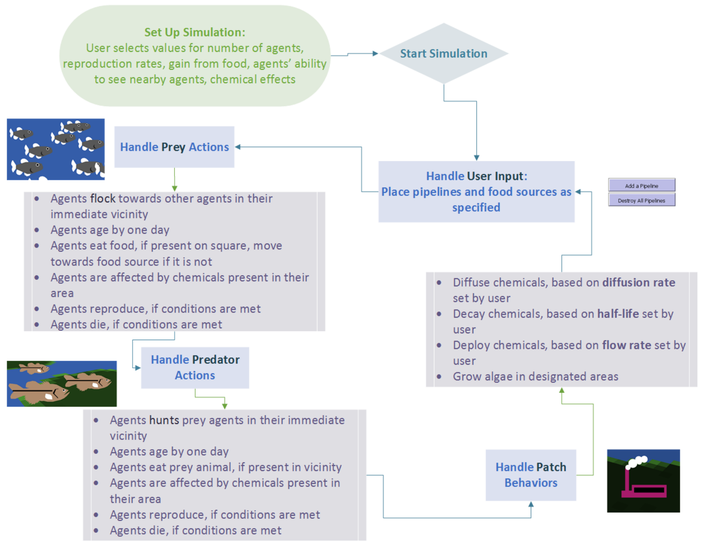
CAPSTONE DESIGN EXPO 2015

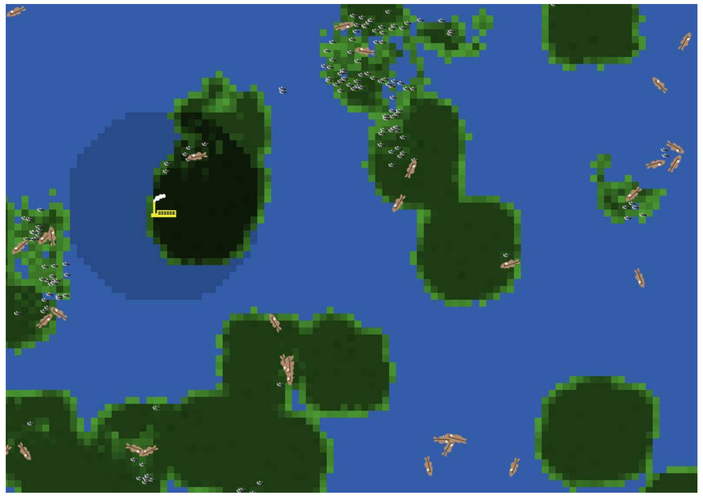
Background Information

With the state of the environment on the forefront of many minds today, it is important for society to be able to understand how interactions within our local ecosystems and the potential impacts we can cause. Creating computational simulations of these environments can help to predict the possible effects of different situations. For this project, we explored the question of how we can best create a game-simulation that will show the results of the introduction of toxins on populations in the area, and what techniques can be used to stabilize these populations?

Game-Simulation Process



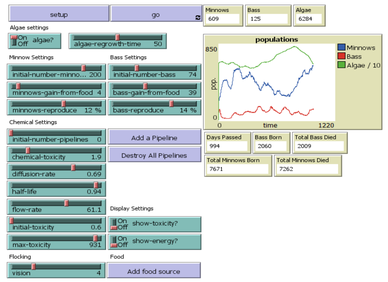
Full Game-Simulation



- The spread of chemicals is represented by the red area in the view panel.
- Population of predator, prey, and prey food source (algae, represented by green area) is tracked and graphed over the course of the simulation.
- Over time, the flow of chemicals slowly kills off all fish populations by inhibiting the reproduction of agents that come into contact with it.
- As the fish die out, algae populations increase due to the lack of limiting factors.

- With a low flow-rate (<25), which determines how quickly chemicals are released from the pipeline, reproductive hindrance is **not widespread enough to wipe out either fish population.**
- Increasing flow-rate causes an initial drop in both populations, but as the chemicals diffuse, **given a low half-life, the populations re-stabilize**.
- A long half life will generally cause bass populations to be wiped out. As reproductive hindrance of the chemicals increases, so does the **likelihood of all fish populations being wiped out.**
- Further optimization of the algorithms would be necessary to model large scale populations of over 100,000 fish.

User Controls



Conclusions

- Game can be used to **predict the effects** on fish populations of the introduction of a multitude of chemicals into the environment.
- Allows the user to **learn about population mechanics** and try to create an optimal ecosystem by adding food sources and re-populating the lake.
- Further **flow models** for different chemicals allow to realistically model the action of a large variety of toxins, allowing the simulation to be used to predict the results of multiple situations

- Knowing how the introduction of chemicals will impact the existing populations will allow ecologists to best prepare methods of handling these possibilities.

Acknowledgement: Game is based on NetLogo modeling software. *NetLogo itself:* Wilensky, U. 1999. NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University. Evanston, IL.

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