An Agent Based Model of Diel Vertical Migration in Mysis *diluviana*

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Results

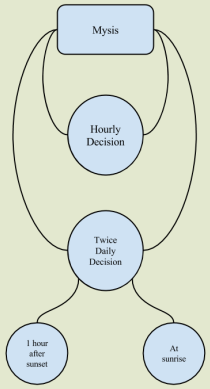
- *Mysis* survival rate is highly sensitive to perturbations in their feeding efficiency.
- Water temperature limits migration extent for the middle of the year whereas light levels do for the rest.

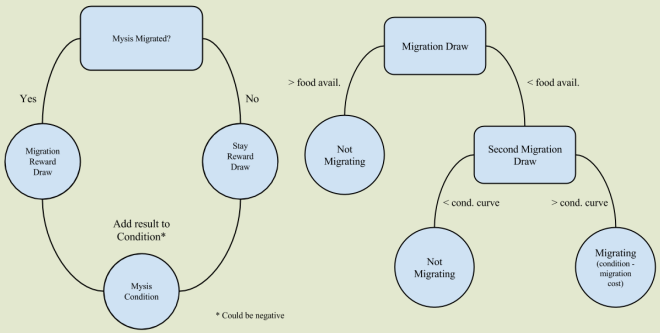
Introduction

- Mysis *diluviana* (*Mysis*) is a macro-invertebrate crustacean that lives in Lake Champlain and other deep glacial lakes.
- Mysis migrate up and down the water column daily in a process called "diel vertical migration."
- We used publicly available data and previous studies to construct a model that simulates the environmental pressures on a *Mysis* at an hourly time interval over the course of a year.

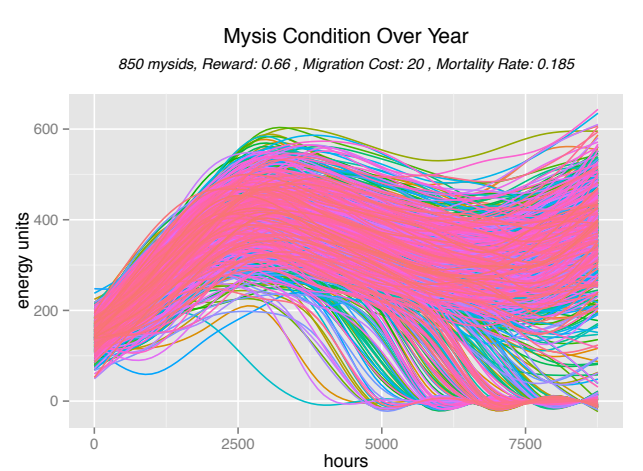
Agent Based Modeling

- Simulates an individual *Mysis*.
- Every hour draws are taken from probability distributions to decide if the M*ysis* migrates and how successful their feeding is.
- Good for complex scenarios with noisy input variables (e.g. cloud cover for light intensity).
- Many individuals are simulated to get a sense of population level trends.



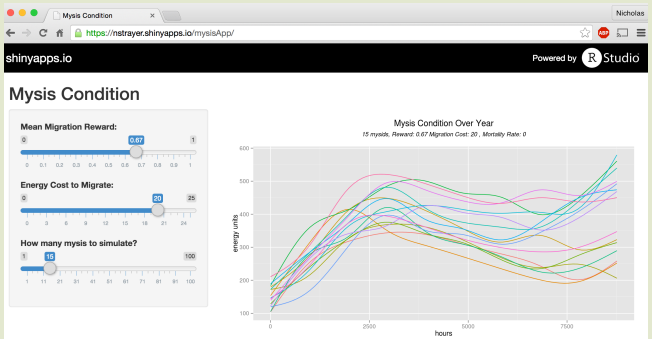


Energy Conditions



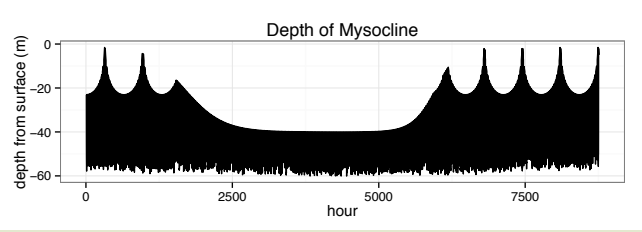
- Each line represents an individual being simulated over the year.
- Lines that drop to or below zero are *Mysis* who have starved.
- Demonstrates model's stochasticity.

Interactive Application



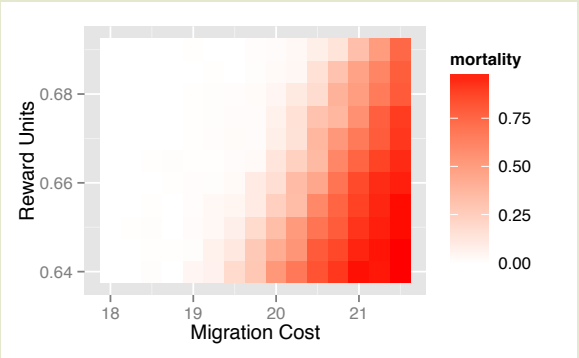
- Utilizes R Shiny Servers to allow user to interact with model parameters without tinkering with code.
- Rapidly facilitates insights into effects of changing parameters.
- Hosted on the web for anyone to use. (https://nstrayer.shinyapps.io/mysisApp)
- Helps make research reproducible by others.

Mysis Migration Extent



- Light intensity and thermocline data combine to paint a picture of mysis migration extent.

Mortality Rates



- There is greater sensitivity to changes in reward units than migration cost.
- Follow expected trends based upon ecological theory.

Future Directions

- Probe the possibility of multiple stable migration patterns.
- Dig in to specific aspects of the model. E.g. predation risk, benthic food availability
- Utilize real data in model inputs such as thermocline depth and food availability.

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