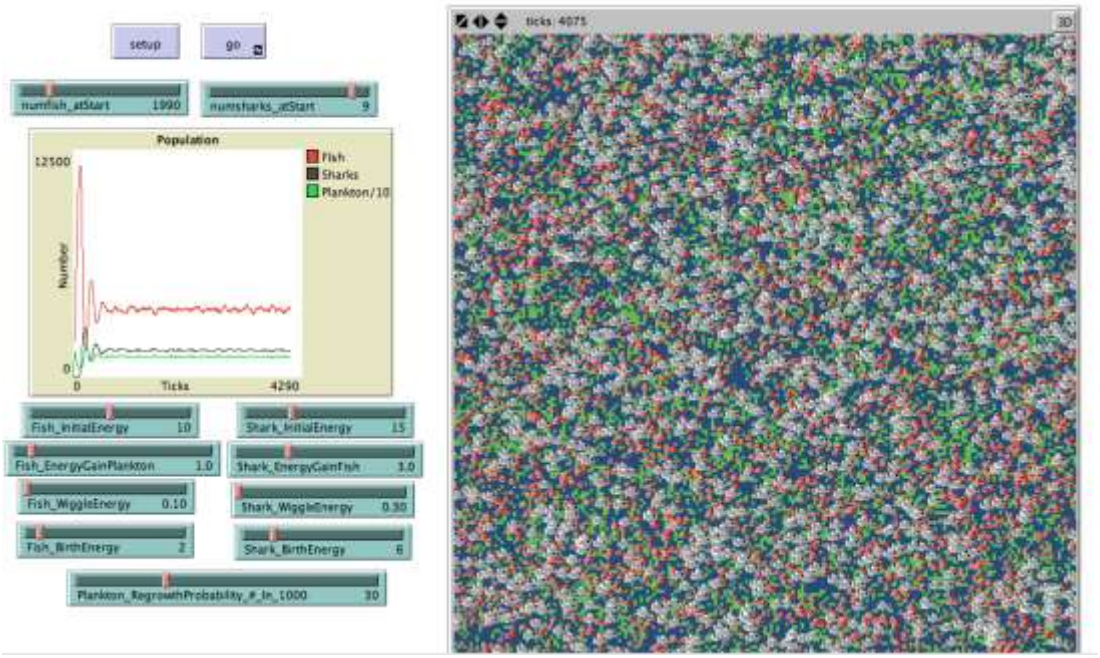
# CS108L Computer Science for All
# Module 10: Eating Nemo:
# A More Advanced Ecosystems Model

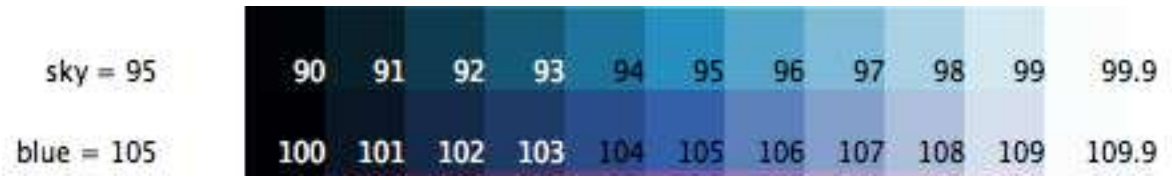



In this lab, you will be creating a more advanced model that represents a fish ecosystem. You have fish swimming around eating plankton and having fun! The fish die if they can't find enough plankton and have fishlettes if they can eat enough plankton. The fish are eaten by sharks that also want to thrive! The sharks eat fish to gain energy, have sharklettes if they have enough fish to eat and die when they have no energy! You can use the model you developed in week 7 as the start of the model for this week or you can start over!

## The Ecosystem Model:

The model has the following requirements:

- Change your world
  - On the interface tab, choose settings and change the max-pxcor, and max-pycor (suggestion: 100). Also change the size of your patches (suggestion: 3).
  - The world wraps around! Your agents live on a doughnut!
  - Change the color of your world to a blue because Nemo lives in the ocean! Here are the color numbers for blues!




- There are Fish and Sharks in your world!
  - Create two breeds of agents (fishes/fish and sharks/shark or something like that). Make sure they are both fish shaped.
  - Add two sliders that allow you to change the initial number of fish and sharks.
  - Fish are big, but NOT too big (size 3 or less) and they are all the same color.
  - Sharks are bigger than fish but not too big either (size 5 or less) and they are all one color that is different from the fish!
  - Each fish and each shark has its own variable to monitor its energy and the initial energy is not zero.
- There is plankton in your world. Plankton makes the patches green! Not all the patches are green though – most are blue!
- Fish and shark do their own thing….
  - For each tick, the fish and sharks move in a wiggle and lose a bit of energy. Remember that the energy variable for each agent needs to be set when a fish or shark wiggles.
  - Fish eat plankton when they get to a green patch and then the patch becomes blue. Also, when a fish eats plankton, it gains energy so its energy value increases.
  - Sharks eat fish when they share a patch (remember the epidemic model!) and the fish dies. The shark gains energy when it eats a fish!
  - Fish and shark die if their energy falls to zero or below.
  - Each fish and shark can reproduce if they have enough energy to do so. Again, how much energy the agent needs to reproduce is up to you to decide but the model needs to behave as required (see Stable or Oscillating Population in the grading rubric).
  - When a fish or shark reproduces, they lose energy. Sharks need to have more energy before they can reproduce and loose more energy when they reproduce.
  - Also, remember that the fishlettes and sharklettes have an energy variable that needs to be set when a fish is hatched.
  - How much energy the fish and sharks gains and loses for each activity (moving, eating, and reproducing) is up to you. However, too much or too little makes a difference! There is not one right answer; it's all about BALANCE! You will need to decide what those values are so that the model behaves in the required manner (see Stable or Oscillating Population in the grading rubric). You might want to put sliders in to

control the energy lost or gained for each agent and activity so you can easily adjust them.

- Then you have to model at least one of two things:
  - The fish and sharks grow as they age. Remember you have to keep track of their age as an agent variable in order to do this! Also, the fish and sharks cannot get too big – there is a maximum size for each – perhaps no bigger than twice its original size. Sharks can get bigger than fish!
  - The fish and sharks swim faster as the get more energy. Swimming faster means moving forward more that one step! One way to do this is to have the distance the turtle will try to move is equal to a fraction of its current energy (for example, if a fish has an energy of 24, then it could move forward 24/10 or 2.4 patches). Remember the faster they swim the more energy they loose. So both the speed of the agent and the amount of energy lost would depend on the energy of the agent.

- Plankton happens! Each blue, empty water patch randomly grows plankton (and changes the patch color to green) with a probability of 1 in 1000 each tick. Note: To keep the model simple we use abstraction to simplify this so we are modeling the presence of significant concentrations of plankton in the water as a simple green patch. In the real world, plankton are very small and as the density of plankton increases or decreases within a patch of water, the water would gradually change color. In the model, when an empty (blue) patch spontaneously generates plankton, you can think of this as a small population of plankton having the right conditions to increase their population density and that this increased density is represented in the model by changing the patch color to green.
- You are also very anxious about your fish, shark and plankton. You create a graph that tracks how many of each is alive in the model as a function of time. Hint: Don't forget about ticks!