

Challenge Final Report Submission Information

Team ID-

Melrose Team #34

School Name-

Melrose High school

House High School

Project's Area of Science-

Ocean Ecology

Computer language(s) used in your project

Net Logo

Team members grade levels in school (comma separated)-

Freshman

Team member's email addresses (comma separated)-

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Beyond the Shore

New Mexico

Supercomputing Challenge

Final Report

April 3, 2018

Team number 34

Melrose High School

House High School

Team Members:

Madison Garrett

Evelyn Garrett

Teacher(s):

Mr. Alan Daugherty

Project Inspiration:

Albuquerque BioPark Aquarium.

Executive Summary:

This is a project of ocean ecology. The problem that we are trying to solve concerns how the jellyfish population exists at the different habitat levels with the sea turtles as one of their predators. We want to learn if they populate fast enough, so that when the sea turtles feed on the jellyfish there is still enough jellyfish so they won't go extinct. Plankton are found at the top level of the ocean, and if some jellyfish float with the current, and others swim then how will the population growth be different if they can't get food in a specific amount of time. We would like to test, and see if jellyfish population will go down if they can't get enough food, and if the sea turtles kill the off to fast.

Our agents allow us to control what the organisms do, and how they repopulate. We control how they swim and eat. We have different levels of the ocean to show where our organisms live. We have monitors and sliders to watch the numbers of our organisms and their energy levels.

Statement of the problem:

We have always been interested in the ocean. The ocean is full of mysterious creatures Jellyfish being one of them. So our project is about how jellyfish live in three levels of the ocean. The problem that we are trying to solve concerns how the jellyfish population exists at the different habitat levels with the sea turtles as one of their predators. We want to learn if they populate fast enough, so that when the sea turtles feed on the jellyfish there is still enough jellyfish so they won't go extinct. Plankton are found at the top level of the ocean, and if some

jellyfish float with the current, and others swim then how will the population growth be different if they can't get food in a specific amount of time. We would like to test, and see if jellyfish population will go down if they can't get enough food, and if the sea turtles kill them off too fast. We decided to do this problem because we wanted to show what would happen to the Jellyfish as the sea turtle and plankton populations change.

Description of method:

We are using a NetLogo model to show how ocean organisms survive and live with each other. The organisms we use are Jellyfish, Sea turtles, and Plankton. The variables we include are population numbers, reproduction rates, how feeding increases energy, And a carrying capacity for Plankton. We have monitors for the population count of our organisms.

The agents we used in our model are, Sea-turtles, Plankton, Cassiopea, and Moons. The Sea-turtles swim around using energy. Once they have a low energy they eat a jellyfish. Once the energy gets high enough they reproduce. The moon and cassiopea do the same. But they eat the plankton. When a Sea-turtle goes near a Moon the moon camouflages with the background. The plankton stay in the top two levels because of the sun.

The background we use has several different layers of the ocean. The very top layer of our model is the sky. We have a thin line that's blue. That line is the surface of the water. The next two layers are the layers all the plankton live in. The next four layers are the layers building up to the midnight zone. The very bottom layer is the Midnight zone. Our organisms don't really go in that zone because it is the deepest area of the ocean.

The buttons we will be using are, Setup, Plankton-pop, Sea-turtle-pop, Moon-pop, Cassiopea-pop, feed-repro, Swim, and clear. Set up will put in our ocean levels that the

organisms live in. Plankton-pop puts in the number of plankton given starting from the top of our ocean levels going down making less and less plankton. Sea-turtle-pop sets up the Sea turtle population. Moon-pop sets up the Moon jellyfish population. Cassiopea-pop also sets up the Cassiopea jellyfish population. Feed-repro lets the sea turtles, and jellyfish feed and reproduce. Swim allows the organisms move. Lastly clear resets the program.

In our program we also have sliders. Amt-plankton, amt-Moons, amt-Cassiopeas, amt-seatutles, turtlemetabolism, jellymetabolism, plankton-reprovalue, turtle-reprovalue, jellyfish-reprovalue, foodvalue-of-plankton, and foodvalue-of-jellyfish. Amt-plankton is used to make number of plankton that can be used in the program. Amt-Moons sets number of moon jellyfish that can be put in the program. Amt-Cassiopeas sets number of Cassiopea jellyfish that can be put into the program. Ant-sea-turtles sets number of sea turtles that can be put into the program. Turtlemetabolism is the amount of energy needed for the sea turtles to move. Jellymetabolism controls the amount of energy the jellyfish need to move. Plankton-reprovalue controls the amount of energy needed for plankton to reproduce. Turtle-reprovalue controls the amount of energy needed for sea turtle to reproduce. Jellyfish-reprovalue controls the amount of energy needed for the jellyfish to reproduce. Foodvalue-of-plankton controls the energy level of the plankton when eaten. Lastly foodvalue-of-jellyfish controls the energy level of jellyfish when eaten. We will also be using monitors in our program. Count Planktons, Count Moons, Count Cassiopeas, Count Sea-turtles, Avg Moon's Energy, Avg Cassiopea's Energy, Avg Sea-turtle Energy. Count Planktons tells us the number of plankton after its been eaten or after its reproduced. Count Moons tells us the number of Moon jellyfish after its been eaten, killed off by starvation or after its reproduced. Count Cassiopeas tells us the number of Cassiopea jellyfish

after its been eaten, killed off by starvation or after its reproduced. Count Sea-turtles tells us the number of sea turtles after it dies of starvation or reproduced. Avg Moon's Energy tells the energy that the Moon jellyfish have. Avg Cassiopea's Energy tells the energy that the Cassiopea jellyfish have. Avg Sea-turtle Energy tell the energy level that the sea turtles have.

Discussion of how we verified and validated our model:

Our research told us what the general population numbers are. Our model numbers are around that general area. Therefore, it is close to the real ecosystem in nature.

Our program is using variables to track three basic things:

Populations of agents; Depth of organisms; & Energy of organisms.

We use population to help us know how much of each species is needed. We are using populations for Plankton, Floater jellyfish, Swimmer jellyfish, and Leatherback sea turtles.

We are using depth to show how deep Plankton, Jellyfish, and Leatherback's can go. Also, depth affects plankton growth.

Energy is needed to survive and reproduce. It is gained by feeding, and lost by swimming.

Results of our study:

If a turtle swims around it loses energy. When the turtle eats a jellyfish it gains energy at a certain energy level it reproduces. There are two type of jellyfish. One jellyfish is called a Moon jellyfish they float with currents and camouflage as protection. The other jellyfish is called Cassiopea. Cassiopea use jet propulsion to swim around. When the Jellyfish swim they lose energy. So they eat the bacteria to gain energy. At a certain energy level, they reproduce. They

bacteria reproduce better near the surface of the water instead of deeper levels, because the sunlight is their energy source.

Conclusions we reached by analyzing the results:

You have to the right balance of organisms in an ecosystem for it to be stable. If it becomes unstable it takes a long time to become stable. There has to be enough sea turtles so the jellyfish don't overpopulate. But there can't be a huge amount of sea turtles so the jellyfish don't go extinct. If bacteria levels go down so do jellyfish because they have no food.

Software, references, tables, and other products of our work:

Attachment #1 Net logo code.

Attachment #2 screenshot of Net logo program showing stable ecosystem values

References:

YouTube video by Free School.

Jellyfish website: factretriever.com, marinecareers.net, MarineBio.org,

marine.rutgers.edu

Visit Albuquerque Aquarium-Spring 2018

Books: Life on a ocean Planet

Most significant achievement of the project:

The main thing we learned is how organisms interacted with each other. When you had no plankton, one jellyfish and two sea turtles, the jellyfish would either die from starvation or be eaten and then go extinct. Then the sea turtles would die of starvation as well. We had to make sure that there was enough Plankton, Jellyfish, and Sea turtles so that none of them would go

extinct. We were able to monitor our number of organisms in our model and found the ideal number of organisms for a stable ecosystem.

Acknowledgement of the people and organizations that helped us:

We appreciate the information we got from the Albuquerque Aquarium.

Attachment #1

```
Breed [planktons Plankton] ; comads to create the breeds and their attributes.
Breed [Sea-turtles Sea-turtle]
Breed [Moons Moon]
Breed [Cassiopeas Cassiopea]
Sea-turtles-own [Energy] ;this gives the agents the spacific characteristics of energy.
Cassiopeas-own [Energy]
Moons-own [Energy camoed]
to setup
  ca ; This creates the differnt sections of the oceans.
  ask patches [set pcolor 96
    If pycor > 24 [set pcolor 88]
    If pycor < 24 [set pcolor 77]
    If pycor < 16 [set pcolor 76]
    If pycor < 8 [set pcolor 75]
    If pycor < 0 [set pcolor 74]
    If pycor < -8 [set pcolor 73]
    If pycor < -16 [set pcolor 72]
    If pycor < -24 [set pcolor 71]]
  End
to plankton-pop ; comands to set the Planktons's breed, shape, size, and color.
  crt amt-plankton [set Breed Planktons set color 54 set shape "plant" set size 1
    setxy random-xcor random-ycor depth-check depth-check]
  End
to Sea-turtle-pop ; comands to set the sea turtle's breed, shape, size, and color.
  crt amt-seaturtles [set Breed Sea-turtles set shape "turtle" set size 4 set color 0
    set energy 75 setxy random-xcor random-ycor
    If pycor > 24 [depth-check depth-check]]
```

End

to Moon-pop ; comands to set the Moon's breed, shape, size, and color.

crt amt-Moons [set Breed Moons set color 88 set shape "Jellyfish" set size 3

set energy 75 setxy random-xcor random-ycor

If pycor > 24 or pycor < -16 [depth-check depth-check]]

End

to Cassiopea-pop ; comands to set the Cassiopea's breed, shape, size, and color.

crt amt-Cassiopeas [set Breed Cassiopeas set color 35 set shape "Jellyfishmedussa" set size 2.5

set energy 75 setxy random-xcor random-ycor

If pycor > 24 or pycor < -16 [depth-check depth-check]]

end

To Swim ; commands that allow the sea turtles to move.

Ask Sea-turtles [Ifelse ycor < 24 [lt random 30 rt random 30 fd 1][set ycor 23 set heading 180 fd 1] set energy energy - .1 * turtlemetabolism]

Ask Planktons [Ifelse ycor < 24 and ycor > 8 [lt random 300 rt random 300 fd .5][set ycor 23 set heading 180]]

Ask Planktons [If ycor < 0 [set heading 0 fd .5]]

Ask Moons [camo Ifelse ycor < 24 [lt random 90 rt random 60 fd 1][set ycor 23 set heading 180 fd 1]]

Ask Moons [If ycor < 5 [set heading 0 fd 1] set energy energy - .01 * jellymetabolism]

Ask Cassiopeas [Ifelse ycor < 24 [lt random 40 rt random 40 fd 1][set ycor 23 set heading 180 fd 1] set energy energy - 1]

Ask Cassiopeas [If ycor < -15 [set heading 0 fd 1] set energy energy - .1 * jellymetabolism]

Ask turtles [If ycor < -31 [set ycor -30 set heading 0 fd 1]]

End

to Depth-check ; commands that allow the sea turtles to go specific depths.

if breed = planktons [if ycor > 24 [set ycor ycor - 10] if ycor < -1 [set ycor ycor + 24]]

if breed = sea-turtles [if ycor > 24 [set ycor ycor - 10]]

if breed = Cassiopeas [if ycor > 24 [set ycor ycor - 10]]

if breed = Moons [if ycor > 24 [set ycor ycor - 10]]

end

to feed-repro ; changes energy level as they feed and reproduce.

```
ask planktons [  
  if pycor > 16 [if count planktons < (amt-plankton * 2) [if random 1000 < plankton-reprovalue  
[hatch 1 ]]]  
  
  if pycor <= 16 [if count planktons < (amt-plankton * 2) [if random 1000 < plankton-  
reprovalue [hatch 1]]]]  
  
ask sea-turtles [ huntjellys if any? turtles-here with [breed = moons ][set energy energy +  
foodvalue-of-jellyfish]  
  
  if energy <= 0 [die]  
  
  if count sea-turtles < (amt-seaturtles * 2) [if energy > turtle-reprovalue [ set energy (turtle-  
reprovalue / 2) hatch 1 [set energy (turtle-reprovalue / 2) ]]]]  
  
ask cassiopeas [ if any? turtles-here with [breed = sea-turtles ]][die]  
  
  if any? turtles-here with [breed = planktons ][set energy energy + foodvalue-of-plankton]  
  
  if energy <= 0 [die]  
  
  if count cassiopeas < (amt-cassiopeas * 3) [if energy > jellyfish-reprovalue [hatch 1]]]  
  
ask moons [ if any? turtles-here with [breed = sea-turtles ] [ifelse camoed = 1 [ if random 100  
< 50 [die]] [if random 100 < 85 [die]]]  
  
  if any? turtles-here with [breed = planktons ][set energy energy + foodvalue-of-plankton]  
  
  if energy <= 0 [die]  
  
  if count moons < (amt-moons * 3) [if energy > jellyfish-reprovalue [hatch 1]]]  
end
```

to huntjellys ; this always sea turtles to find and go after the surrounding jellyfish.

```
ask sea-turtles [let jellys-seen other turtles with [breed = moons or breed = cassiopeas] in-  
radius 8
```

```
let closest-jelly min-one-of jellys-seen [distance myself]
```

```
if closest-jelly != nobody [face closest-jelly ]]
```

end

To Camo ; commands that allow the turtles to match the patch color they are in.

```
Ask Moons [ Ifelse any? turtles in-cone 8 360 with [breed = Sea-turtles] [set color (pcolor - 1) set  
camoed 1] [set color 88 set camoed 0]]
```

Attachment #2

