Water Solutions

New Mexico Supercomputing Challenge
Final Report
April 3, 2013

Team #46
Jackson Middle School

Team Members

Matthey Armijo
Jimmy Duong
Randie Terrill
Luu Thanh

Teacher Sponsor

Mrs. Karen Glennon

Team Mentors

Mrs. Patty Meyer

Ms. Janet Penevolpe

Mr. Maximo S. Lazo

Executive Summary

Our Team has been working on how to find solutions to water shortages in New Mexico. We question what kinds of chemicals are in recreation lakes in New Mexico. Another question that concerned us was how to clean the water we already have in our recreation lakes.

We did an extensive amount of research on Elephant Butte Lake and the recreational activities available there, such as boating and fishing. Boating and skidoos release chemicals such as oil and gases into the lake water. Humans, who water ski, pollute the water with their foods, cans, bottles, and sun block that washes off their bodies. Fishing pollutes the water because of the oils in fishing line and remnants of fishing line and hooks left behind in the water.

We learned to program in Starlogo TNG to create our model. The simulation we created to test our questions, set up a centrifuge filter, placed under the lake waters that could filter the chemicals from the water and then release clean water back into the lake. When boats release chemicals into the lake there could be a number of centrifuges in the lake. We planned to test or run our program innumerable times to see if the centrifuge improved the lake water by removing some of the chemicals. Over time the data would be recorded into graphs showing the fish population as increasing or decreasing with the amount of chemical remaining in the water.

Statement of the Problem

New Mexico is in the middle of a several year drought. Conserving the water we have is vital to our survival. Besides water restrictions on the use of water in our arroyos for farms and irrigation, watering plants and landscapes in residential areas, or use of water for drinking and bathing we need to conserve the water currently in our lakes. If we were to set main points or markers in the lake where would they be set? What would determine their placement? How is the water filtered and chemicals in the lake removed? How is the drought affecting the lake?

Our team found a lot of information on the Internet about New Mexico lakes (6), their problems with filtering water (7), maintaining the levels of water in the lakes (6) and need to maintain the integrity of the water (5). There were not many concrete solutions or answers to the issues. As a team, we took a field trip to Shady Lakes Trout Fishing. We learned information about how these manmade lakes are naturally cleaned and how the lakes are preserved (8).

Method

Our team has researched the types of chemicals released from recreational activities in lakes. However, we haven't found an accurate solution to clean the chemicals in such large bodies of water. We learned about centrifuge filters and thought that by placing these filters under water at different marked spaces in a lake they could be used to filter the chemicals and release cleaned water back to the lake. A count of the population of fish in the lake would be taken and checked as the chemical levels in the lake were checked. A correlation of chemical levels and the number of fish would give us a good idea of how well the centrifuge filters were working.

The total cost of each centrifuge would be around $2000 to $3000. In our program we are planning to use about twenty centrifuge filters in the lakes. The total cost would be around $40,000 to $60,000 dollars. Over time, the data would be recorded on a graph showing the amount of fish and amount of chemicals that decreased or increased over time. The efficiency of using the centrifuge in our Starlogo TNG program will show a change in the chemical levels over time. After a period of time the chemicals would just kill fish normally. We placed twenty centrifuges around the lake to help clean out chemicals over time. This saves the fish. This demonstrates that the centrifuge is helping clean in the lakes. By running the program multiple times with and without centrifuges we are able to see the affects of our centrifuges.

After a visit to Shady Lake Trout Fishing we learned the centrifuge could be just one of the ways to clean water. There are a variety of plants and grasses that could be in water to filter and clean the water. Jan Phillips (8), the owner and our guide, instructed us on the different ways that plants and grasses clean, shade, and nurture the waters at their man-made lakes. Nature is the solution at Shady Lakes. Plants and animals that help with the growth and elimination of algae in the lakes are essential to the health of the water environment.

How the Model is Verified and Validated

The modeling software we used is Starlogo TNG. In our model, food would become the waste product of fish, a boat would produce chemicals, and the centrifuge, placed in select places, would change the chemicals into clean water. The centrifuge is just the first step of leading us into the multi-chambered system. Our team is planning to add different plants that can help with the lakes as we see how the centrifuge works.

For now, our team is focusing on a multi-chambered system that uses multiple centrifuges placed under the water in a lake. A count of fish will begin the process and a count of the population of fish in the lake would be taken and checked as the chemical levels in the lake were checked. A correlation of chemical levels and the number of fish would give us a good idea of how well the centrifuge filters were working. Graphs would be used to note how the centrifuges are working to clean chemicals from the lake and how the population of fish was increasing or decreasing. The hope was that the better the centrifuges worked, the population of fish would rise.

Results of Our Study

Our team has determined that there may never be a completed result of a study like this. There are many variables that cause the results to be different. New Mexico is in a severe drought which means there is less run-off water to be used in the lakes. There is a very real possibility that New Mexico could lose several lakes because of these two issues. There may need to be a restriction of recreational use of lake water that is currently available so there is enough water to be used in farming, drinking, and sustaining the necessary uses.

The centrifuge is expected to be battery powered as opposed to being solar powered. The reason is that the cost would be too much using solar panels and more centrifuges would need to be spread out to clean as much water as possible. As opposed to using nature's cleansers, such as lily pads and other filters would not cost much, but will take longer for the filtering to work. We would have to use a lot more of those filtering kinds of plants than centrifuges.

Running our Starlogo TNG model countless times we found these results: Centrifuges saved the population of the fish and eliminated the chemicals in the water. Originally, the size of the centrifuge was the same size as the fish in the model. Centrifuges should be bigger than the fish in the model, so we increased the area of the centrifuges. Due to this, more fish were saved and the chemicals were removed in a faster time before the fish could die.

We still have questions about the maintenance of the water in the few lakes in New Mexico that allow recreational use of the water. If centrifuges were not able to keep the water clean, then how many filtering plants would we need to keep the lakes clean? We hope that our program will prove a model to see if, through time, the centrifuge will be affective or if it will affect anything.

Conclusion

We discovered the centrifuges were successful in keeping the fish alive. If the centrifuges are the correct size and they are spread out, they can clean the chemicals out of the water faster and more efficiently. A centrifuge filter would take in the lake water then release clean water retaining the chemicals. We conclude that the cost of the centrifuges would be a great deal of money, especially if you had to replace or clean them every year. Also, if we were to use nature to clean the lakes the price would be less. Using the plants for filtration would help clean the lakes slowly through the acreage of the water. The problem is that it would only clean certain types of chemicals such as algae. Our conclusion is that the centrifuges will cost more, but clean more efficiently.

References

1. Fleck, John *City Water Savings: Half Full or Half Empty?,* Albuquerque Journal, Tuesday Morning, January 15, 2013. Copyright 2013, Journal Publishing Company.

2. Fleck, John, *Drying Rivers Taking Toll on Farms, Fish* Albuquerque Journal, Metro & NM section, Friday, August 24, 2012. Copyright 2012 Journal Publishing Company.

3. Fleck, John, *N.M. Water Year: Too Little Under The Bridge,* Albuquerque Journal, Tuesday Morning, October 9, 2012. Copyright 2012 Journal Publishing Company.

4. Fleck, John *Where Drought Hits N.M. the Hardest,* Albuquerque Journal, Tuesday Morning, January 29, 2013. Copyright 2013, Journal Publishing Company.

5. Inskipp, Carol, (2006). Conserving our Fresh Water, Lewes, East Sussex: White- Thomas Publishing Ltd. 48 pages.

6. New Mexico Reservoir Levels, http://www.climas.arizona.edu/swco/aug2012/new-mexico-reservoir-levels, Monday, January 14, 2013

7. Our Water, Our Future, http://www.environmentnewmexico.org/programs/nme/our-water-our-future Monday, November 12, 2012

8. Phillips, Jan, owner, Shady Lakes Trout Fishing, 11033 Hwy. 85 NW (NM 313) Alameda, NM 87114, Wednesday, March 27, 2013.

9. Rodman, Jay *Researchers treating wastewater with algae* NMSU News Service, Albuquerque Journal Business Outlook, Monday, March 18, 2013.

10. Romo, Rene, Journal Southern Bureau, The Sunday Journal, New Mexico Section, August 26, 2012, Copyright 2012 Journal Publishing Company.

Significant Achievements

Jimmy Duong

My most significant achievement on the project was learning more about programming using Starlogo TNG.

Matthew Armijo

I learned a lot about programming – starting out with nothing and showing how to do different scenarios.

Luu Thanh

Learning to do the research and citing of all of the sources was my most significant achievement. It was fun and a real challenge.

Randie Terrill

Creating the program, especially putting the environment in the Spaceland. The lake was the most difficult.

Acknowledgement

Mrs. Patty Meyer for help with keeping us on track, editing, and completion of our project.

Mrs. Karen Glennon for advisory

Peter Terrill for escorting us to all but one of our field trips

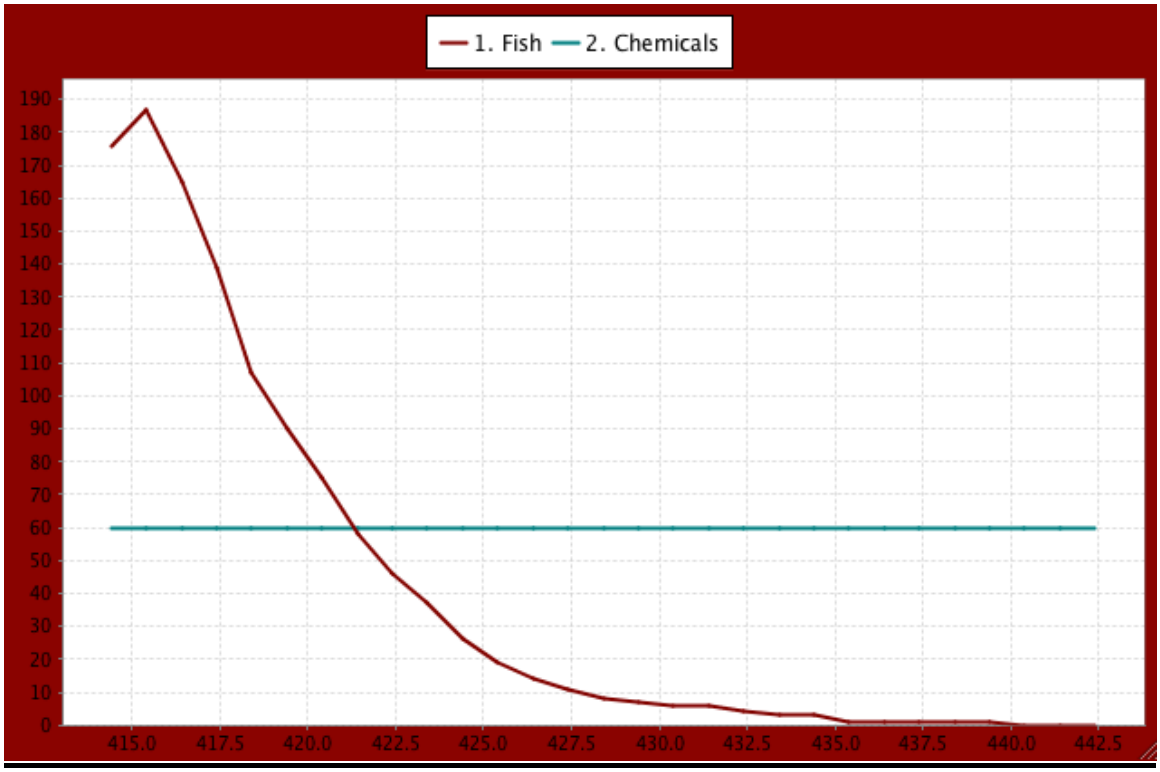
Ms. Janet Penevolpe for help and advice to make our programming better.

Shady Lakes: Jan Phillips

Mrs. Maximo S. Lazo for suggestions on how to make the project better and more interesting.

Consult with MMM emails and tips from Kathy Pallis and Joey Serim.

Our Program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2. Chemicals
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180
170
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130
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110
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30
20
10
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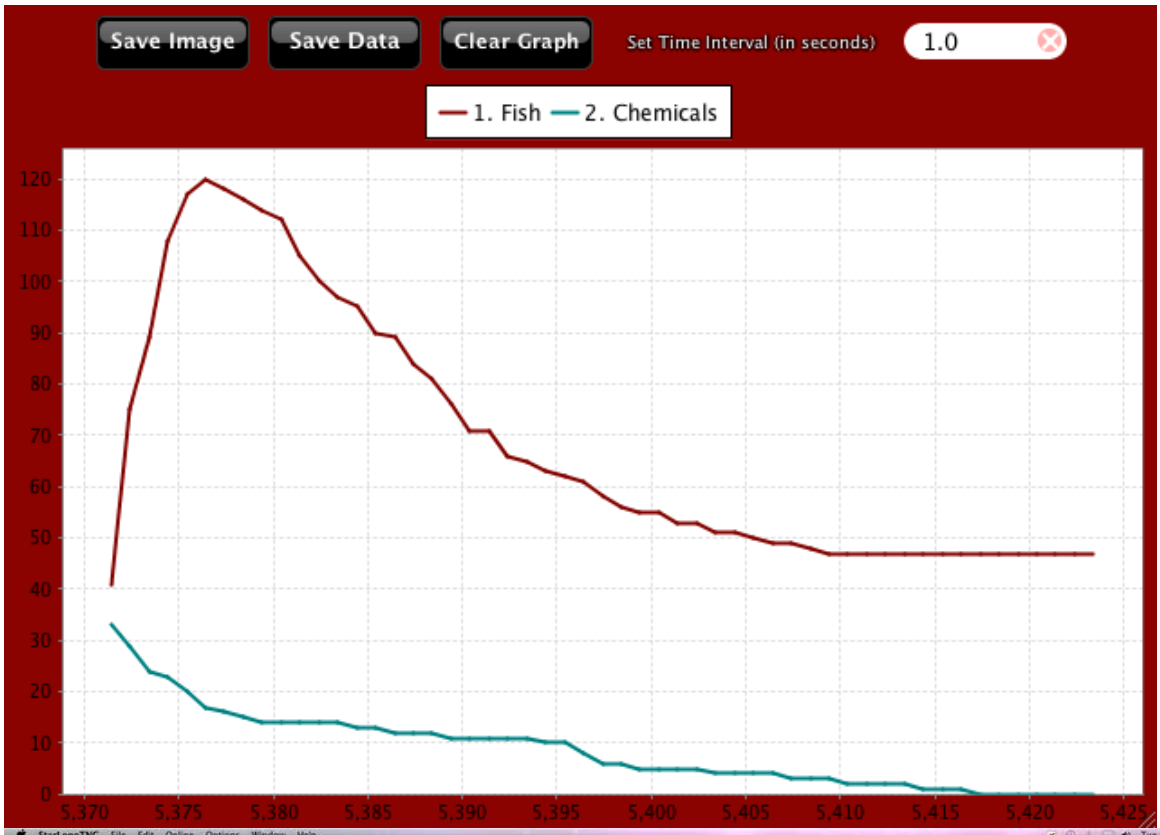
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100
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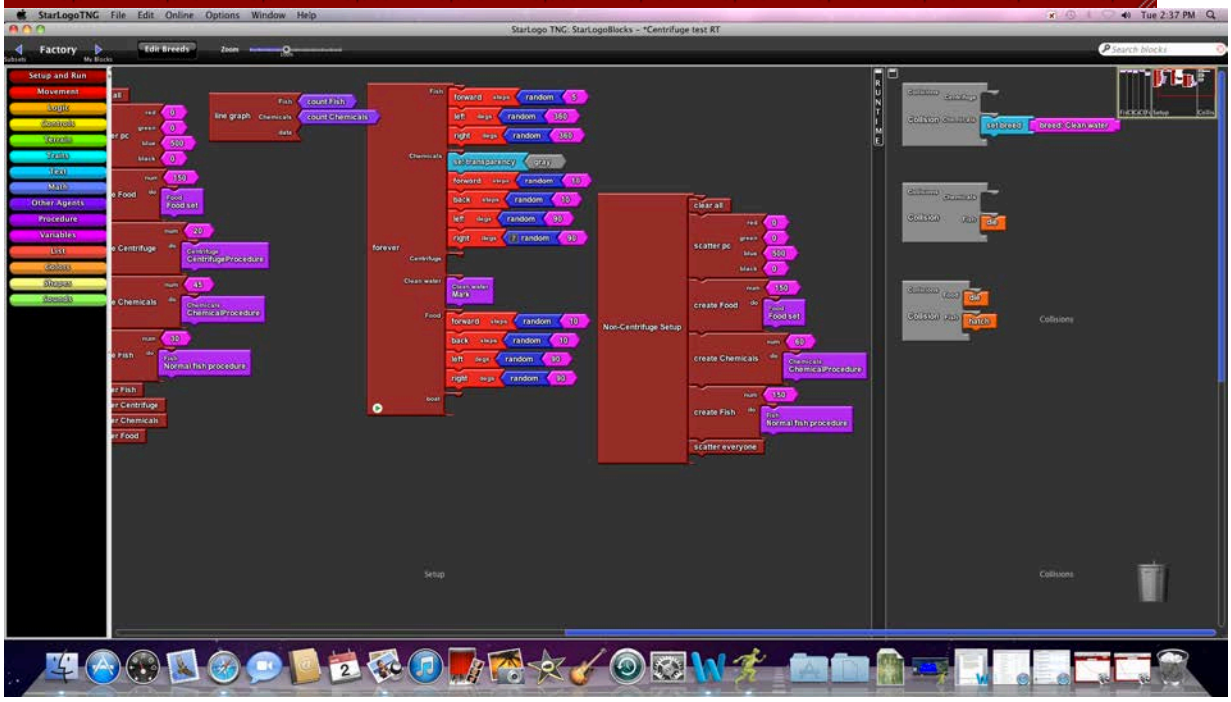
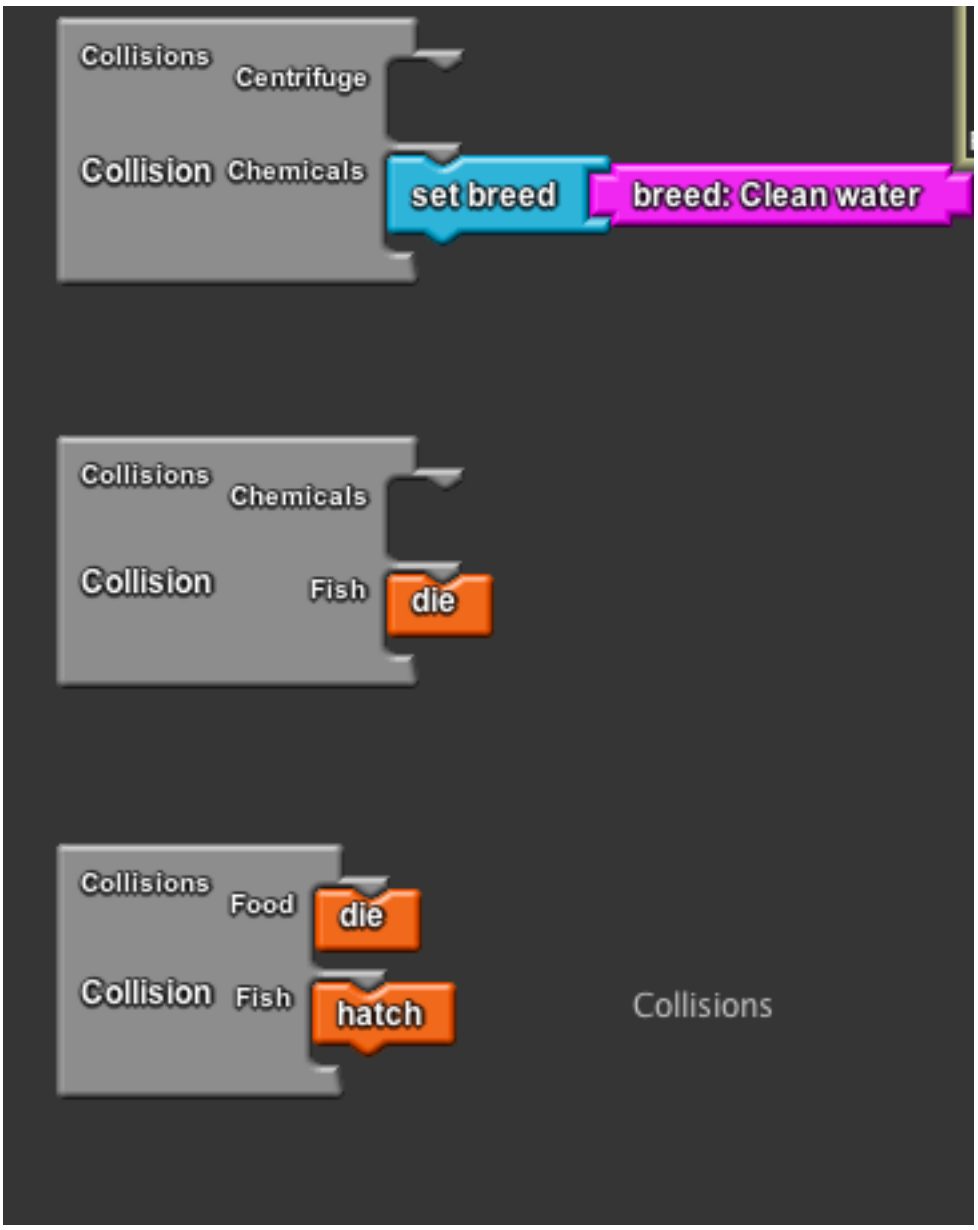
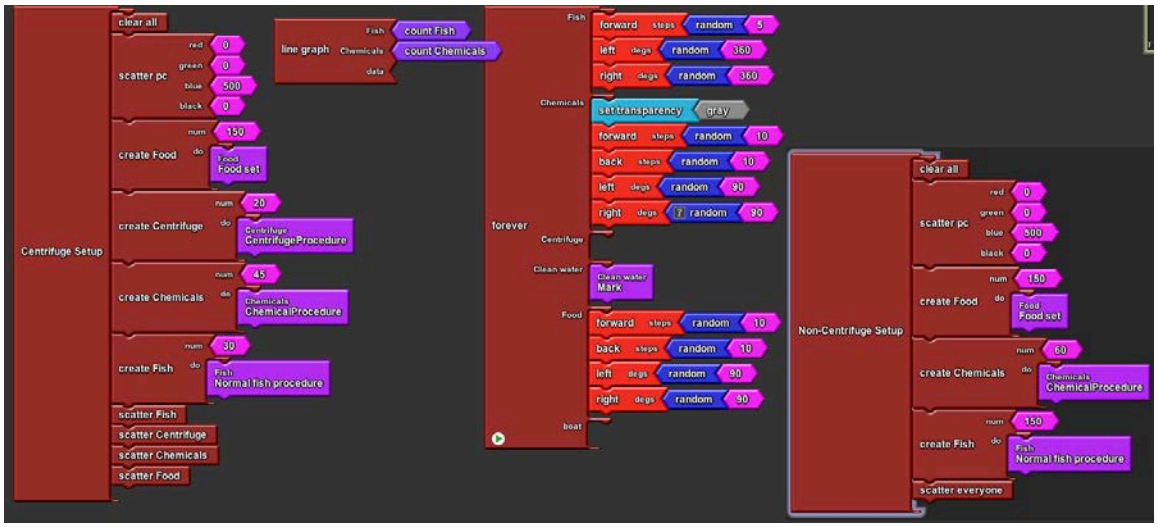

StarLogoTNG File Edit Online Options Window Help
StarLogo TNG: StarLogoBlocks - *Centrifuge test RT
Factory
Edit Breeds
Zoom
Setup and Run
Movement
Logic
Control
Turtle
Text
Math
Other Agents
Procedure
Variables
List
Colors
Shapes
Sounds
forever
Non-Centrifuge Setup
Setup
Collisions


Collisions
Centrifuge
Collision
Chemicals
set breed
breed: Clean water
Collisions
Chemicals
Collision
Fish
die
Collisions
Food
die
Collision
Fish
hatch
Collisions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scatter pc
red 0
green 0
blue 500
black 0
create Food
num 150
do
Food
Food set
create Centrifuge
num 20
do
Centrifuge
CentrifugeProcedure
create Chemicals
num 45
do
Chemicals
ChemicalProcedure
create Fish
num 30
do
Fish
Normal fish procedure
scatter Fish
scatter Centrifuge
scatter Chemicals
scatter Food
line graph
Fish
count Fish
Chemicals
count Chemicals
data
forever
Fish
forward steps random 5
left degs random 360
right degs random 360
Chemicals
set transparency gray
forward steps random 10
back steps random 10
left degs random 90
right degs random 90
Centrifuge
Clean water
Clean water
Mark
Food
forward steps random 10
back steps random 10
left degs random 90
right degs random 90
boat
Non-Centrifuge Setup
clear all
scatter pc
red 0
green 0
blue 500
black 0
create Food
num 150
do
Food
Food set
create Chemicals
num 60
do
Chemicals
ChemicalProcedure
create Fish
num 150
do
Fish
Normal fish procedure
scatter everyone


Fish
Normal fish procedure
set size 200
set color orange
Fish
Chemicals
ChemicalProcedure
set size 500
set color lime
Chemicals
Centrifuge
CentrifugeProcedure
set size 3
set color white
Centrifuge
Clean water
Mark
set color cyan
Clean water
Food
Food set
set color purple
set size 400
Food