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Gone Fishing with Stella

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Environmental Biology

Gone Fishing!!!!!!

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- This simulation is intended to stress your imagination and analytical skills. The simulation models the commercial fishing industry of the northeast and will present for you some of the same problems faced by people involved in that profession from fisherman to federal fish management personnel.

Correlation with the State Standards

Standard #1 Analysis, inquiry and design.

KEY IDEA 1: The central purpose of scientific inquiry.

1.1a Scientific explanations are built by combining evidence that can be observed.

1.2a Inquiry involves asking questions and locating, interpreting, and processing information.

1.2b Inquiry involves making judgments about the reliability of information.

2.2a Development of a research plan involves researching background information and understanding the major concepts in the area being investigated.

2.3c Development of a research plan for testing a hypothesis requires planning to avoid bias.

3.1a Interpretation of data leads to development of additional hypothesizes, the formulation of generalizations, or explanations of natural phenomena.

3.4a Hypotheses are valuable, even if they turn out not to be true.

KEY IDEA 3: The observations made while testing a hypothesis provide new insights into natural phenomena.

3.1a The interpretation of data leads to development of additional hypotheses.

3.4a Hypotheses are valuable, even if they turn out not to be turn, because the may lead to further investigation.

KEY IDEA 6: Plants and Animals depend on each other and their physical environment.

6.1g Relationships between organisms may be negative, neutral, or positive.

6.3a The interrelationship and interdependence of organisms affects the development of stable ecosystems

KEY IDEA 7: Human decisions and activities have had a profound effect on the physical and living world.

Standard #2 Information Systems

Standard #6 Interconnectedness: Common Themes.

Standard #7 Interdisciplinary Problem Solving.

Class room simulation

- Cut out pieces of construction paper which represent the fish you choose
- Find the retail market value for the fish you chose.
- Find the cost of a boat used to catch the fish you selected.
- Create a ledger for both living and business expenses. Numbers used are based on contacts with people in housing, insurance as well as other research.
- Perform the simulation collecting data, noting important events that occurred during the simulation. These events include such things as storms, oil spills, pollution, and visits to your fishing grounds by factory ships or foreign fishing fleets.
- Graph the data; # of fish caught, profit/lose with correlation to events both natural and manmade.
- Make recommendation/changes to the simulation aimed at maximizing profits and maintaining a viable fish population.
- Repeat the simulation.
- Compare the data from the two simulations and write a report summarizing your findings.

Stella computer model

- Run tutorial of stella.
- Select variables to include in model.
- Start with simple flow model with one in flow (birth rate) and one out flow (death rate).
- Based on research and experimentation, select equations that show the relationships of this two factors to fish population.
- As the activity progresses, ad variable until all those used in the classroom simulation are included in the stella mode.
- Finally integrate a “fishing factor” that shows the economic relationship between fish population and the fishing industry.

Modeling Using System Dynamics

What are they doing?

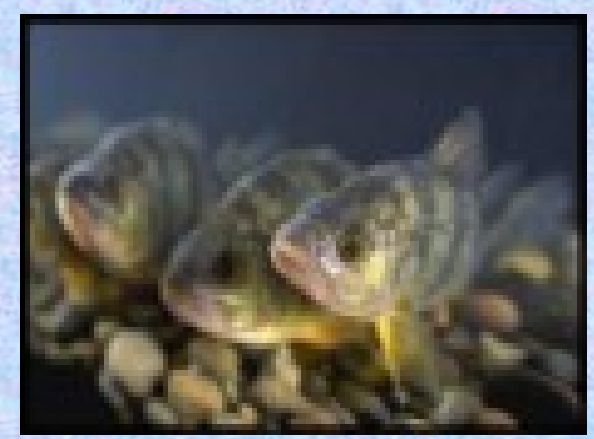
- The project attempts to present a dynamic system, a fish population and how it is affected by a number of variables.
- Some of the variables that impact fish population include: birth rate; death rate; predation; commercial fishing; availability of food; environmental factors such as weather; pollution and other human activities; and others.

  The classroom simulation includes the variables listed above. In the computer model the students will start with only four variables. Over time more variables be added to the model.

- Fish populations affect fisherman and their economic livelihood. So the simulation and model will show the relationships that exist between fish populations, predator populations, commercial fishing and environmental factors, natural and those that are the result of human activity.

Assumptions about fish and fishing.

- Historically there was a time when there were more fish and therefore a much higher density.



- When the fish density is high fisherman caught lots of fish even without a lot of technology

More assumptions about fish and fishing.

- Using fish finding technology allows fisherman to find fish even when population numbers are low.

- At this point the number of fish caught exceeds both the death rate and the birth rate, upsetting the balance the fish have with their predators or prey.

Our Last Assumption

- Eventually, even with the use of fish finding and other improved fishing technology catching fish will become very difficult. There just won't be as many fish.
- At this point the fish population will be on the brink of extinction. There may not be enough of a species left to repopulate.

Where are We?

- Currently our model is incomplete. We are attempting to produce anticipated graph results.
- We are continuing our research looking for existing models with other possible math solutions.
- Research does support our early assumptions.
- Meaningful comparisons can be made between the simulation results and the computer model