

Invasive Species in Ecosystem Simulation

Objective

This activity is to introduce students to competition for resources when a change in the ecosystem occurs because invasive species become established.

Students will ...

- demonstrate changes in aquatic ecosystems invasive species are introduced,
- will discuss relationships of all parts of the ecosystem,
- experience competition of living organisms and
- predict conditions of the ecosystem when an invasive species multiplies.

Background:

Aquatic ecosystems are fragile. Nonnative invasive species can alter aquatic systems permanently resulting in small or large changes in the balance of the system. When nonnative species become invasive they affect the food chain, altering the availability of food and nutrients to native plants and animals. The Invasive Species Simulation actively demonstrates to students the impact that water hyacinth (or *Hydrilla*, *Salvinia*) can have on the biota of aquatic systems.

Water hyacinths can have a dramatic effect on natural systems. They reproduce rapidly and form thick mats on the surface of ponds, lakes and rivers. As water hyacinths cover the water's surface, they restrict sunlight that submerged native plants need to grow. Eventually, these shaded plants die and decay. As the plants die and decay, dissolved oxygen becomes depleted causing animals that need oxygen to leave the area, become stressed or die.

The game is played in three rounds. As each round is completed, the teacher and students should discuss the changes that have occurred in this simulated ecosystem.

The Simulation Game

Object: To survive for as long as possible.

Materials for a class of 30 students below, adjust with class size

Name tags: Make hanging name tags for players (3 per page, cover stock with yarn strung through) labeled:

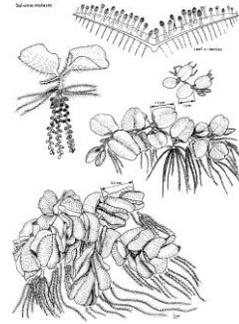
10 Larval fish 10 Large fish 10 Mussels

Game pieces

100 each of two color game pieces, total: 200 pieces. Paper circles or poker chips work well such as white and blue.

Chalkboard or overhead, paper or data sheet and pencil to record student observations.

Set up: A large open area is best to allow free movement of students and located either in- or outdoors. The ideal place to play the game is in a large area outdoors in the school yard, the gym or cafeteria to allow students plenty of room to move quickly.



Begin the game with a greater number of larval fish than crayfish or large fish.

Procedure:

Students wear name tags and talk about their relationship to each other in the ecosystem. Students need to understand that all organisms need oxygen and food to survive, and in some cases, they are food for each other.

Students form a large circle in the play area. Teacher explains that the area is a wetland with small shallow ponds.. The teacher scatters 100 blue poker chips (identified as food) and 100 white poker chips (identified as dissolved oxygen) inside the circle.

Round 1. At the signal from the teacher, students are encouraged to scramble and collect as many game pieces as possible. When all are collected, students are asked to count the number they each have.

Explain that each species needs a certain amount of dissolved oxygen and plankton to survive. Students and teacher will determine which species have survived based on the species needs in the chart below. Each individual species must have at least the required number of the specific game pieces to survive. Survivors continue as the same species during the next round. Species (players) that did not survive are eliminated, return chips to teacher and sit out the next round of play.

	Dissolved Oxygen (white)	Plankton (blue)
Larval fish	6	6
Native mussels	6	6
Larger fish	10	10

Record the total number of each species at the beginning of the game and the number of survivors in each species.

Round 2: Students reform circle and the teacher scatters all of the game pieces again. Explain to students that an invasive species has begun to multiply in their wetland. It is a floating plant called water hyacinth. The students who were eliminated in the first round sit out this round and observe. At the signal, students are encouraged to scramble and collect as many game pieces as possible.

If necessary explain again that in order to survive, each animal needs a specific number of oxygen and plankton chips. Players who do not collect enough chips will be eliminated. When all are collected, students are asked to count the number they have. Students and teacher will determine which species have survived based on the species needs in the chart. Only a few will be eliminated in this round and class should discuss possible reasons (because there was plenty of food and dissolved oxygen for fewer animals).

Record the total number of each species at the beginning of the round and the number of survivors in each species. Teacher collects all game pieces.

Round 3

Describe a new scenario. Water hyacinths have multiplied and now cover the entire water surface. Explain that under these conditions, sunlight cannot penetrate and underwater plants are dying. Plants cannot photosynthesize (produce their own food) without sunlight, and therefore do not produce more oxygen. Fewer plants mean less food for herbivores (plant eating animals) to eat and less habitat and refuge for the animals that live there. **Discuss** with students what they **predict** will happen.

Students reform the circle. To represent the change, the teacher removes half of each survivor's chips, and scatters the balance on the floor for Round 3.

The students who were eliminated in the second round will sit out this round and observe. At the signal, all surviving players scramble for the smaller number of chips collecting as many game pieces as possible. When all are collected, students report and record the number of each in their possession and determine whether they have survived based on the species needs in the chart. A few more players are eliminated.

Ask all players if they can think of any other method to survive. Someone may point out that the larger fish could prey on the smaller fish. The class should eventually note that predation will not sustain life long without a new source of oxygen. Predation supplies food, not oxygen. Each one needs some of both.

If there is time, repeat rounds of play until all food and oxygen has been used up.

Wrapping it up

As a class, create a table of recorded data and graph results of the three rounds. Discuss the graphic results and why populations of fish and mussels were affected by the presence of the water hyacinth.

Important ideas: biodiversity, dissolved oxygen, ecosystems, food chain, food webs, native species, invasive species, plankton

Benchmarks/ GLES

SI-E-A1 G- 1,2 #27

SI-E-A1 G- 3 #57

SI-E-A2 G- 1,2,3 #4

SI-E-A5 G- 3 #9, 10

SI-E-A5 G- 4 #10, 11

SI-M-A1 G- 5,6,7,8 #3

SI-M-A2 G- 5,6,7 #16

SI-M-A4 G- 5,6,7 #11

SI-M-A5 G- 5,6,7 #16

SE-E-A1 G- 3 #57

SE-E-A3 G- 3 #58

SE-E-A3 G- 2 #48

SE-M-A4G- 5 #50

SE-H-A9 Env #10

SE-E-A5 G- 2 #50

SE-E-A5 G- 3 #9, 10

SE-M-A2G- 5 #48

LS-E-A2 G- 1 #28

LS-E-C1 G- 1 #32

LS-E-C1 G- 2 #35

LS-E-C1 G- 4 #50

LS-M-C3G- 7 #29

LS-M-D2G- 7 #34

LS-M-C4G- 7 #29

LS-M-D1G- 7 #31

This activity was adapted by Marilyn Barrett O'Leary and Dianne Lindstedt from "Web of Life Game" in Zebra Mussel Mania.

