Community Development

Grade Level: Middle School, High School
Ecological Concepts: **Community**, **Immigration**, **Interspecific interactions**
Arizona Science Standards: Science as Inquiry; Life Science

Materials:
1) Magnifying lens, loupes*
2) Plankton net (See directions to make, below)
3) Wading pools or large plastic washtubs/dishpans
4) Writing/drawing materials
5) Cups
6) Fine mesh cloth*
7) Bird netting
8) Water de-chlorination drops (optional)
*May be borrowed from SCENE.

BACKGROUND
Most organisms, at one life stage or another, immigrate to another area. These migrations, into or out of an area or habitat, create ecological **communities**. Plants move from place to place in the pollen or seed form. Plant pollen or seeds move by wind, water, and animal carriers. Terrestrial animals move under their own locomotion, or if small enough, by the wind or other animal carriers. Aquatic organisms migrate by water, but also by air or animal carriers. Some aquatic organisms can withstand periods of drying and thus are capable of being moved from one body of water to another.

GUIDED INQUIRY
Observation/Exploration Period: Set out some wading pools in the habitat and fill with de-chlorinated water. (Instructions for how to de-chlorinate are under Sample Experiment Design, below. It's easy!) Leave them open. Students can use their eyes and loupes to observe the contents of the water over time. Students can also observe other, terrestrial parts of the habitat for signs of changes in the composition of inhabitants over time.

Group Discussion and Question Period: What causes new areas to become populated with organisms? How long does it take for a new pool of water to have life growing in it? Do the organisms in an area change naturally over time? What causes the numbers or species to change in an area?

Important aspects of guided inquiry are encouraging students to generate multiple hypotheses, and letting students make decisions about what data are important and create their own data sheets. Keeping these ideas in mind, the sample in the box below illustrates how ONE OF MANY possible investigations around this topic might develop.

Sample Hypothesis: Let's use the question, "What causes new areas to become populated with organisms?" The hypothesis could be: "If pools of water are colonized by windblown organisms and we place open and covered pools in the same area, then the pools in the open will be colonized sooner than the covered pools."

Sample Experiment Design: The **independent variable** is the type of pool, open to the wind versus not open. The **dependent variable** is the number or density of organisms that colonize the pools. Place four wading pools near each other in the habitat. (You can also use smaller pools, such as plastic washtubs, for space and cost considerations.) Fill each pool with the same amount of water. The water needs to be de-chlorinated. Water can be de-chlorinated either with drops for that purpose purchased from a pet supply store, or by letting the water sit in the open air for a few days. The chlorine will naturally dissipate into the air, especially if the water is stirred off and on. Two pools are left completely open to the air, but covered with bird netting to prevent birds from entering the water. The other two pools are covered with a fine mesh net or cloth. This will allow airflow and should keep the water temperatures in all pools similar. This way, you will have two **replicates** for each treatment and be **controlling** for other factors such as temperature and location.

Sample each pool weekly with a **plankton net**. (See All Levels below for instructions on how to make your own plankton nets.) Collect 0.1L (100ml) water samples and pour into individual plastic cups. If it looks like "stuff" (possibly plankton) is sticking to the inside of the plankton net collecting vial, use about 5-10 ml of fresh de-chlorinated water to rinse the vial contents into the sample cup. Sort and categorize the organisms found using a dissecting microscope or loupe. A pond guide will be helpful. The two basic categories are **zooplankton** and **phytoplankton**. For each sample calculate the density (number of organisms/liter water). Sample the pools the same way each time— swirl the pool water, take one net full, empty into water filled cup. Calculate the density of organisms in the pool by dividing the number of organisms in the sample of a pool by the amount of water taken for the sample. For example, if the 0.1 L (100 ml) sample taken from Pool A has 15 organisms then the density is: 15 organisms/0.1 L which equals 150 organisms/liter. To estimate the total number of organisms in the pool, multiply the number of organisms per liter by the number of liters in the pool. Using the above example, this would be: 150 organisms/L x 10L = 1500 organisms. Empty the sample cup and its organisms back into each pool to preserve the population numbers close to normal.

Note: Water levels will drop over time due to evaporation. Mark the pools or tubs at the fill line and keep them filled with de-chlorinated water.

Sample Prediction: Pools in the open will be colonized more quickly and by more organisms than the covered pools.

Record Results: Collect data for four weeks (more if you have time).

Sample Analysis of Data and Presentation: Make a **bar graph** of the raw numbers with time on the horizontal axis and density of organisms on the vertical axis. For students who can divide, calculate the **average** density for two pools per treatment. Graph the average number on the vertical axis.

Discussion: Was your hypothesis supported? If yes, go on to test other hypotheses. If not, why not? What did happen? Why? This is a great opportunity to revise your hypothesis and do another test.

MORE:
(1) Elementary:
(a) Try the same experiment with pools in the sun and pools in the shade. Does light make a difference?

(2) Middle School:
(a) Find the **mean**, **median**, **mode** and **range** of the data.

(3) High School:
(a) Calculate the **standard deviation** of the averaged data.
(b) Perform a **T-test** of species richness. (T-test is a standard statistics test comparing means of two treatment groups.)

All levels:

Making your own plankton nets is easy, and much cheaper than buying them from a biological supply house.

Supplies needed:

Metal or plastic embroidery hoop
Old bed sheet
Small plastic pill vial
2 pieces of strong, flexible wire, each 10 cm longer than hoop diameter
6 meters of nylon fish line
1 rubber band
To make the net: Experiment with a pattern to create one that will form a cone when one side of the cloth is sewn all the way. Sew the bed sheet cloth into a cone shape. Make the top as big around as the hoop and the other end as narrow as the pill vial opening.

Wire yoke: lay the 2 wires next to each other. Bend them in half together. Twist the two wires together in the middle to create an opening. This will be for tying the fishing line on to.

Assemble the net: Put the hoop onto the top of the net by separating the two parts of the hoop, placing the cloth over the inner hoop and the larger hoop over the cloth and inner hoop. Drop the pill vial into the bottom of the cone with the bottom of the vial coming out the opening of the cone. Secure it in place with the rubber band over the cloth. Attach the wire in four places evenly around the large opening. Poke the wire ends through the cloth, pull through and twist back on themselves. Tie the fishing line to the loop at the top of the wires.

To use the net, throw it underhand out into the water, let it sink a little bit, and then slowly pull it back in. Hold it upright until all the water except what is in the vial has drained. Invert the net and pour the contents of the vial into a plastic cup.

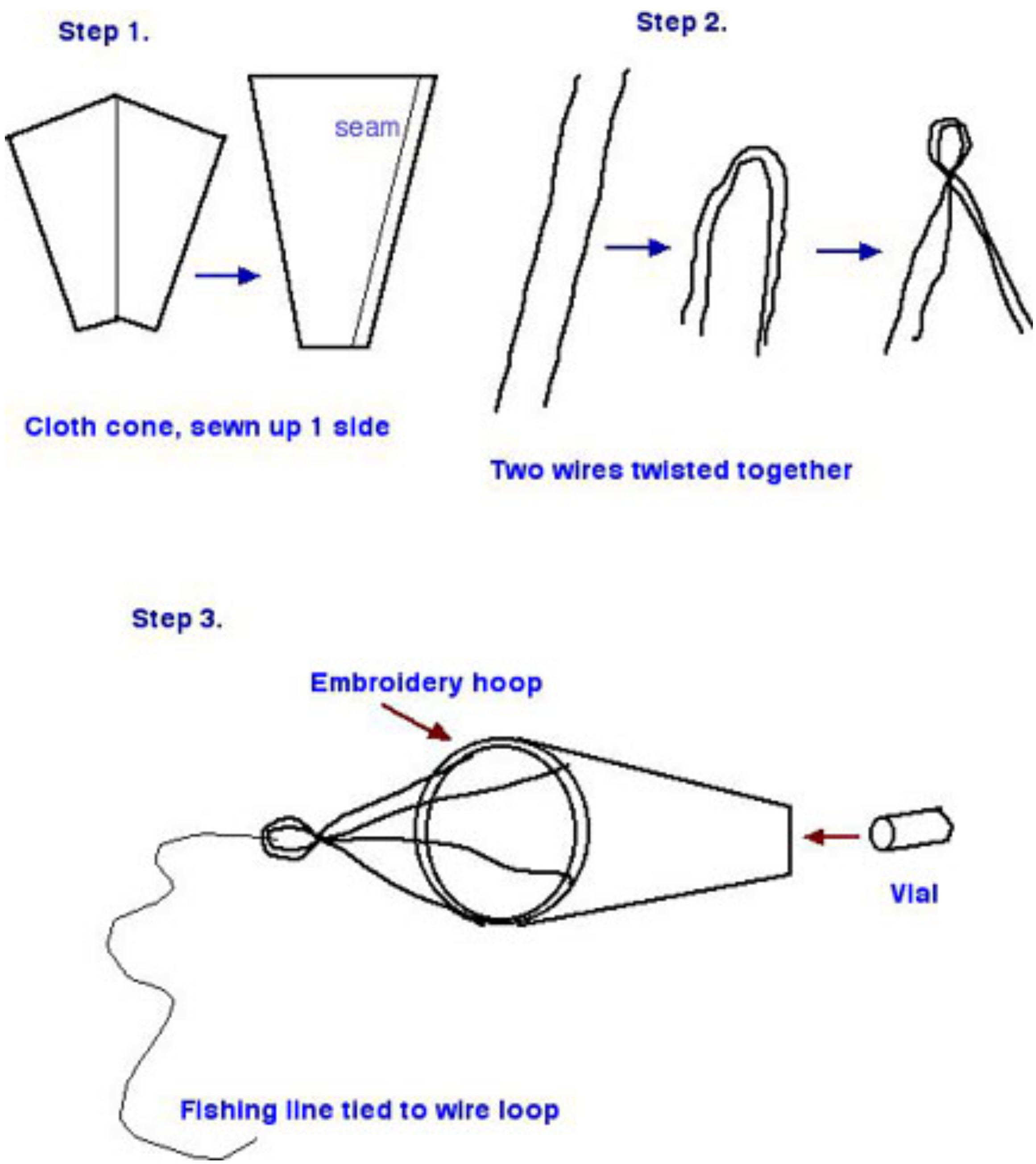

Figure 1. Assembling a plankton net.