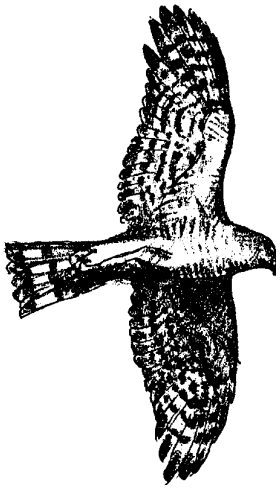
Pyramids in the Marsh

Lesson adapted by Phyllis Schmitt
from "Marsh Math" in the *Salt Marsh Manual*



Key Concepts

1. Estuaries are very productive environments due to the abundance of nutrients from decaying plant material and freshwater inputs.

2. A large number of organisms at the bottom of a food pyramid are

needed to support a small number of organisms at the top.

Background

Estuaries, arms of the sea where fresh and saltwater mix, function as "nutrient traps." This buildup of nutrients makes estuaries and the surrounding salt marshes very productive environments. The following math exercises will help students understand just how productive a salt marsh may be. The math problems illustrate the principle that a large number of organisms at the bottom of a food pyramid are needed to support a small number of organisms at the top. The data used in these exercises were simplified and do not represent actual numbers calculated for the marsh or estuary; however, they are reasonably close to what occurs in real life.

Within a food pyramid, individual food chains exist. One salt marsh food chain includes marsh hawks (harrier), seaside sparrows, grasshoppers, and cordgrass.

cordgrass → grasshopper → sparrow → marsh hawk

The arrow points to the organism that eats the preceding organism and represents the transfer of energy. The hawk is at the top of this food chain. Cordgrass, which gets its energy from the sun, is at the bottom.

There are more organisms at the bottom of the food pyramid than at the top. When moving up the food pyramid, the number of organisms decreases. A large number of cordgrass plants feed thousands of insects. In turn, these insects feed a few hundred sparrows which feed only a few hawks. During this lesson, the food chain outlined above is examined. Each animal is only eating one type of organism. Explain that in real life most animals eat more than one type of food.

Materials

For each group of four students:

- 4 "Pyramids in the Marsh" student activity pages
- at least one calculator (optional)

Teaching Hints

1. Explain that the following data was recorded by a wildlife biologist. Display the data for discussion.
   - One hawk weighs 600 grams and eats 600 grams of sparrows each week.
   - One sparrow weighs 20 grams and eats 50 grams of grasshoppers each week.
   - One grasshopper weighs 1 gram and eats 15 grams of cordgrass each week.
   - One cordgrass plant weighs 5 grams.

2. Distribute worksheets to students in each group. Note that the calculations require multiplication of two digit numbers and use the division symbol, although not the processes of division. Depending on the math skill levels of each group, you may choose to have the members work together, using the data above, to complete their calculations. If the groups have yet to master these math topics, you may wish to do the activity together as a class. Provide any assistance you class needs to be successful. The point of the lesson can be made effectively regardless of who does the math.

3. When groups have completed the worksheets, draw on a chart or blackboard a food pyramid similar to the one found on the second worksheet. Have students fill in the food pyramid using the numbers from their calculations.

4. Next, have students construct a food pyramid with 5 hawks. Then have students create a food pyramid with 10 hawks. Ask questions like:

   How is the marsh able to support all the plants and animals that live there? (Nutrients are brought in with the freshwater, and saltwater tidal action. Detritus provides more nutrients which are trapped in the salt marshes, producing a very productive habitat for plant growth.)

   What organisms, in addition to the grasshoppers, feed on cordgrass? (Many organisms such as worms, clams, crabs, and ducks feed on live and decaying cordgrass.)

   How important is cordgrass to life in the marsh? (Very important. Cordgrass forms the base of the salt marsh pyramid that supports a large number of organisms.)

Key Words

food pyramid - diagram showing relative amounts of food eaten by each animal in a food chain

nutrient - chemicals essential to the health and growth of living organisms, usually containing phosphorus, nitrogen, and potassium

organism - general name for any living thing

Extensions

Construct a food pyramid for an eelgrass bed, or mangrove swamp.

Answer Key

1. 600 gr ÷ 20 gr = 30 sparrows
2. 50 gr ÷ 1 gr = 50 grasshoppers
3. 30 sparrows X 50 grasshoppers = 1500 grasshoppers
4. 15 gr ÷ 5 gr = 3 plants
5. 3 plants X 50 grasshoppers X 30 sparrows = 4,500 plants

Number 1
Name: hawk

Number 30
Name: sparrows

Number 1500
Name: grasshoppers

Number 4,500
Name: cordgrass plants

Adapted from the activity “Marsh Math” found in *Salt Marsh Manual - an educator’s guide, San Francisco Bay National Wildlife Refuge*. 1992