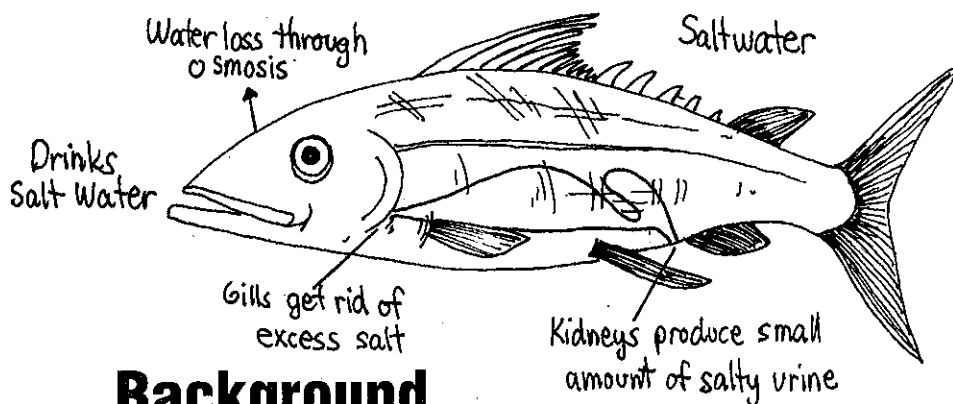
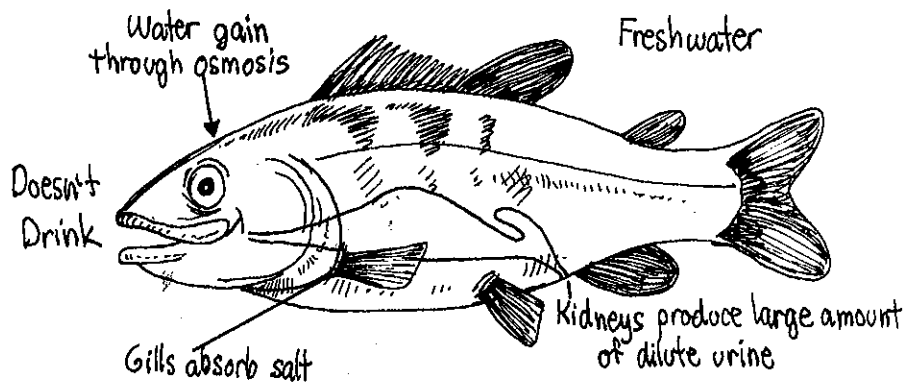


Fish Focus

- Fish can get dehydrated in water.
- Saltwater fish need to absorb more water just as freshwater fish need to give off more water.
- Freshwater fish cannot survive in salt water just as saltwater fish cannot survive in fresh water.

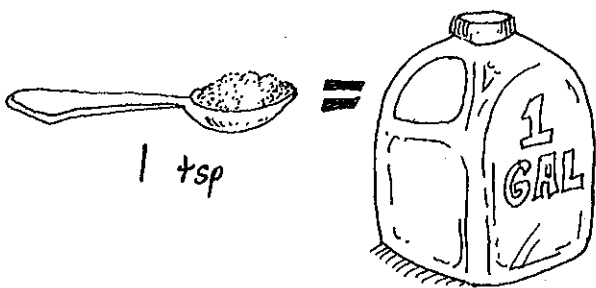
Lesson 4: Special Adaptations to Water



fin fact

Add 1 teaspoon of salt to every gallon of water in your aquarium.

This will help create an environment that is more like home for the fish. Yes, even freshwater lakes and streams contain a certain level of salt picked up by runoff from the land.



Background

Just because fish swim in water doesn't mean they don't get thirsty. Saltwater fishes need to drink a lot more water than freshwater fishes. Water flows in and out of a fish's body through a process called osmosis. In osmosis, water moves from where there is less dissolved salt to where there is more. Since sea water is saltier than the liquids in a fish's body, water inside the fish is constantly flowing out. If they didn't drink to replace the lost water, saltwater fishes would dry up like prunes. But because sea water is so salty, a fish could get sick drinking it without some special adaptations. Special cells in the ocean fish's gills rid the body of some salt. Its digestive tracts remove the rest.

Freshwater fishes have the opposite problem. Liquids in their bodies are saltier than fresh water. So water flows into their bodies constantly. To keep from getting waterlogged, freshwater fishes "bail" themselves out. They pass large amounts of water from their bodies as dilute urine. That is why a closed environment like an aquarium needs to be cleaned on a regular basis. This urine builds up in the tank over time and becomes toxic to the fish.

Discussion

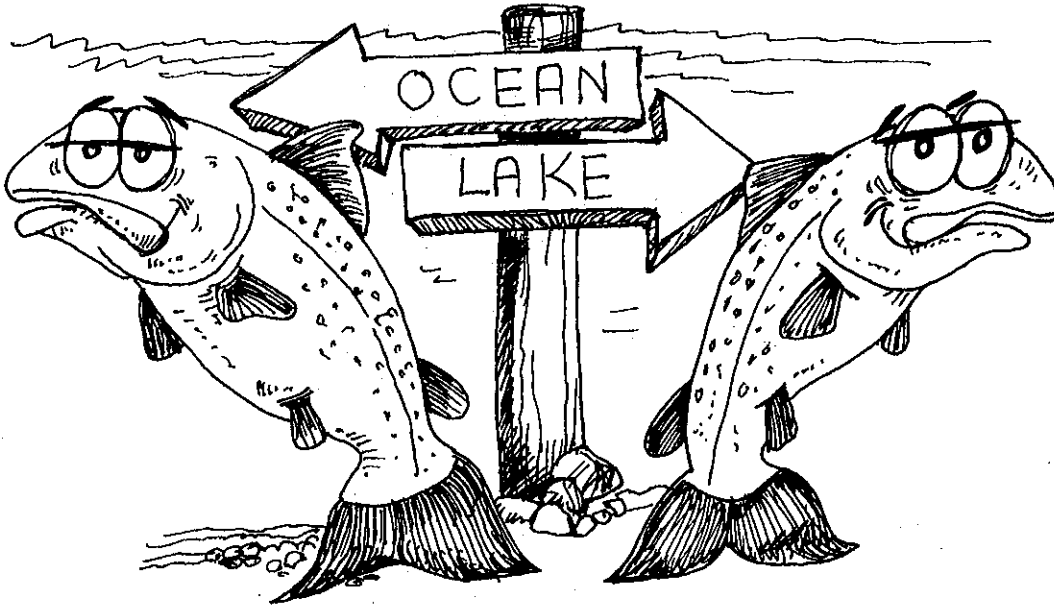
Have the group name reasons why fish need water to survive. One reason they should have learned from an earlier lesson is that fish are especially equipped to extract oxygen from water for respiration. Ask the group if fish ever get thirsty or if they can get dehydrated while in water.

Continue the discussion by introducing the term "osmosis" to the group. Explain that the process of osmosis is responsible for the dramatic differences between freshwater and saltwater fishes. So dramatic, that the two fishes cannot survive in each other's environment. The reasons for this will be revealed in the activities that follow.



fin fact

Salmon is the only type of fish that has the ability to survive the transition from fresh water to salt water.



Activity: Salty Seas

Use this activity to help group members explain what the ocean tastes like. Explain that the ocean is salty because salts and minerals from rocks have become dissolved in the ocean. This happens gradually, over thousands of years. First the rocks are broken up and ground down into soil by the action of ice, wind and rain. Eventually, rivers carry the soil to the ocean. The salts and minerals don't evaporate as water does; they stay in the ocean. Scientists believe the first ocean wasn't salty at all.



Materials

16-ounce clear plastic cup, tap water, salt, measuring spoon, stir stick

1. To taste water as salty as the ocean, have each group member fill a 16-ounce clear plastic cup (6 ounces) with warm tap water.
Then add 1 teaspoon of table salt to each cup and stir.
2. Have the group members taste their salty water.

Explanation

Remind them that real sea water tastes similar yet different. That's because it contains different types of salts besides table salt as well as nutrients and elements including iron and gold.

Digging Deeper

You may wish to show a saucer in which salt water had evaporated away. See if the group members can guess what the white material is that's left behind.



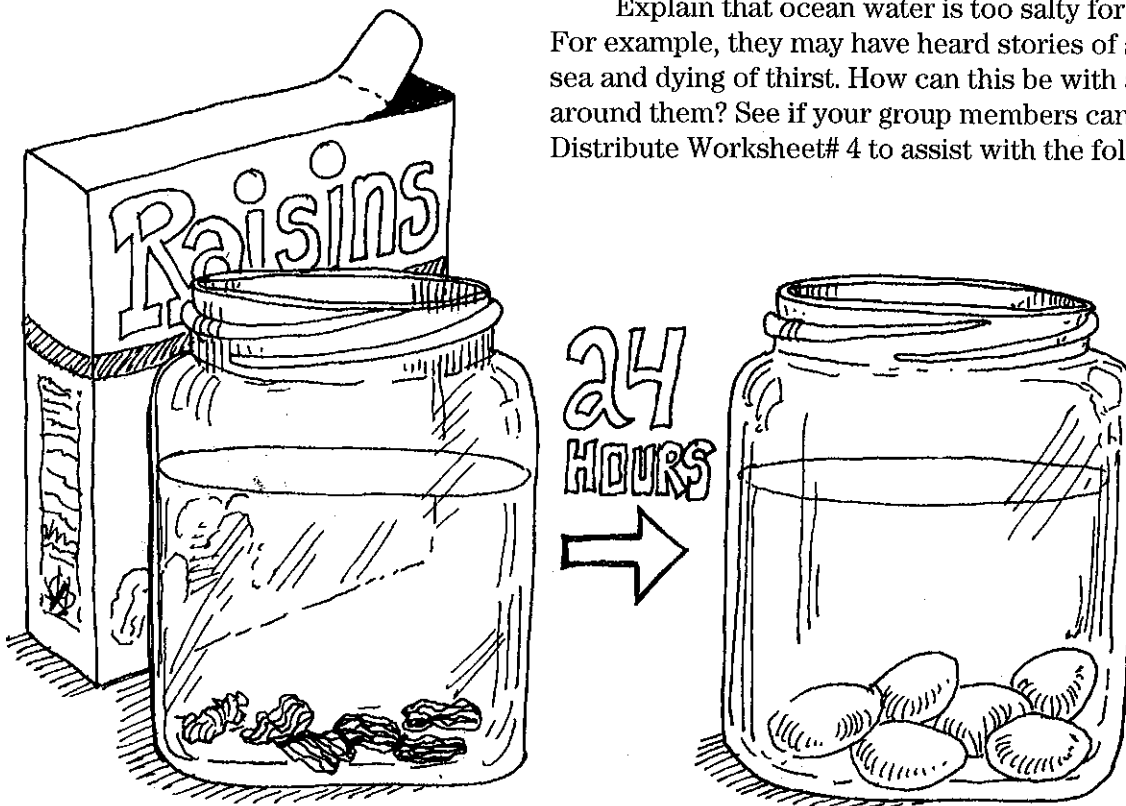
Materials

Worksheet #4, 2 glass pint jars, raisins, grapes, salt, tap water

Activity: Trouble with salt water

This activity will help group members understand why freshwater fish, as well as creatures like us, cannot drink salt water.

Explain that ocean water is too salty for humans to drink. For example, they may have heard stories of sailors stranded at sea and dying of thirst. How can this be with all that water around them? See if your group members can guess why. Distribute Worksheet# 4 to assist with the following activities.



Explain further that fish have the same problem. Freshwater fish cannot survive in salt water for the same reasons that people cannot drink it. Demonstrate with the following example.

1. A day before the activity cut some fresh grapes in half and place in a container filled with salt water. A pint jar filled with water and 5 Tablespoons of salt will work nicely. Also place another amount of raisins in a container filled with tap water. This will be used in the next activity.
2. The day of the activity pass out fresh grapes. Have the group members feel how firm their grapes are. Explain that the cells of the grape are full of water just as those of a fish and ours. After some further observations about the grapes, distribute the grapes that were stored in salt water.
3. Have them examine the salty grapes and compare them to the fresh ones.



words to know

osmosis—the passage of one fluid into another through a membrane between them.

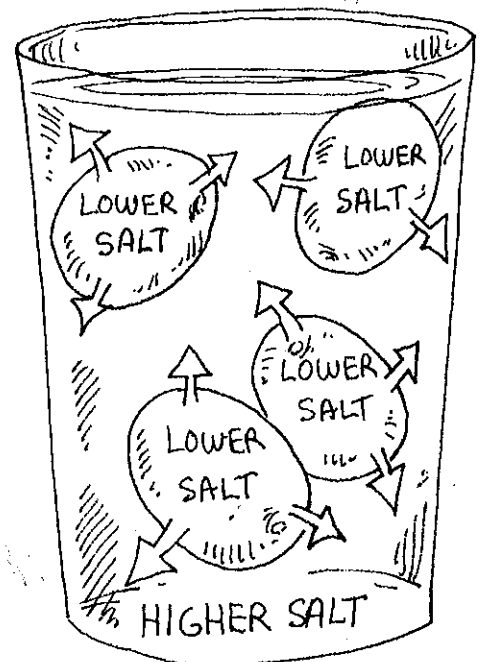
dehydration—to lose water or bodily fluids through evaporation or osmosis

Explanation

Help them understand why the grapes in salt water became limp after soaking overnight. Explain that the water in the grape cells moved through the cell wall by a process called osmosis. This is because lower concentrations of salt will always move toward higher concentrations. In the case of the grape, on the outside of the cell membrane is salt water and the inside is fresh water with a little salt. The fresh water moves through the membrane in an attempt to combine with the salt water on the other side. This removal of water from cells is called dehydration.

Guiding Questions

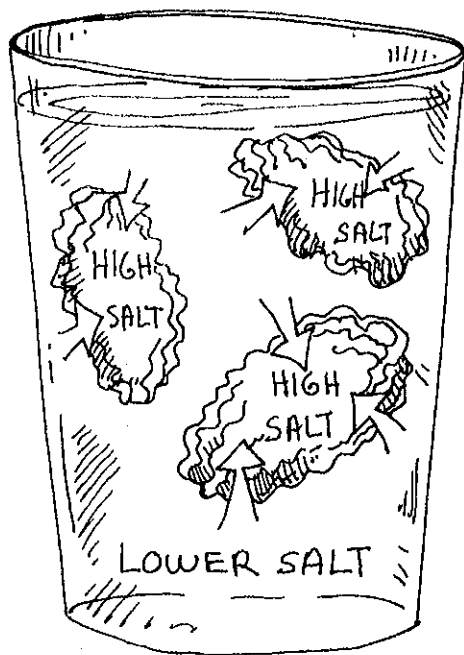
- If the grapes were a saltwater fish what would they do to compensate for this loss of water? (*Take on lots of water*) Explain that saltwater fish drink large amounts of sea water. However, they also have the ability to excrete large amounts of salt from their gills while their kidneys remove very little water from the body; something freshwater fish and sailors stranded at sea cannot do.
- Why is this process just the opposite for freshwater fish living in fresh water? (*Have tendency to absorb water*) To answer this activity, conduct the next activity.



Activity: Waterlogged

See if the group has ever heard of the term "waterlogged." Put their definitions of this term on the blackboard or poster size paper. Point out some reoccurring ideas about the term. To aid the discussion, ask what happens to them when they stay in the bathtub too long. Explain that this is a good example of the term. Continue the discussion with the following activity.

1. Distribute samples of raisins left in fresh water overnight.
2. Have them compare the sample with dry raisins and fresh grapes.
3. Next have them make comparisons between the three including tasting and feeling. Discuss their observations



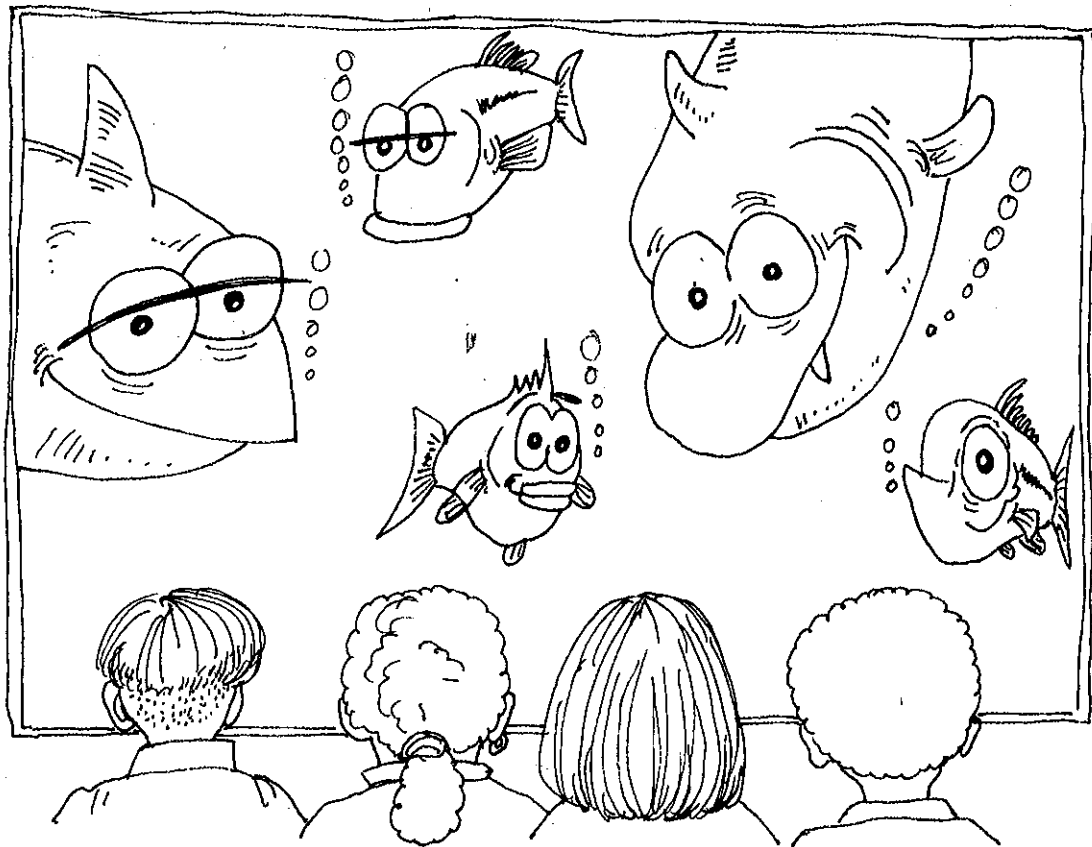
Guiding Questions

- How are the raisins soaked in water like us when we stay in the bathtub too long? (*Both take on water*)
- Do they think the raisins took on water while soaking? (*yes*)
- Why do they think its important for freshwater fish not to become waterlogged? (*control and health*)
- How do freshwater fish control this from happening? (*Excrete water*)

Explanation

Because the water surrounding freshwater fish is less salty than the water in their cells, their cells tend to take on fresh water. Once again, the movement of water is from an area of lower to higher concentration of salts. To compensate for this, freshwater fish excrete large amounts of water from their kidneys.





Digging Deeper

Take a field trip to an aquarium to study freshwater and saltwater fishes. Have group members look for differences in size, shape and movement of the fishes. A well stocked pet store would also have a variety of salt and freshwater fishes to compare. The owner may even be willing to visit your class and with examples of how fishes have adapted themselves for survival in the aquatic world. For additional information of fishes, consult your local librarian, pet store owner, science museum or contact the Aquatic Maestro Inc. The Aquatic Maestro has a good publication on aquatic plants. This publication was produced for 4-H and contains a variety of information and activities on the subject. There is also an instructional video that accompanies the publication. For information write to:

WW PSA Aquatic Maestro Div., 406 South First Avenue,
Arcadia, California 91006-3829.

Name: _____

Activity

Investigate - How Dry I Am

■ Observe grapes that have been soaked in salt water overnight then answer the following questions:

1. Is it important for saltwater fish not to lose water? _____

2. Do you think the grapes lost water while soaking? _____

3. If the grapes were a type of saltwater fish, how would they need to adapt to survive? _____

4. What would happen to you if you floated in the ocean for more than 24 hours? _____

■ Observe raisins that have been soaked in fresh water overnight. Then, answer the following questions.

1. How are raisins soaked in water like people when we stay in the bathtub too long? _____

2. Do you think the raisins took on water while soaking? _____

3. Why do you think it's important for freshwater fish not to become waterlogged? _____

Facts to Know:

Saltwater fish need to drink a lot more water than freshwater fish. If they didn't drink to replace the lost water, saltwater fish would become dehydrated and die.

Freshwater fishes have the opposite problem. Liquids in their bodies are saltier than fresh water. So water flows into their bodies constantly.

