WLHS/Marine Biology/Oppelt Name _____

LAB – Fish, Swim Bladders, and Buoyancy

PART 1: What Are Swim Bladders and How Do Fish Use Them?

QUESTION: How do fish travel to different depths of the ocean?

In the space below, write your hypothesis to the question above.

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_____

PROCEDURE:

1. Fill a bucket about half way with water and set aside for now.

2. Next, take a balloon and place a marble inside. DO NOT put any air into the balloon. Tie a knot close to the marble in this balloon.

3. In a second balloon, add a marble inside and blow a small amount of air into the balloon. Then tie a knot in the balloon.

4. Finally, in a third balloon, add a marble to the balloon and blow more air into the balloon than you did in step 3.

5. One at a time, drop the 3 balloons into the bucket filled with water.

RESULTS

In the space below, draw the beaker and where each of the balloons ended up once you placed them into the beaker.

DISCUSSION

1. Fish have an organ called the swim bladder that acts like the balloon in your experiment. This swim bladder is located in the body cavity of the fish. Why do you think fish need to regulate their swim bladders?

2. If fish didn't move to different depths of water, what might happen?

PART 2: Buoyancy

Buoyancy describes the tendency of a submerged object in a fluid to sink or to rise. Long ago, Archimedes (287-212 B.C.E.) figured out that buoyancy was related to the volume an object displaces compared to its own weight. If the density of the submerged object is less than water, then buoyancy will be a positive upward force. If its density is greater than water, the buoyancy is negative, and it is forced downward. Since density is related to volume, any change in volume will affect the tendency of the object to rise or sink.

Many bony fish possess a flexible gas bladder (swim bladder) that can be filled with various gases. As the fish dives deeper, pressure increases, compressing the air, reducing volume, and thereby effectively making the overall fish denser. The negative buoyancy now pushes the fish down, and it starts to sink. Such fish can add more gas into the gas bladder to increase its volume and return it overall to neutral buoyancy.

Go to the station labeled Buoyancy. You will find a large bucket of water and 3 bottles with different solutions inside. DO NOT open the bottles.

1. Place (NOT DROP) the bottle with oil and water into the bucket of water. Describe what happens to the bottle. Is this considered positively buoyant, negatively buoyant, or neutral?

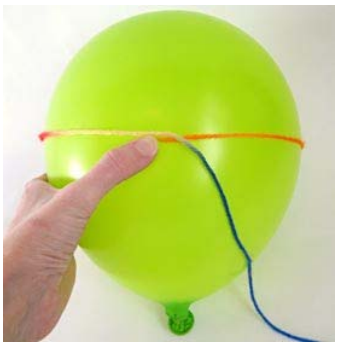
2. Now place the bottle that is filled with air into the bucket of water. Describe what happens to the bottle. Is this considered positively buoyant, negatively buoyant, or neutral?

3. Place (NOT DROP) the bottle with just water into the bucket of water. Describe what happens to the bottle. Is this considered positively buoyant, negatively buoyant, or neutral?

4. What could you do to the bottle with just water to make it neutrally buoyant? (In other words, what can you take out or add?)

5. Take a ziplock bag and fill it with air. As you seal it, leave a small opening. Place the baggie into the water and pull the baggie (from the bottom part of the bag) down into the water unto the top of the baggie is at the surface of the water. Describe what happened to the air in the bag. <u>Explain your answer.</u>

6. Blow up a balloon to about 1 foot in diameter and tie off the ends. Next, using a string and ruler, measure the circumference of the balloon. Record circumference here_____



7. Have one person hold the balloon under water while the other person measures the circumference of the balloon. Record circumference here _____

8. How did the balloon circumference differ between Steps 6 and 7?

9. Are the gases in the balloon expanding or contracting when placed into the water?

10. Imagine we had a deeper bucket. What would happen to the balloon as we pushed the balloon deeper and deeper into the bucket of water?

11. What happens to the swim bladder of a fish as they swim deeper in the ocean?

PART 3: Cartesian Diver

In this demonstration, you will be using a plastic bottle filled with water. Inside the plastic bottle, there will also be an eye dropper (diver).

1. Looking at the bottle, where is the diver within the bottle (top, middle, bottom)?

2. Squeeze the bottle for a few seconds. What happens to the diver?

3. What did you change when you squeezed the bottle?

4. Now stop squeezing the bottle. Describe what happened to the diver.

5. How does this relate to fish and swim bladders?

(CONTINUE ON BACK)

Summary Questions

1. How would buoyancy differ between salt water and fresh water?

2. Nets may entangle fish at a deep depth. The net is pulled up to the surface. What do you think happens to a fish when it is pulled to the surface of the water too fast?

3. Imagine a fisherman catching 2 fish. One fish was captured in shallower waters while the second fish was caught in deeper waters. Which fish would have a bigger swim bladder when they reached the surface of the water?

4. How do these demonstrations relate or apply to scuba divers and submarines?