Grade 5
Unit: Watery Planet
Mystery 1: “How much water is in the world?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! Today I want to tell you a true story. On a late November day in 2012, a fisherman named Jose Alvarenga set sail in his fishing boat off the coast of Mexico. For him, nothing seemed out of the ordinary. He expected to go out and cast his fishing nets and bring in a good catch for the day, which he would sell at the market. That was how he made his living. But Jose Alvarenga didn't realize that things weren't going to be ordinary that day. A storm was forming off the coast. And very soon, he found himself stuck in the middle of it. His luck got even worse. The storm thrashed his boat about violently, damaging the boat's motor and all of his electronics. He was only able to get in one call back to shore to yell for help, but no one responded. And Jose became lost at sea. During and after the storm, the boat drifted in the wind and was soon blown very far off course. After two days of searching, rescuers gave up. But he was still alive. Jose Alvarenga is the longest known survivor at sea. He drifted for over an entire year, from Mexico all the way across the Pacific Ocean. Eventually, he found himself over here in the Marshall Islands in the South Pacific, where he finally was able to spot people and get help. How on Earth did Jose Alvarenga survive a year at sea? Think if you were floating on a boat all alone with nothing. What problems would you face? What would you need to survive?

EXPLORATION VIDEO 2

Think if you were stranded at sea like this. What problems would you face? The biggest issue of all is food. You could actually starve to death. On average a person can only go three weeks without eating. During the storm, Jose Alvarenga had lost most of the fish he had caught, as well as his fishing supplies. Amazingly though, he managed to find and catch ocean creatures with his bare hands. He didn't get to be picky about what he ate. That included things like jellyfish and sea turtles. What other problems would you face? Well, you might be thinking of sharks. Luckily, even though his ship was damaged, he still was able to stay on it. So the possibility of a shark attack was very low. The biggest problem of all might surprise you: water. As in, water to drink. Now you might be thinking: what do you mean? There's no problem there. Jose, he's surrounded by an entire ocean of water. In every direction he looked, that's all he saw, water. But not all water is the same. There's actually different kinds of water. Ocean water is salt water—water that has salt in it, just like the salt you put on your food. Now, surprising as it may be, human beings and most land-dwelling creatures actually cannot survive on salt water. After drinking more than just a few glasses, the salt that's in the water soon overwhelms the body. Despite the fact that it contains water, there's too much salt in it. Drinking salt water actually makes a person sick, rather than helps them. Now, Jose was able to solve his water problem pretty easily. Every time it rained, he collected the rain water using containers he had on board his ship. Rain water, water that falls from the clouds, does not have salt in it. It's what we call fresh water. And that doesn't mean fresh as in new, just that it's plain water. It does not contain salt. So, we need fresh water to survive: water that has no salt in it. This is the water we get from our faucets. Now, most of us cannot survive longer than three days without taking in enough fresh water. Hopefully, none of us will ever have to face such a difficult situation as Jose

Alvarenga did. But imagine if water suddenly became something you did have to worry about finding. How would your life be different? Besides the fact that you can't survive longer than three days without fresh water to drink, what other ways do you depend on water in your life? Take a few moments and try to come up with as many ways that you can think of.

EXPLORATION VIDEO 3

So, what are all the ways you use water, besides the fact that you need to drink it regularly? Well, for starters, maybe you're not someone who drinks just plain water a lot. And so the thought might have crossed your mind: I don't even drink that much water—I drink other things instead. Maybe you drink a lot of juice. But every drink we have, whether juice or tea or soda or coffee, all of these are actually mostly made of water. So you're getting water every time you drink something, regardless of your favorite beverage. How else do you use water, though? You may have thought about the fact that you bathe yourself to stay clean, whether a bath or shower. That's a lot of water. And don't forget about brushing your teeth. Oh, and, you know, there's the toilet. Every time you flush, that's water. There are really important other ways you use fresh water, though—ways that are hidden to you. Did you think about your food itself? Think about everything you eat. Where does it come from? It's grown, or it's raised, on a farm. Every living thing you eat, whether plant or animal, needed fresh water to survive and grow. That's still water that you rely on, even though you didn't drink it directly yourself. Every day, in the United States, the average American family uses not one gallon of water, but more than 60 gallons of fresh water. And again, that's every day. Having access to fresh water is something we take for granted. To us, it's as simple as turning on the faucet. And yet, it's so important to us. We rely on it in so many ways every day. You know the ocean contains salt water, not fresh water, and that rain is fresh water. Where else is there fresh water, though, besides the rain?

You might know that lakes and rivers aren't salty. They contain fresh water. Maybe you also know that snow and ice aren't salty, so technically they're fresh water too—they're just frozen. Fresh water is so important to us, but how much fresh water is there in the world? You're going to find out in today's activity.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to figure out how much of the Earth's surface is covered with water and what kind of water it is. By that, I mean you'll look at how much area of the Earth is covered with liquid fresh water, like lakes and rivers; how much area is covered with frozen fresh water, like the ice at the North and South Poles; and how much area is covered with salt water, the water of the oceans. You'll use that information, that data, to make a graph that compares the areas covered by each. That'll let you see how good your guess was. Now, if you were to really add up the area of water for the entire planet, that might be a lot of work. But there is a way to simplify things. You can divide the world up into lots of smaller pieces. Let's zoom in on one of those pieces. This one shows the continent of North America. To simplify things even more, you can put a grid of squares on top of each piece of the map, like this. Why put squares on the map? Well, the squares can allow you to estimate how much area is covered by each kind of water. To make it easier to count a square as water or land, we did a little adjusting. So, if the square was mostly water with just a little bit of land, we made that all water. And if a square was mostly land with a little bit of water, we made it all land. That creates a map that looks like this. I'm sure you can still recognize North America. Here's the US state of Florida. Here's the US state of Alaska. Here's the country of Mexico. Now we did this to the whole world and made the different types of water different shades of gray. By making the map all these nice square edges like this, you can see that that makes it easier to estimate how many squares are fresh water, how many are frozen fresh water, and how many are salt water. OK, so get started. Each person will get one part of the map to count. Oh, and if you're working by yourself, that's no problem. You can count a couple of maps and then check the answer key to get the count for the other maps. All right, time to figure it out. To get started, follow along step by step.

ACTIVITY STEP 1

If you're in a class, find a partner. There are 18 maps to be counted. So if you have fewer than 18 people or if you're working alone, you'll use my friend Pat's count for the other maps. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Students, get your supplies. The teacher or parent also needs stickers and the Master Checklist.

ACTIVITY STEP 3

Look at your map. Use the key on the page to find areas of fresh water, frozen fresh water, salt water, and land. Do you have all four on your map?

ACTIVITY STEP 4

You want to know how many squares of each kind of water there are, but sometimes there are lots of squares to count. So can you think of a clever math trick to help you count squares quickly? Discuss with your partner.

ACTIVITY STEP 5

Here's a trick we use at Mystery Science. We make the biggest rectangle we can, then calculate that rectangle's area by counting each side and multiplying them together. So, for example, this side of the rectangle has seven squares, and this side has 10 squares. If we multiply those numbers together, you get 70. So there are 70 squares total in this rectangle here. So I might make as many rectangles as I can, and then count the squares that weren't in the rectangles. You can use this trick, or you could just count every square. It's up to you. Go ahead and do questions one, two, and three now.

ACTIVITY STEP 6

OK, you finished counting all the water on your map. In a minute, we're going to use stickers to make a bar graph that includes the results from all the maps. Discuss this question.

ACTIVITY STEP 7

Here's our strategy: we decided that each sticker stands for 50 squares of water. That takes the number of stickers you need way down. OK, go to the next step.

ACTIVITY STEP 8

Now, do questions 4, 5, and 6 on your worksheet to figure out how many stickers you need for each type of water. Remember, you need one sticker for every 50 squares, but you might have some leftover squares. Let's do an example. Let's say that you counted 238 squares of salt water in question 1. So write that number here to remind yourself. Then, you're going to divide by 50. So do some long division. 50 goes into 238 four times, but not cleanly. 38 is left over. It's the remainder. So in question 4, you have four stickers with a remainder of 38 squares. OK, so go for it. If you're working with a partner, help each other out with the math and double-check your work together.

ACTIVITY STEP 9

Now let's see how many squares of salt water are on the map of Earth. Look at question 4 on your worksheet. Does your answer match Pat's answer below? If your numbers don't agree and you think Pat got it wrong, let us know. We suggest you use Pat's numbers now.

ACTIVITY STEP 10

If you're in a class, your teacher will have someone who has counted each map. Come to the graph and put up the right number of salt water stickers. Teacher, use your Master Checklist to call up the 18 maps one by one. Make a checkmark on your checklist as the map stickers are added. If no one has some of the maps, don't check them off. Just skip them for now.

ACTIVITY STEP 11

Are there any maps that have not been checked off for salt water? Add those maps' stickers too.

ACTIVITY STEP 12

We're almost done with the salt water. I'm going to add up all the remainders for you now so we can figure out the final number of stickers to add. Have someone add stickers to the salt water graph.

ACTIVITY STEP 13

Now let's see how many scores of frozen fresh water are on the map of Earth. Look at question 5 on your worksheet. Does your answer match Pat's? Put up each map's stickers. Teacher, put up stickers for any missing maps too. If your numbers don't agree and you think Pat got it wrong, again, let us know. We suggest you use Pat's numbers now.

ACTIVITY STEP 14

We're almost done with the frozen fresh water. I'm going to add up all the remainders for you now, so you know how many more stickers to add. Have someone add those stickers to the frozen fresh water graph.

ACTIVITY STEP 15

Now it's time for the all-important fresh water. Look at question 6. Did you have enough squares to get a sticker for the fresh water graph? Raise your hand if you do. No one has a sticker. No one has 50 squares? How about 40 squares? Raise your hand if you have 40? No one? All right, how about 30 squares? 20? Go to the next slide, and we'll figure out what we should put on the fresh water graph.

ACTIVITY STEP 16

All right, here is Pat's count for fresh water. Add them all up. Do you have enough squares for a sticker now?

ACTIVITY STEP 17

When you counted up all the squares, you saw that all of the world's biggest lakes don't even make up 50 squares. But there are lots of smaller lakes and rivers that were too small to show on the map. We've estimated that the smaller lakes and rivers on the globe take up at least nine squares of fresh water. Now there's about 50 squares altogether. Have someone put one sticker up for the fresh water graph. Now your graph is done.

ACTIVITY STEP 18

Discuss, then advance the slide to watch the final video.

WRAP-UP VIDEO

The Earth is sometimes called the blue planet, and with good reason—it's a watery world. If you were to go to outer space, like an astronaut, and orbit above the Earth, there is a point high above the Pacific Ocean where you can see a view like this. This is a real photograph taken of the Earth from far away. Imagine if there were an alien seeing our planet for the first time from this viewpoint. That alien might think the entire planet is just water. That's how vast the Pacific Ocean is. Now maybe you noticed that when you were counting the squares on the map, you were figuring out the area covered by water. But just looking at the area or amount of surface doesn't really tell you how much water there is. Because you know that lakes and oceans aren't just things on the surface, they're deep too. They have volume. So to figure out how much water there is on the Earth, we actually need to look at both area and volume. Well, the deepest freshwater lake in the world—Lake Baikal in Russia—is about 1 mile deep. Now, remember, that's the deepest lake there is. Most lakes aren't anywhere near that deep. The ocean, on the other hand, on average is almost 2 and 1/2 miles deep. And at its deepest point, the ocean is almost seven miles deep. So if we look at the volume of all the fresh water and the volume of all the salt water, that would really just make things slightly more dramatic than what you saw today. In other words, just considering the area and not the volume is good enough for estimating the difference between salt water and fresh water on Earth. Now here's what we found when we added it all up. Of all the Earth's water, most of it is the salt water of the oceans. Only a tiny amount of that is fresh water. And of that tiny amount of fresh water, a lot of it is frozen and not easily accessible to us. It's in the form of ice caps that exist over Greenland and Antarctica. It's just the fresh water of lakes and rivers that's sitting on the surface. That's in a form that we can scoop it up, purify it, use it for drinking and for watering crops and animals, and for all our other uses of water. Only 1% of the world's water is liquid fresh water. Is that enough fresh water for everyone? There are 7 billion people on the Earth, over 300 million people in the United States alone. Well, cities like Chicago and Cleveland in the United States, they're right next to these giant lakes—the Great Lakes, they're called. These are freshwater lakes, and that's the source of water for these cities and for the suburbs around them. So there's no major problems getting access to fresh water in those places. What about other places though? Not everyone lives close to a lake or river. Maybe if giant lakes like North America's Great Lakes were divided up and spread out across the land, then sure, people might live within walking distance of fresh water, but that's not how the world looks. And most places in the world don't have giant freshwater lakes like these, as you could see on your map. In fact, there are huge sections of land that don't have any obvious, easily scoopable fresh water nearby at all. For most of history, getting easy access to fresh water has been such a problem that it has determined where we could even live and build cities in the first place. All the old large settlements were started near a source of scoopable fresh water, like lakes or rivers. Today, though, people manage to live just about anywhere. There are major cities in the United States, like Los Angeles and Denver—neither of them has big lakes or big rivers nearby. In fact, most people in the world do not live within walking distance of scoopable fresh water. So, where do they get their water from? You'll find out in the next Mystery. Have fun and stay curious!