But Why: A Podcast for Curious Kids

How Deep Is the Ocean?

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Jane 00:21
This is But Why: a Podcast for Curious Kids from Vermont Public Radio. I'm Jane Lindholm. And on this show, we explore things you tell us you want to know more about. You sent us questions, and it's the job of me and Melody Bodette to search out answers. Today we're going to explore a part of the world that not much is known about. In fact, you could be one of the people who helps us understand and learn more about this very important and very, very large part of the earth as you grow older. One of the reasons not much is known about this vast part of our planet is because it's really hard to explore there. You need a lot of special equipment and technology. And it all needs to be waterproof. Have you guessed what I'm talking about yet? It's the ocean, specifically, the bottom of the ocean, the sea floor. The land underneath the ocean is as varied and interesting as the terrain up on dry land, with mountains and canyons, plains and forests. That's right, forests. There are kelp forests where the kelp, a type of seaweed, is as much as 150 feet tall. So today, we're going to explore what's known about the bottom of the ocean, and we're going to pay special attention to what's not yet known with two people whose job it is to discover more.

Jamie 01:44
Hello, I'm Jamie McMichael-Phillips, I'm the director of the Nippon Foundation-GEBCO Seabed 2030 project, a very long name, we normally call it Seabed 2030 for short.

Vicki 01:57
My name is Vicki Ferrini. I am a senior research scientist at Columbia University. And I lead one of the regional centers for the Seabed 2030 project.

Jane 02:08
And what is Seabed 2030.

Jamie 02:10
Seabed 2030 is a global collaboration designed to map our seabed, our ocean floor by the year 2030.

Jane 02:20
The project got started because as Jamie McMichael Phillips told me, we really don't know much about what it looks like on the bottom of the ocean.

Jamie 02:28
Hardly anything, the ocean size is about 362 million square kilometers. And to date, we have mapped nearly 20 percent of the world's ocean floor round about 69-70 million square kilometers. So a long,

long way to go. And considering that we are surrounded by the ocean, we've got a tough task ahead of us.

Jane 02:55
That's amazing to think abou: 20 percent. So if you live in a house or an apartment with five rooms, it would be like only knowing the floor of one room of your house.

Jamie 03:07
That's right.

Vicki 03:08
It would also though be knowing the floor of your room, not with very much detail. Like you wouldn't be able to see the trash basket, or the shoes that you might trip over, you just see the general shape, maybe the shape of the bed and the desk. But you wouldn't see all the other details because we don't have very much detailed information.

Jane 03:28
Well, some parents might be pleased about that you wouldn't see all of the things that the kids had left on the floor. But yeah, I mean, if you can't see, if you don't know everything that's on the floor, you just kind of know the shape of the room. You're right, you're missing a lot of detail, a lot of important things like where those toys are.

Vicki 03:43
exactly,

Jamie 03:44
But the biggest challenge that we've got is that we can't see the ocean floor. So unlike walking across land where we can see what's in front of us, we can see what's underneath us, we can see what's in the sky. That's not the same in the ocean. So we have to use sound waves to penetrate the ocean depths to measure what's on the seabed. And that takes a long time. It's not as quick as looking through our eyes or looking through a camera. It's a slower process.

Jane 04:13
Why do we care about knowing what's on the sea floor if we don't live there? We know there are animals and other kinds of organisms that do live down there, but humans aren't going to so why should we care about knowing exactly what it looks like down there?

Vicki 04:28
So the shape of the ocean floor, which is really what we're getting at here affects all sorts of different things. It effects the way water circulates in the ocean, which can have an effect on climate. It can effect storms moving around hurricanes, we all know are affected by water temperature. You know fish and different resources on the sea floor near the sea floor that we're dependent upon, whether it be for food or for metals, for our phones. Actually our phones, the communication that we're using to talk on our phones. It doesn't go through the sky it goes on cables on the sea floor. And so we don't even realize

that every day we're very all of us are very connected to each other through the sea floor, which is pretty cool.

Jane 05:10
While we have Vicki and Jamie, let's get into some of the questions you've sent us about the ocean depths.

Siri 05:16
My name is Siri, and I am five and I live in Denver, Colorado. My question is, how deep is the sea?

Freya 05:26
My name is Freya, and I'm eight years old. And I live in Wellington in New Zealand. And my question is how deepest the deepest part of the ocean? Thank you.

Sophie 05:36
My name is Sophie. I live in Minneapolis, Minnesota. I'm eight years old. My question is, How deep is the ocean?

Campbell 05:46
My name is Campbell. I'm seven years old. And I live in Pennsylvania. And I want to know how the ocean got so deep?

Jane 05:55
So how deep is it? And how did it get so deep?

Jamie 05:58
Well, I know how deep it is. And I think Vicki's better place to say how it gets so deep. So the deepest part of the ocean, and I'll stand by to be correct on this, is about 11,034 meters in a place called the Challenger Deep in the Marianas Trench in the Pacific Ocean is about seven miles deep.

Jane 06:19
That's amazing.

Jamie 06:20
That is. That is amazing.

Jane 06:22
Let's add two more voices to the chorus wanting to know how that part of the ocean got so deep.

Toby 06:27
Hi, my name is Toby and I'm four and a half. I live in Chicago. And my question is, how did the Mariana Trench get so deep?

Alice 06:28

Hi, my name is Alice. I'm six years old. I'm from Buffalo, New York. And my question is, how was the Mariana Trench formed?

Jane 06:49
Not surprisingly, how the sea floor formed is complicated.

Vicki 06:54
Well, so there's a lot of really large scale processes that are happening on our planet. I think a lot of people have heard of plate tectonics and how the the plates move around the planet. As they're moving around. There's different processes happening like subduction. So one plates going below another one, and that's causing a lot of the trenches. There's collision of plates, which causes the creation of mountains. I think people have some familiarity with the ring of fire that surrounds the Pacific lots of volcanic activity because of how these plates are moving around.

Jane 07:26
Basically the same processes that formed canyons and mountains on dry land also formed the depths of the ocean and the islands that peak above the water. In the case of the Mariana Trench, it was formed by a process called subduction. When one tectonic plate slides underneath another one, a tectonic plate is a gigantic piece of the Earth's crust, and the next layer below that called the upper mantle. These massive slabs of rock are constantly moving, usually very slowly. So a lot of changes to the Earth's surface and structure take place over a long time. But sometimes something like an earthquake can speed that process up. A trench is formed when one plate slides or melts beneath another one. The Mariana Trench is the deepest trench in the world. It's farther below sea level, then Mount Everest is above sea level. And Jamie McMichael-Philip says that's got people interested in learning more,

Jamie 08:27
There's been a huge amount of interest in exploring it, in diving down into it to find out what life exists in such deep water. And that activity has been going on through the years and more recently by an expedition called the Five Deeps where they've been taking a submersible onboard a ship. And they've been going around the world looking at these fantastically deep areas to discover what's down there.

Jane 08:58
Okay, so that's the deepest part. But what about on average? Do we know generally how deep the sea can be and how much it varies?

Vicki 09:06
So this kind of takes us back to, you know, maybe people are surprised to hear that the ocean really hasn't been mapped more than 20 percent, right? So we have an idea of the shape of the sea floor based on prediction. So we're basically using satellite data to look at very small perturbations of the sea surface that responds to the shape of the sea floor. And there's a gravity equation that's used to compute what the shape of the sea floor is from that. And so when you look at a world map, and you see the general shape of the sea floor, that's what it's based on.

Jane 09:38
Did you get that? Basically, because not much of the sea floor has been actually mapped using the best possible technology, scientists use other information to give them kind of a best guess. But it's still pretty vague. It doesn't give a lot of detail.

Vicki 09:53
So we have a relatively you know, good idea of where it's kind of flat where there's bumps where there's ridges. And that's all supplemented with direct observation. But if we really want to see detail like striations on the sea floor, you know, tiny little seamounts, volcanoes of different kinds, we really need to get in there and image directly with sonar.

Jane 10:15
When we come back, we'll go deeper into how teams of researchers are using that enhanced technology like sonar to create a much more detailed map of what the ground looks like all the way at the bottom of the sea.

Jane 10:30
This is, But Why: a Podcast for Curious Kids. I'm Jane Lindholm, and today we're talking with two of the key leaders have a project called Seabed 2030, which has the ambitious goal of mapping the entire bottom of the ocean by that year, 2030. Remember, most of the sea floor hasn't really been mapped yet. So it's a massive project. Just a minute ago, Vicki Ferrini was explaining that modern technology can help us figure out what terrain looks like under the water. But it's not just going down in a boat and looking at the ground. One of the main tools researchers use is called sonar. That technology uses sound to map things. It might sound kind of confusing, but the way sound bounces off the bottom of the sea floor can give researchers using computers a sense of what the landscape looks like. Some animals like bats and dolphins use sonar to help them see underwater or in the dark. In animals, it's usually called echolocation. But it's the same basic idea. I asked Vicki to explain how sonar works. Because no matter how many times I go into my bedroom, close my eyes and shout, I still can't figure out how the sound is supposed to tell me what's on the floor of my room.

Vicki 11:49
So I have some good ways of thinking about this. So fundamentally, what we're using is the time that it takes for the sound to travel from the source to the sea floor and back, we can go back to our room analogy, right. So if you're in a house, and you don't know anything inside, it's dark. And you want to see what it looks like you have a flashlight, maybe you can get little observation. So in some ways, sonar is giving us that little look at little spots. As we look, the closer the flashlight is to the wall, the tighter the light that you see, the further away you are, the more the brighter, it is more diffuse. And the sonar works that way in terms of resolution. If we're close and tight, you can see more crisp, and more focus. If you're broad, and it's wide. It's not as focused.

Jamie 12:34
I mean, it's a bit like I suppose standing on a mountainside or in a big sports hall and shouting, and you hear the echo of your shout come back to you. But but we're not quick enough as human beings to be

able to measure the time between shouting and hearing it back. So it is down to computers and technology to be able to do that.

Vicki 12:58
But like in the early days, the way that water depth was measured, or the way that you might do it, if you're in a kayak right, is you put something over the side something physical, and you measure the distance. So in the old days, it could be a weight on a rope or on a wire, or like in a kayak, you could use your oar to see how far down it goes. And so there's physical ways to measure but that's very inefficient. With sound, and again, going back to the flashlight analogy, the sound systems that we use now, it's not just a single flashlight pointing, but it's like a whole bunch of flashlights that are oriented in a fan. So you get a lot of measurements at the same time. And we actually call it mowing the lawn because you get a swath of data. And so you go back and forth in a pattern and you fill in the gaps, and you get a lot of measurements at the same time.

Jane 13:44
I mean, it sounds like we have the technology. And you're already doing this work. But your project is called Seabed 2030. We've got nine more years before 2030. In some ways, that sounds like such a short amount of time to map the entire ocean floor. But other people might say why is it going to take so long?

Jamie 14:06
Well, it is a short time, because we've worked out that if we used one ship, and what we're talking about a ship now we're not talking about other technology, one ship with a sonar system on board and set that to work today. It would take 200 years of that ship's time to complete the ocean map

Vicki 14:26
actually that the 200 year estimate is just for the water that's deeper than 3,000 meters depth. It's what to do the whole ocean it's almost 1000 years for one ship.

Jamie 14:36
We want to compress that into 10 years. So we need more ships fitted with sonars and we can do that we need to use uncrewed technology. So vessels on the surface that have got no crew on board that can be remotely controlled, or vessels that are submersible, again remotely controlled. And if we can bring all those together, then we can achieve our aiming in 10 years, but it's gonna cost and we need to bring the world together, everybody who's got those pieces of equipment, we need to find somebody to pay for it. And it's going to cost we estimate about between $3 and 5 billion US Dollars to bring all that together. But that's about the cost of sending a mission to Mars. So let's do it on our own planet.

Jane 15:26
So lots of money, lots of people working on this, lots of ships and other kinds of technology to do this work. But then you hope by 2030, we'll have perhaps a map of the entire ocean floor. How can kids who are fascinated by this, either follow the progress or maybe even get involved, and maybe even get involved after 2030 when, okay, there's a map but there's still a lot more to do?

Vicki 15:55
I like to think of ocean mapping as the beginning. So the first thing you do when you're going to do a project, if you're going to go research something is you want to have a map, particularly if you're going out at sea, where it's you know, very challenging for lots of reasons that the seas are rough, the ships moving equipment breaks, you need to know where you are. So having a map is just the beginning, we think about 20 percent of the ocean being mapped, even less of it has been explored to the detail, like with which we can see each other right, we're still talking about very coarse data here. There's a lot of different groups working on ocean exploration around the world, making more than just mapping data available, making video data making still imagery, putting content out for crowdsource projects, so people can explore and help annotate and become part of the scientific process. So there's lots of stuff out there.

Jamie 16:51
It's not going to stop in 2030, because we will have a base map, but the whole process of surveying the ocean, will throw up new discoveries. So that there is a wealth of opportunity for further research further science. So people who are going through school, going through universities at the moment is not going to stop in 2030, there's going to be more opportunity for them to get involved.

Jane 17:16
So think about how old you will be in nine years. Even if this ambitious goal of mapping the entire bottom of the ocean is complete by 2030, there will still be so many opportunities for research and exploration. I love what Vicki says about a map being just the beginning of the adventure. Maybe you will be one of the people who discovers something amazing down there. What would you do with your map of the ocean floor?

Jane 17:45
That's it for today. Now I should mention if you are interested in learning more about the ocean, we have a But Why book coming out next year all about it, answering questions that you've sent us. You can pre order it now. It's called Do Fish Breathe Underwater? But you'll have to have a lot of patience. It's not set to come out until next summer. So we'll be sure to remind you when it's about to be published.

Jane 18:09
Thanks to Vicki Ferrini and Jamie McMichael-Phillips with Seabed 2030. You can find out much more about their project at seabed2030.org. And we'll put a link to that in our show notes.

Jane 18:22
And if you'd like to send us a question, think of anything that you're wondering maybe something you think we haven't tackled yet, and have an adult help you record yourself asking it. You can do it using a free app that comes with a smartphone. Be sure to tell us your first name, how old you are and where you live, and then send your question to questions@butwhykids.org. If you don't like to speak into a microphone or talking is hard for you. It's okay to have your adult just email us a written question too.

Jane 18:53

But Why is produced by Melody Bodette and me, Jane Lindholm, for Vermont Public Radio, and it's distributed by PRX. Our theme music is by Luke Reynolds. We'll be back in two weeks with an all new episode. Until then, stay curious.