Ocean Gazing: Episode 30
Liquid light
Wetlabs

<begin music>

Ari: This is Ocean Gazing, the podcast where we peer into the brew of chemicals and colors dancing in the sea. I'm Ari Daniel Shapiro. A few weeks back, I went to Yaquina Bay on the central Oregon coast. An arch bridge galloped across the bay and a couple hundred boats lined the piers.

Koch: Hey, Ari. Welcome aboard: you're officially on the Pontoon Boat of Science. Thanks for comin'.

Ari: Corey Koch works for a company called Wetlabs that's based in Oregon. The team there designs and builds instruments that use optics – that is, lenses and light – to measure all kinds of things in ocean water.

Koch: We really can see the whole story of what's going on in this ecosystem right here with this suite of sensors.

Ari: I visited Wetlabs and learned how light can say a lot about liquid. Stay tuned.

<fade up music to full and sustain; then fade up ambient of Pontoon Boat of Science>

Ari: Let's consider for just a moment why Wetlabs bothers to make these sensors in the first place. <we hear Ron faintly> Ron Zaneveld is a senior oceanographer at Wetlabs, and one of the co-founders of the company. I met him onboard the Pontoon Boat of Science, a 27-foot catamaran tied to the dock in Yaquina Bay. It's where the Wetlabs team does most of their field experiments. Zaneveld sported a thick brown mustache.

Zaneveld: So many people are living near the ocean. So we get pollution problems, we get overcrowding, we have all these issues, and we have to make a lot of decisions about how do we deal with various problems. And what is required to make good decisions is information. And I think that's what we provide, is good information on which scientists and managers can make decisions about the ocean.

Ari: All the building and designing of the sensors that collect this information happens elsewhere. <door latch> Head due east about 50 miles from Yaquina Bay and you get to a town called Philomath where Wetlabs' land headquarters are based. I walked onto their large production floor. <filter noise> A filter circulated air at one end of the room. A dozen benches were packed with screwdrivers, current meters, circuit boards, plastic fragments. To understand the sensors they make on these benches, you gotta know what happens to sunlight when it enters the ocean. Andrew Barnard is another senior oceanographer at Wetlabs and the vice president of research.

Barnard: There's two ultimate fates for any photon of light. And that is: annihilation of that, which is an absorption process so it's taking in that photon of energy. Or, it can actually scatter the light, redirect the light.

Ari: So when you say absorption and scattering, absorption is kind of the amount of light that something takes in, or holds onto, and scattering is how much it reflects.

Barnard: Exactly.

Ari: The basic idea here is that by looking at how water absorbs or scatters different colors of light, you can learn something about what's *in* that water. Lemme give you an example. We wandered into a part of that building where sensors go to get repaired – kind of like a little hospital for the electronics and circuits and stuff.

Barnard: Hospital's right: some of 'em aren't sick necessarily, some of 'em…

Ari: On one of the lab benches, an instrument was switched on: a fat, shiny black cylinder about the size of a house cat. At one of the flat ends there were these 9 flashing lights, each one a different color. Three shades of red, three of green and three of blue. I stood there with Corey Koch. He's the chemist and post-doctoral fellow who we heard from earlier.

Koch: If you see one of these sensors underwater at night, it's like a disco. You have all these different colors of flashing lights illuminating the water column: a little underwater party for the phytoplankton.

Ari: Do you guys ever have a holiday party where you turn these things on, and…?

Walsh: No.

Barnard: No. <laughter>

Ari: And while Wetlabs may not be rigging these instruments up for their parties, they are using them to double-check and inform satellite measurements. Satellites recording the color of our oceans. From high up in orbit, the small plants of the sea called phytoplankton can make seawater look green. But down in the ocean, it's a different story because you can tell different types of phytoplankton apart. Ian Walsh is, well, yet another senior oceanographer and the vice president for sales and marketing.

Walsh: So in other words, you've got this satellite up there that's 600 million dollars or more and you're running it. But you need to get: what's that image look like? Not just the image from up there, but what is it in reality in the water so that you can make the corrections and then get more data out of that.

Ari: This is like the zoomed in version of the big picture that the satellites are capturing.

Walsh: Yeah. Yes.

Ari: Each type of phytoplankton reflects back a unique blend of colors when it's hit with these 9 flashing lights. So it's the different types of phytoplankton this sensor can detect, which can then inform the more generic satellite measurements. And when the Wetlabs sensors are up and running, they monitor the ocean continuously. Back aboard the Pontoon Boat of Science, Corey Koch elaborated.

Koch: You can catch those key events that you would miss with normal sampling. You know, you can't always go out at 2 in the morning and take a sample when something really interesting or something really bad could be happening.

Ari: And that's the big appeal of these instruments. They're in the water all the time, sampling and beaming their data back to shore every hour. Traditionally, water samples have to be brought aboard and frozen for later testing. But the Wetlabs sensors stay submerged. There's no danger of contaminating the water on the boat or in the lab, and these sensors measure the water where it's at. So they tend to be just as accurate or even better than conventional techniques.

Zaneveld: Show him that. That's really cool.

Ari: Another sensor called the Land/Ocean Biogeochemical Observatory, or LOBO, was suspended in the moonpool, an open hatch in the back of the Pontoon Boat of Science. Koch whipped out his smart phone, pulled up a website that anyone can view, and showed me the data that the LOBO was collecting just beneath us.

Koch: And we have just the latest values that have come out. So we can see chlorophyll: we have 1.6 micrograms per liter.

Ari: And that was just recorded off of that sensor down there?

Koch: That was 1400, 2 o'clock, the last hour. And so we can see that salinity was 28.8 PSU, water temperature was about 11 degrees Celsius. And then actually if we want to plot the data, and so here we can see nitrate. You can see it varying really nicely with the tidal cycle. You see these peaks increase in nitrate.

Ari: So as the tide flows out, you're gonna see more nitrate flowing past the sensor?

Koch: Yes, generally.

Ari: So my question for you, listening to this podcast now, is why. Why would this sensor in the bay register more nitrate as the tide flowed out? And what do you think happens to the salinity measurement as the tide flows in and out? Visit oceangazing.org to look at the data and send in your answer to this puzzler.

Now, there is one concern with leaving these instruments underwater for months at a time. Ian Walsh explained.

Walsh: The ocean is a living organism. There's biofouling everywhere. One of–

Ari: By biofouling, you mean critters that are gonna grow all over your stuff that you're building so carefully here.

Walsh: Exactly. And we want it to keep working. But biology will always win. Biofouling will always win.

Ari: It's a race against time.

Walsh: It is always a race against time.

<sound of winch>

Ari: Mechanical engineer Alex Derr rotated a winch to haul the LOBO up through the moonpool and make the noise of our last sonic stumper.

Derr: So this has been in since November 11.

Ari: The shiny cylinders of the LOBO, the batteries and the metal cage supporting it all were covered in life. 100 pounds of equipment, and close to 200 pounds of biology.

Derr: Let's see what we have. We have a sponge. Here's a tiny anemone, lots of mussels.

Koch: Is that another sponge?

Derr: Oh, yeah. There's an orange sponge.

Ari: What do you got there, Ron?

Walsh: Is it a euphausiid?

Zaneveld: I don't know, what is it?

Walsh: I think it's a euphausiid.

Zaneveld. A euphausiid. And of course, this doesn't look at all like what you think scientific instrumentation looks like, right? You think hospital, you think clean, and beautiful. And this looks more like, well, something growing on a piling in the ocean, which is more or less what it is.

Ari: Wetlabs uses copper to keep the growth down.

Derr: I don't see any crabs today though.

Ari: These critters don't settle on copper and so, wherever they can, the Wetlabs team outfits their instruments with copper casings and swiveling copper shutters that work like windshield wipers. These shutters swivel out of the way of the light and the detector when a measurement is made and then slide back into place, scraping away any bit of life that may have settled down.

Derr: We usually have crabs on here.

Ari: I looked over at the team gathered on the catamaran, hunched over the sensor, peering at all the life it had collected. They were working, but they were also really enjoying themselves.

Wetlabs takes on the challenge of monitoring the smallest forms of life in the sea while discouraging the slightly larger forms from settling on their sensors, all the while tracking the chemicals and water properties that sustain and destroy ocean life at all scales.

<fade up transition music>

Ari: Here's the new sonic stumper.

<sonic stumper; cross-fade outro music>

Ari: Send in your guess for the stumper and your answer to the puzzler by visiting our website: oceangazing.org. You'll also find links to the Wetlab data streams and a couple of videos I took – one of the sensor that belongs on the disco floor and another one of the instrument caked with life.

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<fade up outro music and sustain until it ends>