Ocean Gazing: Episode 25
A green ocean
Gene Feldman: NASA

<begin music>

Ari: This is Ocean Gazing, the podcast where we survey the seas up close and from afar. I'm Ari Daniel Shapiro. You might not think it, but NASA – the National Aeronautics and Space Administration – doesn't just study distant stars and galaxies. It's also keeping watch over our planet, from 450 miles up to be precise.

Feldman: Yeah, I mean, ultimately we're measuring life on Earth. What can be more significant than monitoring the very life of this planet?

Ari: Gene Feldman has been with NASA for over 25 years, using satellites to monitor and study the oceans. And the work that he and his colleagues are doing has revolutionized our understanding of life on Earth. Stay tuned.

<fade up music and sustain until it ends>

Ari: Feldman's quick to point out that sometimes a pretty picture can have a deep and lasting impact. <fade up Philip Glass' Etude No. 5>

Feldman: If you think back, what's one of the most iconic images of all time? It's that picture of the entire Earth taken by the Apollo astronauts when they went to the Moon. The Moon pictures were fine: gray moon with craters. But what really touched the hearts of the world was that picture of the Earth, this beautiful blue and white orb dangling in the black of space from the Moon. That really, really crystallized in people's minds: one, how fragile this planet is. And more importantly, how countries and states and borders don't mean anything. When you look at it from the vantage point of space, it's one Earth interconnected by oceans and atmosphere. <fade out Philip Glass' Etude No. 5>

Ari: Feldman also takes pretty pictures of the Earth that are pretty important too. He uses a NASA satellite that's got an instrument on it called SeaWiFS, which stands for Sea-viewing Wide Field-of-view Sensor. You get bonus points if you can figure out which of those words ended up in the acronym. This sensor lets him keep track of the colors of the ocean.

Feldman: Most people think, ok, the ocean's blue. Well, for most of the ocean, it indeed *is* blue. But, whenever you put anything in the water, it will change the color of the ocean because it either absorbs or it reflects light differently that comes into the ocean from the sun. And the thing that I study that impacts the color of the ocean more than anything else are microscopic plants called phytoplankton. Entire ecosystems depend on phytoplankton. Phytoplankton form the base of the food

web. And without phytoplankton in the ocean, it's safe to say there would not be life on Earth as we know it.

And phytoplankton, because they're plants, have this molecule called chlorophyll, which is green. And the basic idea is, the more chlorophyll you have in the water, the greener the water and the less chlorophyll, the bluer the water. So what we're able to do from space is actually measure how green the water is.

Ari: If you had a globe in front of you and all the oceans were, say, dark and you were to take a palette of paint and start painting on it, how would you apply that paint?

Feldman: Before I start painting, I need to understand why different parts of the oceans would be different colors. And phytoplankton, being plants, they need certain things to grow. They need light, which there's plenty of in the surface waters. They need nutrients, which generally is found in the deeper, colder waters in the ocean. So anytime you can bring those cold, nutrient-rich waters up near the surface, you stimulate phytoplankton growth.

So if I had my little brush in my hand, what I would do is along all of the coasts where there's a lot of mixing and nutrient input from the land, I would paint those green. So you've got this green ribbon around all of the coasts. And then you've got places where the broad oceanic currents or wind systems stir up the waters even in the very, very deep parts. So I'd probably paint a green line along the equator, a line in the sea, essentially. But the large central portions of the Pacific and the Atlantic – those would not be green. Those would be essentially blue because there's not a lot of nutrients near the surface.

Ari: The thing about SeaWiFS is that it doesn't just measure chlorophyll in the sea. It also keeps track of it on land. So you get a picture of what Feldman likes to call, well, he calls it…

Feldman: What I like to call it, I call it the global biosphere. The Earth is not just ocean or just land or just atmosphere. All of these different pieces work together in beautiful harmony to create an environment in which life can flourish. And when you look at these global biosphere images and more importantly, when you look at the animations over time, you can literally watch the Earth breathe. You can watch it respond to the changing seasons, to the changing location of the sun. It's really amazing to watch the living Earth respond to the change in its environment.

Ari: And a lot of information's been pouring out of these snapshots and movies.

Feldman: We can actually calculate from these beautiful maps how much carbon the Earth's vegetation takes up every year.

Ari: In addition, Feldman and his team have been able to track how warmer temperatures in large areas of the ocean over the last decade are leading to lower phytoplankton numbers.

Feldman: And that has huge consequences for fisheries and for the environment.

Ari: This global accounting that Feldman's doing of the phytoplankton and carbon has caught the attention of a handful of high profile figures, like this guy.

Gore: It's only a few kilometers to the top of the sky. And the engines of our civilization are now filling that small space with global warming pollution, as if it were an open sewer.

Ari: Back in 1999, then Senator Al Gore was interested in having a copy of Feldman's global biosphere image. Naturally, Feldman said yes.

Feldman: We printed out one of these images and framed it up, and I took it down to his office. I went in there – I forgot which building – he's in one of the Senate office buildings and the office is just immense: 20-foot ceilings and mahogany wood and leather sofas and all that. And so he took the picture, which I had, and jumped up on his couch and took whatever the picture was that he had behind his couch off the wall and put this one in its place. And we just sat there for a while, talking about what the colors meant and what the different patterns showed and what it meant for the kinds of things that he was doing environmentally.

Gore <clip from "Inconvenient Truth" trailer>: We have to act together to solve this global crisis. Our ability to live is what is at stake.

Ari: Similar to Gore, Feldman feels compelled to reach out to and teach the public. But in Feldman's case, he's communicating his own science.

Feldman: I sincerely believe that part of the responsibility I have is to give back whatever it is that I've learned and the information that I've been able to gather to as broad an audience as possible. I think that our future and the future of this planet can only be made safe if people understand how the Earth works, and how we as just one creature might be impacting that.

Ari: Feldman's giving back by offering public lectures, for example, and by going into classrooms and talking with students. <fade up guitar music of "Here comes the sun"> And when he's not exploring the planet and talking to people about this blue marble that we call home, Feldman likes to spend time with his dog Max, and to play his guitar, which incidentally, was last week's sonic stumper.

<fade guitar to full, and sustain until the end of the clip>

Ari: Now for our next sonic stumper.

<fade up new sonic stumper, then fade under next graf>

Ari: Any ideas? Visit oceangazing.org to let us know your guesses, to see some of Gene Feldman's animations of the global biosphere, and to hear him describe how his grandfather's fishing eventually led Feldman to oceanography.

Thanks to Pat Kennedy, Rich Melnick and Maria Frostic.

Ocean Gazing is a product of COSEE, and receives funding from the National Science Foundation.

<fade up the sonic stumper and sustain until it concludes>