

PLANT PEOPLE Season Three Episode Ten “Kelp with Dr. April Ridlon” Transcript

JENNIFER BERNSTEIN NARRATION: You might think of a forest as a purely land-based phenomenon, but along much of the world's coastlines, if you dip beneath the ocean waves, you'll find forests of a different sort. Composed of countless waving fronds of seaweed, kelp forests offer food and shelter for a wide variety of animal species, protect our coasts from erosion, and even benefit our economy. But to do all that, they need balance.

I'm Jennifer Bernstein, CEO and the William C. Steere, Sr. President at the New York Botanical Garden, and this is Plant People.

Today, I'm joined by Dr. April Ridlon, Director of Science at the Monterey Bay Aquarium, and we're diving into the vast importance of kelp forests to our oceans, the way humans have thrown off the balance that keeps them thriving, and what's being done to protect them for the future.

JENNIFER BERNSTEIN: April, welcome to Plant People.

APRIL RIDLON: Thank you for having me.

JENNIFER: I'm so excited to have this conversation today. And to start us out, let's clarify upfront one very important thing. This is Plant People, but kelp is not actually a plant. So, what is kelp and why is it not considered a plant?

APRIL: That's right. So, kelp is a species of algae, and kelp is not a true plant because it doesn't have roots or stems or leaves or flowers. It is a little bit tricky because if you look at kelp, they look to have many of the same elements that plants do, and they actually do photosynthesis, so they make their food the same way plants do too.

So, they have...instead of roots, they've got a stipe, which is flexible and can bend in the waves. Instead of roots, they've got a holdfast, which is just this massive tangle of that stipe material that holds them onto the surface of the floor of the

ocean, usually rocks or rocky surface. And then they do have blades that look very much like leaves, and each one of those leaves, in the case of giant kelp, has a pneumatocyst, which is like a gas-filled bladder that helps them come up towards the surface of the ocean so that they can capture light and do photosynthesis. So, even though they're not a plant, they have very similar structures to all of the structures that we recognize as a terrestrial plant.

JENNIFER: Okay, so looks like plants, acts like plants, not plants, but plant-adjacent. We'll take it. I want to back up and start with you for a moment. Can you tell us about your work at the Monterey Bay Aquarium, and how did you get into your career in ocean conservation?

APRIL: Yeah, so as director of science here, I oversee several of our research programs. The one that people are immediately most familiar with maybe is our southern sea otter species recovery program. So, we do research on wild and rehabilitated otters, we actually rehabilitate otters and put them back in the wild. Equally important, and actually the subject of my favorite exhibit at the aquarium, is the kelp forest that is right off our shores. And so another part of my job here at the aquarium is overseeing our coastal ecosystems research, which is research into kelp forests and what makes them resilient and persistent and what might drive their loss or recovery, and estuarine systems, so like estuaries, sloughs, salt marshes. These are both really important coastal habitats, and we do research in both of these places.

JENNIFER: That's amazing. Well, I want to come and check it all out in person. How did you get into this line of work?

APRIL: I always loved the ocean since I was a little girl. And I think of all the answers I could give you to that question, the truth is I figured out that being in conservation and being a marine ecologist meant that I got to play outside as an adult, and I got to protect the places that I love most.

JENNIFER: It's wonderful when you can have a career where you have that kind of meaning. I feel that same way about my role here at the Garden. So, if someone has seen kelp only, you know, as seaweed washed up on the beach, what would

surprise them about kelp forests underwater? What are they really like when they're alive and thriving?

APRIL: Yeah, I think one thing that is surprising to realize about kelp forests is that they support so much biodiversity. So, if you go for a walk in redwood forests, I think it's obvious that there are a plethora of plants and animals that are living under that canopy.

But, what you might not realize is that underneath the water, there is truly a forest, just like the forest that we have here on land, that is supporting fish and invertebrates and hundreds of other species of algae.

And so there's a really diverse community living underneath the water that is dependent on these kelp, and that the kelp is actually making a home for.

JENNIFER: Do you find kelp forests at the coastline or do they grow further in?

APRIL: They typically speaking, follow the coast, although some kelp can grow quite deep. The real magic for the kelp is being able to have access to sunlight. And that depends on how clear the water is and how close they can get to the sun. So, there's kelp all over the globe, and they mostly are in coastal areas.

JENNIFER: Okay. Is there a sort of center of diversity of kelp or are they very distributed around the world?

APRIL: I mean, the short answer is, like, kelp, at least giant kelp and bull kelp, they really prefer cold water, so they're going to be most abundant where there is cold, nutrient-rich water. Because, because they don't have roots, they're literally sucking the nutrients from the water around them.

JENNIFER: I see. That's interesting. It's interesting because you hear kelp compared to rainforests, and I don't think of cold water when I think of rainforests. Why, why do people make that comparison?

I think it's the biodiversity. I mean, I think it's two things, right? We as human beings are able to see more of the terrestrial parts of Earth. It's a real privilege to be able to put a mask on your face and get in the water, and not many people are able to do that. Um, it's one of the things I love about the kelp forest exhibit at the aquarium is that even if you don't dive or you haven't had the experience of going into a kelp forest yourself, you can stand at the bottom of that exhibit and watch the kelp swaying and see the leopard sharks swimming by, and the garibaldi, and the sheephead, and you can really get the same sense of wonder and peace that I have felt while diving in a kelp forest.

One of the coolest things about kelp forests is that once you're under the water, you can see really clearly the different layers of life. There are invertebrates, kelp crabs, snails living almost at the surface of the water where they would have no business being if there weren't kelp there to support them, right?

Usually, they have to hang out at the bottom and be in pretty shallow places. Or you can see from the surface egrets and other shorebirds walking on the surface of kelp or using the kelp as a hunting ground and sort of waiting for fish and other unsuspecting creatures to come close to the surface and then diving them.

So, it's just really magical.

JENNIFER: How deep are we talking about in a kelp forest? How deep do they go?

APRIL: So, under ideal conditions, giant kelp can grow up to 175 feet.

JENNIFER: 175 feet?

APRIL: Yeah, the statistic that people usually...

JENNIFER: Well that's why they call them giant kelp!

APRIL: Exactly. They are actually the world's biggest algae. So, yeah, people say they can grow two feet a day. That's usually under ideal conditions. So, here in

Monterey Bay, we have seen them grow up to 12 inches a day, right? But if you had the perfect conditions, the perfect temperature, nutrients, sunlight, et cetera, they can get up to two feet a day. So, they're just incredibly fast-growing.

JENNIFER: It must be a major driver of blue carbon too. They're sequestering carbon in these ecosystems, or is that an important part of their sort of ecosystem service or no?

APRIL: Yeah, it's a good question and one that I think scientists are still working on, to be honest. So there's good evidence....scientists have estimated how much carbon gets trapped in a kelp forest relative to, like, a terrestrial forest, right?

And so those calculations are, standing biomass calculations, which means, in the stand of the kelp forest that you're in, how much carbon is being captured right here.

And those publications have found this enormous amount of carbon being stored in kelp forests. One thing that gives me pause, though, is in thinking about sequestration. When we talk about carbon sequestration as it relates to climate effects...carbon sequestration really means that we're taking the carbon out of the cycle for significantly long periods of time.

It's still a question that scientists are trying to answer, how much carbon is sequestered and for how long, by kelp in coastal systems.

Because unlike trees, when you have a stand of trees on land, unless they burn down, there is only a certain amount of cycling that's happening there. Kelp they prefer really rough waters and turbulent waters, which means that the stipes break off pretty regularly.

That's right. And they're actually broken down by bacteria, so they get eaten by things. When the kelp breaks down, the stipes break off, et cetera, that becomes drift kelp, and that drift kelp is a really important source of food for a lot of the herbivores that live in kelp forests.

Bacteria also break them down further into detritus. But to me, all of that kelp is still sort of cycling in the system. So, that's the only note of caution I would give is like there's a lot more turnover, I think, in kelp systems of carbon than there would be in a terrestrial forest. But, I think it's good that we're recognizing this immense storage of carbon that the live kelp are providing.

JENNIFER: So you talked about the biodiversity...Can you give us some other examples of the types of animals, and life that depend on these kelp forests and how you think about that in terms of their importance to the environment writ large?

APRIL: Yeah, it's a great question. So, we've talked about kelp being what we would call a foundation species, which means that they're literally creating the habitat that other creatures are living in. They also do, to some degree, create conditions like environmental conditions around them, microclimates, like microcurrents, they slow the water down. They allow for sedimentation. So, they're, they create physical habitat for other things. And a lot of those other things that they're creating habitat for are juvenile species of fish that we eat, and invertebrates that are really a critical part of the habitat around them. So, for example, we have quite a number of rockfish here in California that are important to our commercial fisheries, and at least a handful of them use kelp as nursery grounds. So, if the kelp disappears, then those fish are also going to struggle to find a place to have their young growing up.

JENNIFER: That's a great segue into just sort of what's happening with these kelp forests right now, especially along the California coast. What are the biggest threats that they're facing today?

APRIL: Probably all of your listeners will know or remember the marine heatwave that was coined The Blob. That was in 2013 or '14 here in California.

JENNIFER: Yeah, that's a sticky name, The Blob.

APRIL: Right. At the time, I was living in Santa Barbara. I was a graduate student, and we thought, we the scientific community, at least I was definitely

under the impression that this was sort of like an unprecedented event. We started seeing like weird, tropical species where they shouldn't be, and it got a lot of press, this marine heatwave. And during that time, we also, and immediately after, we saw an unprecedented loss of kelp all over the West Coast of North America, especially, here in California, we saw the estimates from our ecologists are about 50% of the kelp forests declined here in Central California.

Up north in Northern California, it was closer to 90% of the bull kelp disappeared there. And so we had this massive die-off of these giant habitat-forming species. It would be like if we just went out and clear-cut a bunch of terrestrial forests. But of course, it was happening under the water, and so the visual impact of that wasn't as great as if you went to go hike in your favorite redwood stand or a piece of forest, and it was just gone because of this climate event, right?

Unfortunately, since that major heatwave, we're starting to see these marine heatwaves come more frequently and, sort of becoming the norm. So, in the last handful of years, we've had marine heatwaves of some magnitude every single year, and they just keep seeming to break records in terms of how hot the waters are and for how long.

And unfortunately, right now we're experiencing another marine heatwave, and I am sort of holding my breath for what is to come because we're also going to be in an El Niño year. So, that already means that we may experience not as much upwelling right off our coast. And again, like the kelp really relies on that upwelling to bring cold, nutrient-rich water.

And when that...those temperatures increase and the nutrients drop, the kelp suffers. So, I think kelp forests are a very clear example of what can happen when we change our climate and with warming waters. And we have...we do have some bright spots.

As I said, like our scientists have estimated only around a 50% loss of kelp forests in this place, whereas in other places there was a wider spread loss. And of course, there's going to be many different reasons for that, but one of the things that is

correlated to that persistence of kelp forests through time is having a healthy predator population in place when the marine heatwave hits.

So, the more intact your ecosystems are, the better they are going to be able to resist those events and recover from them. We're already seeing recovery here in Monterey Bay too, and that's natural recovery. There are lots of people working on restoring kelp actively, but here we're seeing kelp recover without human intervention. So, that is a bright spot.

JENNIFER: So, it makes sense to me that the healthier the ecosystem sort of pre a challenging event, the better able the ecosystem is to recover. But, what is it about the...the presence of predators that assists in that?

APRIL: So, I mentioned before that there are herbivores that like to munch on kelp, and one of those is the sea urchin. Sea urchins mostly feed on drift kelp. So, those pieces of kelp that break off over time and float down to the bottom get eaten by urchins.

Purple and red sea urchins, when held in check, are a really important part of the kelp forest, and they're doing a really important function. So, um, even, and even in places where otters have been absent for a long time, there are other predators that can help keep these populations in check.

Down south, we have sheephead wrasse, and we have lobster who are doing that job. All over the coast, we have different species of sea star, including Pycnopodia, um, the sunflower star. And so, you know, but all of these predators are experiencing a warming ocean and...and multiple human stressors at the same time. And so as we lose one predator after another, the balance is...is lost in the kelp forest.

JENNIFER: Okay, so in that context, we've got these threats to the kelp forest, which it sounds like the warming oceans are a major factor. I'm sure that there are other concerns around development and fisheries. But you also hear people talking about kelp as a sustainable food source, farming, even climate solutions. What makes kelp an exciting option in the sort of solution set?

APRIL: Yeah. There is a lot of talk about kelp farming and that being a sustainable solution. I think more of the world is now aware that aquaculture is part of a solution for sustainable life on Earth, that we need to be looking for sustainable ways to do that. And kelp is a...could be a big part of that. I think also that kelp is, as I said before, sort of a sentinel species for what climate change can enact in the oceans and in our systems. And because the loss of kelp was so dramatic, I would say even five years ago, I ran into fewer people who would know what a kelp forest is, even here on the coast, because of the things we talked about...being able to get access to the ocean, essentially.

But, you're right that both bull kelp and giant kelp can be used in all kinds of commercial products as well as eaten themselves. And so using kelp in those ways is one way that we can make sure that we're using kelp sustainably, and sort of managing the way that we use kelp.

JENNIFER: So, it's a sort of conservation by use strategy. Encourage the sustainable use of kelp in order to support conservation efforts or growing of...how would you grow a kelp forest? Can they be propagated?

APRIL: It's a great question. Yeah, they can be propagated. In fact, one of the lines of research that I'm working on right now is trying to get experts in kelp forest ecology together to kind of match up the methods that might be used to regrow kelp forests to what has been driving the loss of kelp forests.

So, in every place, there are going to be different challenges to regrowing a forest that has been lost. And our approach at the aquarium is really to try to support natural recovery to understand what drives that natural recovery we're seeing, and try to support it. So, predator reintroduction is like a writ large example of this.

If you support the conservation or reintroduction of kelp forest predators, then you are going to be contributing to their resilience over time. If you want to regrow kelp in a place, I think the first step is to make sure that it needs to be regrown. And what I mean by that is, are there any spores from kelp getting to that place?

Like, what is actually preventing the kelp from regrowing in that place. If it's true, like, I mean, some places on the north coast of California, there's so little kelp left that it's very likely that spores are not reaching those places anymore because the kelp has just disappeared. And so you can seed lines to grow kelp, with their sporophyte.

Once they actually settle and they make a little teeny tiny, holdfast and they're starting to grow in a miniature version of themselves, you can seed them on lines. You can also do that with something called green gravel. So, there are ways that we can encourage kelp to come into places where it isn't currently.

And there are also the other approach is to try to move the barriers to regrowth. So, with urchins, we talked about predators. Some people also will remove urchins or smash them in place to do the job of predators when natural predators are not present. So, I think there are a lot of creative solutions that people have come up with for restoring kelp, and there's still work to be done to match those methods with what is going on in that particular kelp forest to make sure that we're not just putting a bunch of kelp out and they're getting eaten by a bunch of urchins because the urchins aren't, in check, for example.

Or we're bringing the urchins out of the water, but kelp doesn't seed in that place because there's no nearby population to seed it.

JENNIFER: Yeah, ecological restoration's so complicated in a terrestrial environment. I can't imagine the added layer of complexity when you look at marine ecosystems. But it's encouraging to know that it can be this combination of sort of letting the reintroduction of predators or sort of natural systems do some of the work and maybe more proactive measures as well. As you look at the work that you're doing now at the Monterey Bay Aquarium, what are the things that you're the most excited about?

APRIL: Oh, I love my job, and I'm so excited to be doing this kelp forest research. This is going to sound very nerdy, but in the last two years, we did some research around looking at the transitions between kelp forests that are thriving and urchin

barrens...those places that are like wall-to-wall urchin zombies, and the transition zones between them.

What makes an urchin barren start to transition back to a kelp forest, and what can make a kelp forest transition sort of downgrade into an urchin barren? And to answer those questions, we put divers in the water doing transects across those different habitats as they transitioned. And at the same time, our biologists who have decades of experience watching sea otters and knowing all about their foraging behavior went out and watched to see in those places whether there were otters there and what they were eating.

And so we were kind of pairing both of those approaches under the water and above the water to try to answer questions about what might help accelerate recovery in the places where it's already started. So, that's been really exciting. I'm hoping that we're going to have a paper coming out later this year about that.

And this year we just started looking at recruitment of kelp and urchins. So, the other question we've been talking about is, is there a supply of kelp in a place where you don't see it anymore?

And if so, why isn't it growing there? And part of that will have to do with the kelp itself. Of course, part of it will have to do with the urchins.

And so our teams are now out collecting the tiny, tiny microscopic babies of kelp and urchins to try to answer that question. And, so that, nerdy as it might be...we're taking microscope slides and putting them directly in the water so we can see really tiny forms of life. And brushes are collecting some of these organisms in their smallest forms. And to me, that's just as exciting as looking at the behavior of predators.

JENNIFER: Yeah, that's incredible. We have a herbarium here. It's one of the largest herbariums in the world, and we have a collection of algae. And so, when the herbarium staff will do maps, we have eight million specimens in the herbarium, they'll map the collections from all over the world, and you'll get all of these little dots in the oceans and people will think that it's a mistake, but it's not.

Those are algae collections from places all over the world. Well, it's incredible work that you're doing. For our listeners, if you're not a diver, you're not doing this sort of research, what can the average person do to help protect kelp forests?

APRIL: Well, it's a great question. I think all of the individual actions that we are now more familiar with than ever about reducing your carbon footprint, taking your bike when you can, reducing your energy consumption, all of those things help our planet. Our policy team works hard to try to advocate for kelp protections and moving funds and resources in the right direction so that scientists can continue to do the kind of research we're doing and to figure out how to bring kelp forests back where they actually do need human intervention and human help to do so.

As we all know that funding landscape has changed quite a bit very recently, and it's made it tough for especially my colleagues. I feel privileged to be at an institution that has a very long-term view, and we are able to be in the water to see marine heatwaves coming, to explore solutions in the water for kelp.

My colleagues at other institutions are not as privileged and we've lost a lot of funding for science in this country in the last year. So, that's tough, but we're happy that we can partner with a lot of people to make sure that that research is still going on. You asked me about individual connections, and this is not a solution, but just this weekend, my daughter and I were at the beach together, and she decided, unprompted, to make a kelp forest in her beach pail.

JENNIFER: Oh.

APRIL: She, for herself, discovered that, you know, at first she was trying to take the blades and the pneumatocysts and, like, push them into the sand at the bottom of the bucket to make the kelp float up, and she had already filled it with water, and they kept popping up. And so it gave her the experience of, like, what those things are for, right?

What those blades and what those pneumatocysts are doing...They're filled with gas to bring the blades up to the surface. So, then she figured out if she poked holes in them, she could sink them down and make it look like a kelp forest and put her little, diver character in there and play kelp forest.

And it just reminded me of all the times that I walked on the beach as a kid and picked up different types of kelp and algae and played with it, put it in your hair, built sandcastles with it. And so, I think that's another, like, deep connection that we as human beings have.

So, I think just any time we can connect ourselves with the natural world, it can ground us and inspire us to protect the things that we love.

JENNIFER: I could not agree more. That's a beautiful place to leave it. Thank you so much, April, for taking the time to be on Plant People.

APRIL: Thank you so much.

JENNIFER NARRATION: The next time you see a patch of seaweed washed up on the beach, you might just think about the vast underwater biome it came from. To learn more about what you heard on this week's episode, check out our show notes at nybg.org.

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