March 6, 2017, oc030617.mp3
3-D Ocean Farming-A Restorative Model
Jennifer Stock, Bren Smith

Jennifer Stock: You're listening to Ocean Currents. A podcast brought to you by NOAA's Cordell Bank National Marine Sanctuary. This show was originally broadcast on KWMR in Point Reyes Station, California. Thanks for listening.

(Music)

Jennifer Stock: You're tuned to Ocean Currents. I'm your host, Jennifer Stock. On this show we talk with scientists, educators, fishermen, explorers, policymakers, ocean enthusiasts, authors, and more all uncovering and learning about the mysterious and vital part of our planet, the blue ocean. I bring this show to you monthly from NOAA's Cordell Bank National Marine Sanctuary, one of four national marine sanctuaries in California, all working to protect unique and biologically diverse ecosystems. Just offshore of the KWMR listening radius on the West Coast are Greater Farallones and Cordell Bank national marine sanctuaries, which together protect 4,581 square miles. Aquaculture has been a part of human society for eons of time from the ancient Polynesians to now. It's taken many turns, some for the better, some not so much. Aquaculture by definition refers to the breeding, rearing, and harvesting of plants and animals and all types of water environments, including ponds, rivers, lakes, and the ocean.

The U.S. imports over 90 percent of its seafood, about half of which is farmed. Aquaculture globally has grown dramatically over the last 30 years. In the U.S., production has remained low. While aquaculture remains a controversial topic of fisheries management and sustaining wild populations, there is a role to play for producing the ever-growing demand for seafood. GreenWave is a non-profit that not only produces food but does so in what's called a restorative model. Today we'll be talking with Bren Smith, the executive director of GreenWave, a nonprofit organization that's working to support a new generation of ocean farmers to restore ecosystems, mitigate climate change, and build a blue green economy. So stick around here for Ocean Currents. We have a full show. We'll be back in just a minute.

(Music)

Jennifer Stock: My name is Jennifer Stock and today we're talking about a restorative model of aquaculture with Bren Smith from GreenWave and Bren, I want to welcome you to KWMR. You're live on the air.

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Bren Smith: Thanks so much. It's an honor to be here.

Jennifer Stock: Thank you so much for calling in. I want to start with finding out how you got into aquaculture, you started out in commercial fishing. What brought you to aquaculture?

Bren Smith: I was born and raised in Newfoundland and dropped out of high school when I was 14 and turned into a commercial fisherman and fished all over the globe, but I ended up in the Bering Sea fishing for cod and crab. Absolutely loved that job, I really miss it so much for the, you know, being in 40-foot seas being on a boat with bunch of other people working 30 hour shifts, a great life for a young kid. But the cod stocks crashed back in Newfoundland while I was working in the Bering Sea and it was sort of a wake up call for a whole generation of us trying to figure out, you know, OK, if this is not sustainable this sort of factory trawling on the seas, what's the future? And so I started doing aquaculture in northern Canada and on the salmon farms because that was supposed to be an answer to overfishing and job creation, stuff like that.

Jennifer Stock: So what brought you to starting your own model of aquaculture?

Bren Smith: Yes. So, you know, think back on the days of the salmon farms back in the ‘90s essentially we were running Iowa pig farms at sea, all the things we know, you know. Aquaculture is actually the worst brand name in the grocery store at this point. And it's made incredible improvements. Wild fish meal usage in feed. As far as the use of pesticides and antibiotics it’s taken real leaps. But I decided I want to come at it from a totally different direction and sort of asked the oceans what can the oceans provide, what's the most sustainable food we can grow and then change tastes. So one of the missteps of aquaculture was it first started growing what people wanted to eat rather than what the ecology of the ocean could provide and that was salmon and tuna and things like that. So we're kind of the other direction. So I headed, after I left the salmon farms, I ended up in Long Island Sound and became an oyster farmer and that was sort of the beginning of boutique oystering. They had a new program to open up shell fishing grounds to young fishers to track them back to the industry. So I renamed myself as an oysterman and I did that for a bunch of years and there was a big shift quite honestly, like the thrill of hunting on the ocean was gone. It was kind of boring. I feel like, uh, you know, an arugula farmer, just always knowing where I'm going to go which is a half mile out, floating around all day. It's a real sort of psychic shift for a fisherman.

Jennifer Stock: The local oyster farms around here might have a challenge with you on that, in terms of excitement. It's such a beautiful place to be. We have a lot of oyster farms here on Tomales Bay in this region overall.

Bren Smith: Well, it's beautiful, but it really is a change of an identity. If you come out of the commercial fisheries on the wild seas, chasing, hunting. I mean seafood is our last wild foods. Overtime we're going to say goodbye to that and that's really heartbreaking and the question for all of us, which I hadn't thought of when we were moving into this new model, but how do we keep that sort of culture and the soul of fishing alive, what's that core component, and I think it is the excitement, but we're going to lose that because we have to become farmers instead. What we can keep, and I tell this to my fishermen when we go to the training programs, which is you get to own your own boat, succeed and fail on your own terms. No boss, a self-directed life, and you still get the pride of helping feed the country and you know, we think… to be a fisherman. There are certain professions in the country, coal miners, steel workers, I think farmers, fishermen that come with an entire culture for the jobs you can write and sing songs. So the question for the transition of our oceans for wild fishery into ocean farming is "Can we keep these sort of beautiful, meaningful jobs that we just love so much?"

Jennifer Stock: Thanks for explaining. So tell us what is GreenWave? What is the mission of your organization? And we'll talk a little bit about this restorative model, but let's first just to start with what is GreenWave all about?

Bren Smith: It's a "GreenWave" is designed to help replicate, as you were saying in the intro, and train a new generation of ocean farmers, and we do two sorts of things. One, we do training and education, and our training and education program includes two years of support to get small grants, you get access to free or low cost seed for your farms, you get gear from Patagonia, and we agree on our for-profit side to buy 80 percent of what you grow. So that's our training programs and the other two things it does is policy work. Trying to figure out how do we protect our commons, how do we work with stakeholders so that ocean farming really has a light footprint both aesthetically and physically, and then the R&D side. How do we do research to stay ahead of the climate curve? How do we develop solar processing, you know, ocean combines, and new hatchery technology that reduces energy costs.

Jennifer Stock: So you're really looking at a lot of main components of a successful model here, both for the environment and for profit and for producing food, which

I think is different than a lot of other systems. Can you talk about what the restorative model is because I think that also helps put it all together.

Bren Smith: So there's so many people doing amazing work around the country, around the world and lots of pieces. What we tried to do was really simplify it and make it accessible so it could be replicated. We came at it from a polyculture approach. So much of ocean farming, pretty much 100 percent, is a mono-cultural model. So we switched the polyculture. What we do is we grow a range of species, seaweeds, and shellfish using the entire water column. So we grow clams, oysters, mussels, scallops, and then two types of seaweed – kelp and gracilaria. We also harvest salt in these same 20-acre areas. It's restorative for a couple reasons. One, for the environment. We soak up about five times more carbon than land-based plants. Our kelp is called the sequoia to the sea. The New Yorker called it the culinary equivalent of the electric car. We soak up nitrogen through our oysters and other shellfish. Of course, as you all know, over-nitrification, the root causes of a dead zone.

We also worked with the Department of Energy and some folks around the world in the early stages of biofuels. Then we also use it for land-based input, so animal feeds and fertilizers. If you feed cattle a majority diet of seaweed, you get up to a 90 percent reduction in methane. And what's key here in terms of the sustainable, restorative piece is we grow zero input foods so we don't require any freshwater, no feed, no fertilizers, and this makes it the most sustainable form of food production on the planet. And in the era of climate change, water prices go up, feed, fertilizer prices go up, and energy prices go up. Zero input food will also be the most affordable food on the planet. So the economics of climate change will drive us towards zero input food. And luckily, you know, as former fishermen and farmers, we're able to grow.

Jennifer Stock: When you were talking about training for people to be able to start growing a range of species, how much do you take into account the actual region that you're in? I know you're based in Long Island right now. Do you have farmers all around the United States or some different bioregions? Cause I'm thinking that species you are able to grow probably vary based on the region.

Bren Smith: Absolutely. And we really need some serious, great scientific research behind this. That is why it's so important that the Sea Grant at the NOAA labs really stay alive. They're absolutely central to those of us that are creating, trying to create this new industry or new sorts of jobs in the U.S. So the way we, I mean actually in Connecticut outside of New Haven, we

only grow native species. Our farm network right now is from Maine, it's throughout New England, Maine all the way down to Rhode Island, Massachusetts, Connecticut. We're just starting in New York. We have a first farm going through its permitting processes in Santa Barbara. And then we have a small cluster farms forming the Pacific Northwest. But the key is like I know what to grow in my area, but there are 10,000 edible plants in the ocean and a couple hundred kinds of shellfish. As soon as you look at your local ecosystem, get with the scientists, get with the chefs and ask the question "What are all the kinds of restorative species we can grow and that we can eat?", the possibilities are limitless. The doom and gloom of climate change disrupting the food system, which is all very true, there is a flip side which our oceans are this incredible bounty where we can grow whole new crops, new arugulas, new lettuces, tomatoes, that, you know, we've never seen before. And then this new climate cuisine actually for the chefs and the home cooks becomes pretty exciting.

Jennifer Stock: So how about the regulatory angle? We have a lot of marine protected areas around here. I'm not so familiar with the amount of marine protected areas in the east coast, but how do you work with the local regulations in terms of identifying an area to potentially farm and what types of regulations might you experience as a farmer?

Bren Smith: Yeah, I think the first way to deal with, I mean the oceans are these beautiful, pristine places and we need to keep them that way. And really what we've tried to do is take all the lessons from industrial agriculture, all the lessons of industrial aquaculture and not repeat them. So part of the issue around permitting and legislation is actually farm design. So when you come out to our farm there's kind of very little to see because it sits way below the surface. Anybody can boat, fish and swim in our farms. They're community not privatized spaces. People dive through our kelp forests. They tie up the best commercial fishing in the entire area surrounding our farm. People, you know, surround it literally with gillnets. The other thing is because we're vertical, we've got a much smaller footprint. My farms used to be a hundred acres, now it's down to 20 acres and I can grow way more food than ever before.

Bren Smith: And then the lease rights are key because we don't own that water or that patch of water. All we own is the right to grow shellfish and seaweed. So we own a process on a property right and it's up for renewal every five years. The community has a lever of democratic control. And then when I die on my boat happily one day that lease goes back to the town or state. Like I said, I think a lot of work needs to be done on ocean planning. We need to get together with our wind farm companies, embed our 3D farms

in the wind farms. We need to make sure shoreline residents and, you know, recreation, commercial boaters aren't interrupted. There is one thing I'd say about marine zones, I'm a huge advocate of marine zones. They're really important conservation zones. The issue is that if you can set aside the entire world's ocean as a marine park and in the era of climate change, it's still going to die. Unless we have strategies to address climate change in our waters, a marine park strategy won't work. In a way a conservation only strategy is almost like a Teddy Roosevelt type Republican environmental policy and oftentimes where they are. Conservationists to some degree, you know, they're good friends, I don't mean to be overly critical, but are their own sort of climate deniers because they see, they know that it's real, but they haven't accepted the real implications. We believe that the vision is marine parks with 3D ocean farms embedded in the marine zones, which breathe life back into our oceans, keep those conservation parks alive. And unless we have those engines of restoration embedded or surrounding the marine parks, we're just not prepared for the future of climate change.

Jennifer Stock: I hear what you're saying about marine protected areas and this need for multi-use and adapting as we are in this age of climate change and I think we're all quite in that stage right now of how to move forward, and we'll have to see how our local coastal plans and state plans and federal plans can adapt if they can go as quickly as we need. One of the things I'm hearing really loudly is the farming of algae and this 3D structure, vertical farming. And I'm wondering if you could just verbally describe what that looks like from sea floor to surface in terms of all those species and how do you do it?

Bren Smith: Sure. So the great thing about the ocean is you don't have to fight gravity, so it just makes great business sense from the farmer perspective to use that to our advantage. So imagine an underwater garden where we just have anchors that are hurricane proof around the edges of the farm, then ropes vertically upwards to the surface with a buoy. And then about eight feet below the surface we have horizontal zonal lines. So a simple, simple scaffolding system and from there we grow our kelp vertically downwards. We have our scallops in lantern nets. We have mussels in mussel socks. And then down below that on the seafloor, we've got our oysters in oyster cages. And then down in the mud we have our clams which we harvest, you know, like between the rows of kelp and other shellfish. So it's, you know, multi-species, a sea basket approach. From a farmer's perspective, the more species you can grow, it reduces the risk, right? It spreads the risk so if one crop fails we're not out of play. The reason, you know, I'm not big kelp fan, I'm never gonna eat seaweed, it's not my culture, but from

a farming perspective, kelp is so fast growing that it becomes the economic engine of the farm. It's one of the fastest growing plants on earth. So the shellfish are regional, super regional markets as well. But the kelp is like the soy of the sea. It's in everything with food, fertilizers, cosmetics, pharmaceuticals. So we can weave it through our, you know, food and other sectors.

Jennifer Stock: So one of the efforts that you have with your organization is to kind of do market development and how is that going with kelp and other seaweeds? I know here on the West Coast we have somewhat limited harvesting of seaweed and it's marketed in stores, but not quite on the scale that it sounds like we could potentially go in terms of in the restaurants, you know. It's a very limited market so far. So I'm curious how you are marketing seaweed and doing research and development with it.

Bren Smith: Absolutely. I was worried that it was going to take 20 years to figure out the market like how to get Americans to eat this stuff, how to move shellfish and sea greens to the center of the plate and wild fish to the edges. The supply we figured out. We open-sourced the model of the farm. We reduced the cost so anybody with 20 acres and a boat and $20,000 can start their own farm, be up and running. The market side we leaned heavily on storied food on social media, but what I did wrong was start in the boutique market, and I did kelp cocktail events in New York City and sort of all these hipster things. That was a mistake because we need to go to scale, right? Our farmers markets, things like that. They're actually not viable at any scale. Most, 91 percent of land-based farmers, lost money last year. We need to figure out actually how to scale the new food economy in a way that's viable. So what we did was we started working not with seafood chef because they brought the same sort of sensibilities of wrapping it around fish and seaweed salad, things like that. We didn't move into Asian market. We decided, OK, what we need to do is de-sushify this, and we started working with chefs that knew nothing about seafood. So we worked with Brooks Headley at Superiority Burger in New York City. We gave them our kelp noodles, which is a main product we make, and the first thing he came up with was barbecue kelp noodles with parsnips and breadcrumb. It sells out every night. You begin seeing it as a vegetable, not as a seafood, and it completely flips.

Bren Smith: The other thing is we work with large institutions. We work with Google, we work with Patagonia, universities that create large scale stable markets for our farmers' crops. Two things about scale. One is, you know, we're able to produce a huge amount of food per acre, you know, 10 to 25 tons of seaweed per acre. If you were to take a network of our farms totaling

the size of Washington state, you could technically see the whirl, but we don't want a thousand-acre farms. What we want is network productions. GreenWave's vision is of 25 to 50 farms dotting our coastlines, surrounded by conservation zones, a seafood hub and a hatchery located in struggling and poor shoreline communities, a ring of big institutional buyers, the Google's, the Patagonia's, and then a ring of entrepreneurs doing value-added products. Then you take that GreenWave reef and you replicated every 200 miles and I think, hopefully, that's the future of ocean farming, of having a sort of a light touch on our oceans, but actually scale and create thousands and thousands of jobs and really try to lift communities out of poverty.

Jennifer Stock: How did the health of the surrounding waters of each farm affect product? You know, we have a lot of red tide here, more toxic algal blooms on the rise, and warming waters. Have you encountered issues with rapid changes in any of these areas and what are some of the challenges that come with that?

Bren Smith: Yeah, I mean, one of my challenges is I'm getting different growth rates on the same plots year-to-year. I mean radically different. Our kelp alone will go from 20 feet to 3 feet year-to-year in the exact same spot. It drives me crazy and that's why working with NOAA, we've got a really close relationship with the NOAA labs here in Milford, Connecticut, which is the birth of shell fishing and shellfish aquaculture in America back in the thirties, to really figure out what to grow, where, and how to stay ahead of that climate curve. The pollution question, which I think is an important one. We see two kinds of farming: we farm for food and we farm for pollution. Where we're growing food, our waters, it's the most regulated, just like all the oystermen growing stuff out on your coast, it's the most regulated food in the country and we want to keep it that way. You wish your arugulas and sprouts were as traceable as our shellfish. Then we also grow in polluted areas like the Bronx River and we have plans in many other places to just farm for ecosystem services, pulling that nitrogen, pulling that carbon, pulling those heavy metals out of the system so that we're cleaning waterways. And those crops can either stay and just be used to rebuild reefs, or the seaweeds and shells can go potentially into the biofuel sector.

Jennifer Stock: Wow, that's fascinating. So do you actually work with scientists in areas like that to monitor the uptake and changes in the water quality with that system in place?

Bren Smith: Oh, absolutely. We work closely with the University of Connecticut, Woods Hole, Yale is here. We've got new relationships with the University of Santa Barbara, Scripps, places like that. One of the exciting new things we're doing is working with the EPA and some of the companies developing new sensor technology to use our farms as data platforms. So let's take this new affordable sensor technology, embed it in our farms and then, we have15 farms now scattered up and down the coast, we can use those and extract data about climate change, about pollution, nitrogen, carbon of the ecosystem services our farms are providing so the farmers can benefit on carbon trading markets and nitrogen trading markets. And, also, I'd hope that our farmers at some point actually can sell that data to the scientific community because it's way cheaper for us to collect it on our farms than for scientists to set up new farms. As soon as you begin, as soon as you sort of wade out into these waters, the oceans are a blank slate and we can just rethink, we can just think through all the different levels and potential uses of our farm. It gets pretty exciting.

Jennifer Stock: I see how your partnership with NOAA Sea Grant is very important because that's a big thing of what Sea Grant does and working with fishing communities and scaling up and also doing some of the science in some of these areas.

Bren Smith: We wouldn't exist without the Sea Grant. I mean the Sea Grant sits at that place of applied science, of taking some basic science in early science that comes out of the universities, improving it and then getting it out to folks like me that can create jobs, businesses, things like that. But Connecticut Sea Grant here has just been just amazing. The NOAA lab where we actually have a GreenWave hatchery. We got invited in to grow our sea stocks there. Honestly, you know, I'm a high school dropout. Don't know anything about science, but I do know that I wouldn't be here today without that help.

Jennifer Stock: That's fantastic to hear. I know a lot of people are going to be speaking about Sea Grant much more in the coming months and other divisions of NOAA and I hope they do talk about the value that they bring, that the organization agency brings. We're going to come up on a break in just a minute here, but I can squeeze in one more question. This goes back to talking about the areas that are kind of polluted in farming and you were talking about the algae and growing kelp and harvesting for fertilizer, for plants, science wise. Do algae absorb those toxic chemicals, and do they pass them on as you process that kelp to become fertilizer or does it somehow act as a buffer? I don't really know that much about seaweed and how it works like that.

Bren Smith: Yeah, it's a great question. So the kelp we grow in polluted areas doesn't go into fertilizer. I see that as the food system. So everything we're growing in clean, pristine waters, that can go into animal feed fertilizers, you know, human food, up and down that chain. What we grow in polluted waters would go into biofuel, which is key. So it stays out of the food system completely.

Jennifer Stock: How much biofuel market is there right now?

Bren Smith: So the trouble is it's really expensive to produce so it's not viable. The Department of Energy has a new $30,000,000 program to figure out how to scale and deal with the logical choke points to scale up and make biofuel viable. In Europe, I think it's England, kelp is part of their 50-year energy plan. Some early studies that was done by the Department of Energy, I think a decade ago, that you could get five times more ethanol yield than corn per acre. But it's still expensive to process. To do that at the biofuel level, I think, you know, we're a decade or two away, but we have the machinery to do it. We can make it. It's an experimental place we really want to push forward.

Jennifer Stock: That sounds great. Sounds like you're right on the cutting edge of helping that to really go forward. That's awesome. We'll be back in a little bit. We're going to take a short musical break. We'll come back and continue talking about GreenWave.

(Music)

Jennifer Stock: Bren, you are back live on the air with us. Do fishermen come to you or do you recruit fisherman and I'm curious, why are they coming to you? I mean are they coming to you the same way you started this up or what? Tell me some stories about some of the folks that are coming to you to help get involved in this.

Bren Smith: Yeah. So when I first started doing this, I was getting laughed off the water, you know, I couldn't hang out in the same bars I used cause I'd get beat up, and I had to go to the arugula farmer bars. But what's happened is in a couple turns. One is, you know, we're running out of fish. The U.S. fisheries are extremely well managed, but more and more fishermen need to diversify. We now have requests to start farms in every coastal state in North America and 20 countries around the world. We're a small organization and the demand is just stunning. Some of the farmers we have, we got 11 generation fishermen out of Rhode Island's. third generation lobstermen, but we also have interestingly enough a lot of

land-based farmers, young kids that can't afford to build to get land because it's so expensive. But here with, you know, 20 grand and a boat, we can get them up and started the first year. We also have a lot of women coming in, indigenous folks. I think it's because of this low barrier to entry, minimal skill requirements, minimal capital cost, so it's sort of the nail salon model of the sea, we're attracting more and more folks. We've never had to advertise or anything like that. Unfortunately, we spend too much time saying no to people because we just don't have the resources to run enough programs. I mean just in California, I think, we have a list of 150 farmers that want to start right away. And other regulatory, you know, there needs to be real work on legalizing the other weed because it's not legal to grow seaweed in a lot of states including California at this point. As far as fishers, they're poised and ready.

Jennifer Stock: This radio station is on the West Coast, California. Is there a farm in the Bay Area or near anywhere in California that people can see that's been supported by GreenWave.

Bren Smith: There's one in Santa Barbara that's not in the water yet. That will be our first multi-species farm. It's in the last leg of the permitting process. The guy Dan Marquez is a fifth generation out of Santa Barbara. His brother was a commercial fisherman and he's our first sort of GreenWave storyteller and ocean farmer and ambassador out in California.

Jennifer Stock: Do you ever have people come to you that haven't been commercial fishermen before where they're just young and really motivated by this model and want to get involved early on in their career?

Bren Smith: Yeah. The young, land-based farmers are a huge sector of that. I've got a new kid, did eight years on a dairy farm. He's just been looking for land forever, so it's, you know, 300,000 bucks for him to buy the land he needs, and he came to us and now he's farming. But then there are endless kids out of college and high school kids. There's just a lot of energy and, you know, I think the reason why is that it's giving people a sense of agency so you don't need to be a Google or an Amazon in order to build your own farm, be feeding your local community, but also participating in helping address some of the major problems we face whether it's food security or climate change. You can actually be, you know, you can make a difference, but with very low overhead and it just feels, yeah, it feels possible.

Jennifer Stock: What's your biggest limitation at this point in terms of being able to help all these people that are wanting to get started and dive into doing this?

Bren Smith: Yeah, I think there were three. One is resources. You know, just getting enough money for a training program and, you know, folks really do need two years of support so they become, you know, good, consistent, high quality growers. The second is the science, really figuring out what to grow where, and that goes all the way from hatchery to harvest, time, species selection, things like that. We figured it out here, but I think, you know, we've got farmers that want to start in the Gulf Coast and also all different places and it's not clear yet what mix of species are the most viable. And then the last one is permitting. We've had huge success here out in New England because we'd just have a lot of support that we've been writing legislation state to state. Our legislation here was called the Seaweed Jobs Bill, of all things, and so, but as we expand and create these new reefs, there needs to be sort of, you know, new legislation on a rethinking of how we use our ocean resources and making sure we bring everybody onboard together. Start small. What I did, I just put two experimental lines in the water, grew all my species, invited the community, invited legislators out, environmentalists just to sort of see and learn, create the coalition that then can move forward to really support it as a new model of aquaculture.

Jennifer Stock: It seems like a great marketing tool for the restaurants in terms of selling a product like that that is so local and adding stewardship to the environment and the 3R's coming all together in their own hometown. Are you seeing that from the restaurants?

Bren Smith: Yeah, I mean we just had been incredibly, I mean it's hard being a chef, it's hard to stay ahead of the curve for a chef. So any new local crops they can use, there is a lot of interest. We just had, you know, Rene Redzepi, David Chang, top chefs from around the world out on the farm this summer. They were part of the Yale Leadership Institute, so huge interest there. What was so interesting, these folks really know their seafood and they really know their seaweeds, they had never tasted seaweeds like this. We grow in the southern region of kelp and so our kelp is a very mild taste. It's got a nice *al dente* mouth feel, and so they were shocked how it didn't taste like what they think of as seaweed. As we're working with more and more chefs, I think they're bringing their creativity into it to make this delicious food. This is either going to be like we're going to be eating it because of the economic stuff, but there's a question is it going to be delicious and beautiful or is it going to be like being force-fed cod-liver oil? That's where we're at with climate cuisine. Is it going to be bugs and lab meet or is it going to be beautiful things that were able to grow locally and sustain communities?

Jennifer Stock: Fantastic. Bren, thank you so much for sharing all this information and knowledge. Is there any last pieces you'd want to share with listeners and please include ways that people can learn more about GreenWave.

Bren Smith: The 30,000-foot view is that this is our chance to do food right. Oceans are a blank slate. We can weave things like food justice into the DNA of the new ocean economy and really take those lessons learned from land and ocean industrialized model and just do it right this time and I think that's exciting. We need all hands on deck because we need scientists, students, other farmers, and chefs. We need everybody. We really want folks to come and make our model better and you know, and join the movement. You can get ahold of us on greenwave.org and we've got a place where people to sign up as farmers, as volunteers, fellows, like that, and we'd love to hear from you.

Jennifer Stock: Fantastic. Thank you so much and congratulations on your success to date. And it's really exciting to hear a model that takes into account everything with job training and climate and food and a small footprint. I really enjoyed hearing all about the different models that you're working to scale up. So best of luck to you.

Bren Smith: Well thanks so much. It was an honor to be on.

Jennifer Stock: Thank you. Have a great afternoon.

Bren Smith: You too. Bye bye.

Jennifer Stock: For you folks that are tuning in, this is Ocean Currents. My name's Jennifer Stock and I just was speaking with Bren Smith from GreenWave talking about the restorative model of aquaculture using a 3D model of vertical farming in the ocean and very cutting-edge time for thinking about food models and a way to mitigate climate change by growing species that absorb carbon and also take out nutrients out of the water that are excess and recycling the product to land and also to the soil. So keep in touch with that – greenwave.org and I hope we'll be hearing more about them in the future.

Jennifer Stock: This is my 99th radio program, which means April is my 100th radio program and I love hearing from listeners, so if you have ideas for topics, questions, comments, please email me Cordellbank@NOAA.gov. You can also tweet @OceanKWMR. Thanks so much for listening. Enjoy the ocean, bay, or whatever body of water you can get into safely. This has been Ocean Currents here on KWMR, Community Radio for West Marin.

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(Music)

Jennifer Stock: Thank you for listening to Ocean Currents. This show is brought to you by NOAA's Cordell Bank National Marine Sanctuary on West Marin Community Radio, KWMR. Views expressed by guests on this program may or may not be that of the National Oceanic and Atmospheric Administration and are meant to be educational in nature. To contact the show's host, Jennifer Stock, email me at Jennifer.stock@noaa.gov. To learn more about Cordell Bank National Marine Sanctuary, go to CordellBank.NOAA.gov.

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