

*December 1, 2014, oc120114.mp3*  
*Updates from the Pacific*  
*Jennifer Stock, Russ Bradley, Lance Morgan, Pete Raimondi*

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

(pause)

And welcome to another edition of Ocean Currents. I'm your host Jennifer Stock. On this show I talk with scientists, educators, explorers, policy makers, ocean enthusiasts, adventurers, 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 on KWMR 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.

Well, today's show is going to feature a few different updates from various ocean experts in the field. There's always so much going on with the ocean, so we're going to have three different guests today. We're going to do some speed interviews. And first we'll be getting an update from Russ Bradley of Point Blue Conservation Science, on a widespread seabird die off that started a few weeks ago on the west coast. So we'll learn what's going on with that. Followed by Dr. Lance Morgan of Marine Conservation Institute, who will tell us about the creation of the Pacific Remote Islands Marine National Monument, which happened earlier this year. And then later on, after the half hour, we'll have a break, and we'll have an update about the sea star wasting disease event that's been happening for the last year on the west coast, with Dr. Pete Raimondi of UC Santa Cruz. So lots of information, a very busy show. So stay tuned and we'll be right back with Russ Bradley.

(pause)

On the line with me I have Russ Bradley of Point Blue Conservation Science. Welcome, Russ. You're live on the air.

*Russ Bradley:* Well, thank you. Thanks for having me, Jennifer.

*Jennifer Stock:* Russ is a senior scientist with the Farallon Program at Point Blue Conservation Science, and we've had Russ on before. He directs all aspects of research at the Farallon Islands, which is just a fascinating, wonderful place just a couple miles off shore here of Point Reyes. But today we're mainly going to be talking about what's been going on with Cassin's auklets. Russ, I understand there's been a die off that's happened, but before we get into the die off, can you just describe this special little seabird? They're so unique and wonderful, and maybe you can just tell us a little bit about them, and what they eat, and where they breed.

*Russ Bradley:* For sure, Jennifer, Cassin's auklets are a very unique species. These are small, diving seabirds that are related to common murres and the guillemot that you'd more likely see along the coast, and so they use their short little stubby wings to actually dive underwater and catch their main prey of krill, which is pretty unique among the seabirds in our region, for a species to focus completely on krill. They breed only on offshore islands and they're really seen mostly far offshore, and they actually attain the breeding colonies like the Farallones only at night. You only see them out at night. They have really

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unique vocalizations, I've heard them described as sounding like crickets on steroids, and they live in these boroughs underneath the ground while they're nesting, or rock crevices, or nest boxes that we utilize in our research to follow and study them. And they're a very unique species because we found them to be an excellent indicator of what's going on with the krill in our region. And we've been studying these birds in-depth since 1971, continuously, out on the Farallon National Wildlife Refuge. We've been able to track a lot of different changes that have been going on in the system through observing how successful they are in their breeding and in their survival.

*Jennifer Stock:* So they're a really important seabird to keep an eye on for sure. And this summer, it sounded like they had a very good start to breeding, we had pretty good upwelling early in this season. And then what's been happening this last month? It seems kind of late for something like this to be happening, but why don't you tell us what's been going on?

*Russ Bradley:* Well, basically in this region, the spring and summer were very productive as far as krill is concerned. We had blue whales near the island in January, and again in March, we had auklets breeding at the highest densities that we've ever seen, in very, very healthy numbers and with very healthy chicks, and really high reproductive success. Actually the highest that we'd ever seen from the first clutches, basically the first attempt of these birds to breed. And then the ocean in this region really changed about mid-July. We went from having a lot of krill and a lot of juvenile rockfish to this warm-water incursion that's been observed that is not El Niño, something else that really has caused water temperatures to increase. It has caused a lot of tropical species to move up into the area, and it's also caused apparently a reduction in krill, and we had a lot of birds basically fledging into these conditions, into these conditions that became very poor. And this year is the first year out of the last several where the auklets have not been able to successfully rear a second clutch, where they have another egg and chick after successfully rearing one. The first time through all of those attempts failed this year, so that's what's happened in our region, so we're starting to see a fair amount of mortality above what's normally been observed through our partners that conduct beach surveys in this region.

*Jennifer Stock:* What's the geographic range that these birds are washing up on the beaches in terms of is it just here locally in the Point Reyes region, or is this broad scale?

*Russ Bradley:* It's a very good question because it plays into what's being observed overall. So, in this region, with some of the standardized surveys that are conducted by organizations like Beach Watch and Beachcombers, are finding larger than normal carcasses between Point Arena and Año Nuevo. But this event actually spreads all the way up into Washington state, and there are high densities of dead birds being found there as well. And there's still some birds coming in, and there's still more research to be done, but the early indications show that most of the birds that have been found have been juveniles, have been young of the year, and have been very emaciated. And another thing to keep in mind while on your question of range, is that most of the world's population of this species actually breeds in British Columbia, where I'm from. There's a large colony, the largest colony in the world is an island called Triangle Island, off the northern tip of Vancouver Island, and there are several

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other large colonies, and our partners up there with the Canadian Wildlife Service tell us that auklets there had an incredibly reproductive season as well. The best that they'd seen in 20 years. And what happens with those birds in the wintertime is that they will actually migrate down the coast, down to California. So, it appears that both our birds locally, of which we have a little over 20,000 at the Farallones, basically this Canadian population is well over 10 times, more like 20, 25 times what we have down here, so these birds that we may be seeing all along the entire coast are definitely some of our birds from the Farallon Islands, but also probably a lot of these starving juveniles are from these larger colonies in Canada that have headed south for the winter as they normally do.

*Jennifer Stock:* Wow, that's fascinating. I did not know that there was a colony that would actually migrate down here this time of year for feeding. That's really interesting. How far south do they breed, Cassin's auklets?

*Russ Bradley:* They actually will breed into Mexico, so we have Cassin's auklets at the Farallon Islands, they also breed in the Channel Islands, and there's a population down into central Baja, California, basically. And they stretch all the way up north into the Aleutian Islands. And recent genetic work shows that the population from the Aleutian Islands to about the Farallones is pretty similar in terms of its genetic makeup, and things really start to change with the birds that are in the Channel Islands and especially down in Mexico. So they range along the entire Pacific coast.

*Jennifer Stock:* If people encounter either dead or dying seabirds, either on the beach, or near shore, which is just not typical, they shouldn't be seen near shore, is there any protocol that you'd recommend for people to call or notify anybody?

*Russ Bradley:* Well, a lot of those beaches are being surveyed regularly for dead birds, so I think one of the initial things is to not remove animals that are on the beach. But I think through partners that Gulf of the Farallones National Marine Sanctuary and the Marine Sanctuary Association, the Beach Watch Program in this region, in the surveys beaches in the West Marine region and going on the web and looking up contacts for them would probably be possible. You could notify them especially if there was a drastic event with a lot of individuals found, but there are regular surveys for these animals on beaches, so I think that's one of the big messages that folks want to get out, is to not remove these animals when they find them, initially, and to inform the folks who would be able to come out and survey for them.

*Jennifer Stock:* Good to know. Okay. Now it sounds like this is definitely related to food, and how about overall for the population? Is this a concern? I know that their population seems to go up and down a little bit, and because they're such an important species to monitor, is there concern about this large-scale die off, in terms of their overall success of a population in years to come?

*Russ Bradley:* So far, Farallon population, we've been lucky enough that through over 40 years of study, we've been able to track a lot of individuals, look at adult survival, and some of these key metrics that can tell us about what's happening with populations. And the real question is, is this event confined to primarily affecting juveniles and young of the year? And up here so far, those are the individuals that have encountered these sort of fledglings that have fledged under the poor conditions. These birds are very long lived, they don't

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start breeding until they get most into three or four years old, and they can live up to 20 years. We have individuals that have made it that old. So, if this event is limited to mostly young of the year, then while there may be some impacts to the population, it would not be as pronounced as if this were affecting a lot of adult birds as well. And in major El Niños or events like oil spills that would affect adults as well, you're going to see more population impact from an event like that, so we still need to get a more complete sense of what's going on with this particular die off, but if it is targeting exclusively juvenile, young of the year birds, the overall population impact is not going to be as big as some of these other mortality events, because if it's not affecting the adults, basically a lot of the seabird strategy is to live a long time and be able to ride out successful reproductive years. And the last several years since 2010 have been extremely good for Cassin's auklets in this area. So if it's mostly juveniles, less of an impact, if it's affecting a lot of adults as well, that could have a population impact.

*Jennifer Stock:* Well, that's good to know. Let's hope that there's no oil spills or any other complicating factors to affect the adults. Russ, I know that there is a team of biologists on the island and they're seasonal out there in terms of what's going on with the weather. Is there a place where people can learn about what's going on the Farallon Islands, or other activities of Point Blue on the web that you'd recommend folks to check out?

*Russ Bradley:* Absolutely. Folks can come to our website at [pointblue.org](http://pointblue.org) and see what's going on in the organization. And we also have a blog on the Farallon islands that we update from the islands, and we have a regular update there that people can check in and see what's happening out on the Farallones through that site as well.

*Jennifer Stock:* That's great. It's a wonderful site. I just checked it out and it was really fun to see the biologists' Halloween costumes! So go check it out, everybody, of what biologists of the Farallon Islands do for Halloween!  
Well, thanks again Russ. I appreciate your updates, always, and the good work that Point Blue is doing; monitoring our local ocean and seabird populations, and many, many, many, many other things. So thank you so much for calling in today.

*Russ Bradley:* Thank you, Jenny.

*Jennifer Stock:* That was Russ Bradley of Point Blue Conservation Science, and we were talking about this local, or not so local, it actually goes all the way up to Washington state, die off of Cassin's auklets, and it sounds like this is related to the lack of food. We had good food earlier in the summer and then it scaled back when we had a warm water event come in.  
We're going to take a quick short music break, and come back to learn about the Remote Pacific Islands Marine National Monument that has recently been expanded, very exciting news. Stay with us, and we'll be back in a little bit with Lance Morgan.

(pause)

This is Jennifer Stock. You're tuned to Ocean Currents, and on the phone with me today I have Dr. Lance Morgan of the Marine Conservation Institute. Lance, welcome, you're live on the air.

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*Lance Morgan:* Hi, Jenny, how are you today?

*Jennifer Stock:* Good. Thank you so much for calling in.

*Lance Morgan:* Of course.

*Jennifer Stock:* So, this has been a pretty fascinating and exciting year for you, I'm sure. This past September was a huge, huge milestone for ocean conservation, with the expansion of the Pacific Remote Islands Marine National Monument. And I know you were extremely involved with this effort. Can you give us a little bit of a background on the creation of it?

*Lance Morgan:* Sure, thanks. Back with President George Bush, we'd initially put together a case for support for the White House office for the Council for Environmental Quality, and we argued at the time that we thought the whole surrounding economic exclusive zone, the Pacific Remote Islands, needed to be protected because of the great cultural and scientific value of the area, and he could do that under the Antiquities Act. So we had worked then with his administration and they had actually revised the proposal and said we should only protect up to 50 miles around the area, which at the time of course was terrific. It was something on the verge of 90,000 square miles, and protection for the coral reefs and the surrounding waters and a lot of the migratory species, but we had felt like there was still a very strong argument for the full expansion, and when we were able to hear that there was still some interest in that in the Obama Administration earlier this year, we updated a lot of the information, and resubmitted our proposal and argued that the value of the area as a national monument protect foraging seabirds, many of which forage hundreds of miles offshore, and the migrations. Marine mammals and sea turtles, including leatherback sea turtles, and we got to really look at this area. It has very low economic activity at present, but you never know what may be coming down the road, so we put together this case for support. And we're very pleased that President Obama took many of the recommendations and expanded this area so it's now the world's largest protected area of ocean, something close to 500,000 square miles of the Pacific.

*Jennifer Stock:* Wow. Where exactly are these remote Pacific islands? Can you give us a little bit of geographic reference?

*Lance Morgan:* Well, they actually cover an area that is spread across the central Pacific, in an area that's actually if you can overlay the map of the U.S., would be just about as broad as going from the south down around New Orleans all the way up to Seattle. The areas lie along the equator adjacent to the island nation of Kiribass, to the south, which is almost due south of Hawai'i, all the way out to the west where Wake Atoll is, which is really out in the middle of almost nowhere, going towards Guam, and then up to Palmyra, towards the North which is one of the closer areas to the Hawaiian Islands chain.

*Jennifer Stock:* So these are really tiny little atoll islands, probably not very many feet above sea level at this point.

*Lance Morgan:* That's correct. Yes. Many of them are coral reef atolls, and class extents of that, which were coral reefs that built up on to volcanic structures or seamounts, and then the corals continued to kind of keep pace with the

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sinking of the seamounts, down that the corals of this living growth around the edges keeps this circular island structure going. Most of them have lagoons that the coral reefs fringe around, but none of them have ever been permanently inhabited. They all came into the U.S. possession as a result of an 1860s act of Congress called the Guano Act, which meant we needed the poop of seabirds to help us make dynamite and other ammunitions, so anyone who was willing to go out there and collect bird guano was protected by the U.S. government in exchange for them putting them on barges and shipping them back.

*Jennifer Stock:* Leave it to the U.S. to enact a law to go after seabird poop. We need the seabirds. So, is this south of the Papahānaumokuākea Marine National Monument? Are there ecological links between that region, the Northwest Hawaiian Islands, and these islands?

*Lance Morgan:* Right. Yes, there are in certain cases. This, again, is a fairly vast area. Most of it is much more, especially the southern islands are right on the equator, and so they're basically between 0 degrees latitude up to about 15, where as Hawai'i is a little bit more in the subtropics of 20 degrees latitude. But many of the same species, especially the seabirds are common to the area, so species like the red-tailed tropicbirds, the boobys, and so forth overlap the same region. Many of the terns as well.

*Jennifer Stock:* Wow. Now, the Papahānaumokuākea Marine National Monument was put under the state of Hawai'i to be co-managed with NOAA and national marine sanctuaries. How is the Pacific Remote Islands Marine National Monument going to be managed or administered?

*Lance Morgan:* Right. So this is territories that were never part of any U.S. state. They were always territories of the U.S. federal government. So they are going to be jointly managed by the National Wildlife Refuge Program, the islands themselves were already seabird refuges, and NOAA itself. So a different part of the government that also manages sanctuaries. Together, NOAA and the Fish and Wildlife Service co-manage these areas.

*Jennifer Stock:* So, with the designation of a monument, what's prohibited? I know there's not a lot of people using that area, but what activities are exclusively prohibited by becoming this monument?

*Lance Morgan:* Right. So, each monument is really subject for the president to decide what he wants to allow or not allow. In this case, they've prevented any commercial extraction of both marine life or mining, so there will be no taking of anything like that, or any future development of commercial activities in this region, so will be set aside for scientific exploration and conservation, and the animals and seabirds and the fishes will be the ones that reign out there.

*Jennifer Stock:* Wonderful. What type of seafloor mining would be of interest in that region? It doesn't sound like an oil type of area, but what type of mining would be?

*Lance Morgan:* There would be no oil and gas. There are potentially, and I don't know how much of this area has ever really been explored, but rare earth elements, manganese nodules and so forth, that are present in different parts of the Pacific, and again I don't know how much of that might have gone on in this region. There are certainly some crusts around some of the seamounts out

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there that might potentially someday have been worth some money. It's still not a hugely cost-effective mining strategy to go to these remote areas and dig up the seafloor for these elements, but you don't know down the road whether that might become, with the prices of these elements somewhat economically feasible in the future. But I don't think we have any real good handle. There's recoverable amounts in this region.

*Jennifer Stock:* Great. Definitely precautionary principle is a good way to go.

*Lance Morgan:* Right.

*Jennifer Stock:* So, this just must be a fantastic accomplishment for the Marine Conservation Institute. What is the significance of this action in terms of ocean conservation globally? This is now the largest marine protected area in the world, so it must have a lot of significance in this action happening in itself.

*Lance Morgan:* In the global setting, we have something on the order of a little over 2% of the ocean protected in something like a marine protected area similar to the sanctuaries or marine reserves, wildlife refuges. So, most scientists and in fact the World Parks Congress that recently concluded down in Sydney, Australia, recommend that the amount of ocean that needs to be protected is something on the order to 20 to 30% of the ocean. So we clearly have a long ways to go to get those types of numbers. But an area the size of what was just protected by President Obama is almost getting close to a half a percent on a tone. And so we are lucky that the U.S. had this territory that was able to have this vast area protected, but it's also leading to a bit of a competition between some of the nations with large oversea territories. We see the U.S., the United Kingdom with the British Indian Ocean territory around the Chagos Archipelago, kind of vying for who's got the biggest area, which is a nice trend for marine conservation, that countries are actually taking some pride in setting aside these areas to help secure healthy oceans for the future. France and New Caledonia is looking potentially to another large designation to their oversea territories. And we have places like Palau and the Cook Islands as well stepping up. And so I think where we used to think that large protected areas can never be managed or protected, with the advent of technologies and satellites and things like that, countries are feeling much more confident about the ability to actually manage these areas, and do so in a productive way. And we're getting to see some competition amongst the different nations to actually see who can protect the most of the ocean, and like I said, that's a great trend if we're trying to get from 2% up to 20 or 30% of the ocean protected.

*Jennifer Stock:* And I just want to add, too, I think a lot of times people get upset when they hear protection, they think exclusion, and can't do anything. But in reality, a lot of these protections are to basically help sustain life on our planet. We've kind of taken a little bit too much out of the ocean historically, so it's pretty important that we start looking at protecting some source supplies of food and habitats for all these animals. And I really applaud the work of your organization going after important important places like this.

*Lance Morgan:* Yeah. I think you raised a really critical point, it's that with some reports as much as 90 to 95% of votes of marine life populations declining, we really do need to invest in some of these recovery zones so that we can rebuild these populations. And as the human population continues to grow towards 9, 10, 11

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billion people, there's a lot of loss productivity out of the ocean that we can regain by strategically recovering certain populations. And we're also facing a very uncertain future with climate change and other impacts that a lot of people are talking about, the sixth mass extinction on the planet in the coming years as the results of our activities. And so these are the areas that are going to be resilient and probably best able to help us survive these types of threats.

*Jennifer Stock:* Great. Well, Lance, thank you so much for talking about this. You know, it's interesting. I heard about this earlier this year, but I didn't hear a ton about it. And I think in particular maybe because national marine sanctuaries weren't involved, and I work for sanctuaries. But I'm really glad that I learned more about it, and about the special place. Is there a website you'd like for folks to visit to learn more about the work of Marine Conservation Institute?

*Lance Morgan:* Well, you can certainly go to our website [marine-conservation.org](http://marine-conservation.org) and there's plenty of links to get to some of the different sites. Pacific Remote Islands Marine National Monument has its own website, you can see some great pictures of the variety of seabirds and other marine life that live out there. And we also run another site called [npaatlas.org](http://npaatlas.org) where you can learn about the different protected areas we mentioned around the world, and you can explore a map interactively and click and go find out what some of those areas are.

*Jennifer Stock:* Great. And what was the website for the Remote Islands National Monument?

*Lance Morgan:* Good question. You'd have to Google Pacific Remote Islands. I don't know the exact title.

*Jennifer Stock:* Great, yeah, I'd like to learn more about what they're going to be doing to kind of get it off the ground with the National Wildlife Refuge Program and NOAA.

*Lance Morgan:* Yup. Absolutely. So, it's exciting. They will definitely be going to a new round of preparing the management plan for it, and I think also an opportunity for the public to go in and voice their opinion about the area as well.

*Jennifer Stock:* Great. Well, Lance, thanks again. We're going to move on, but I appreciate you calling in this afternoon, and thanks again for all your time.

*Lance Morgan:* Yeah, absolutely. Thanks, Jenny, for the opportunity to talk with you.

*Jennifer Stock:* You're welcome. Take care.  
We were just talking with Dr. Lance Morgan, president of the Marine Conservation Institute and hearing about the creation of the world's largest marine protected area, the Pacific Remote Islands Marine National Monument. 490,000 square miles. And here's a couple more statistics about the place: There's 130 seamounts in the region, undersea mountains which can provide essential rest stops for tuna and sea turtles migrating across thousands of miles of Pacific Ocean; several million seabirds of 19 species, many of which find the fish and squid they eat in the now expanded marine monument waters; habitat for whales and dolphins including the newly discovered Palmyra beaked whale; and nearly pristine coral reef ecosystems. So, sounds like a phenomenally beautiful, important area. You can learn more about it at [marine-conservation.org](http://marine-conservation.org) and other work through the marine conservations at [npaatlas.org](http://npaatlas.org).



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You're tuned to KWMR 90.5 Point Reyes station, 89.9 Bolinas, and 92.3 the San Geronimo Valley. My name is Jennifer Stock. This is Ocean Currents. We're going to take a short break, come back, and we'll be talking pretty soon with Dr Pete Raimondi to find out the latest of the sea star wasting disease that's been happening on the west coast. So stick with us here.

(pause)

And we're back here on KWMR. This is Ocean Currents. My name is Jennifer Stock. And we've been doing some quick updates on what's been happening in the ocean world with different guests today. And my guest here on the line, Dr. Peter Raimondi, is with UC Santa Cruz. Pete, you're live on the air.

*Pete Raimondi:* Good to be here.

*Jennifer Stock:* Thanks for joining me today. So, the sea star wasting disease has been plaguing our stars on the west coast since later last year, and Pete was on our show earlier in March this year, giving us an overview of what's been going on. And I know there's been some updates and findings regarding this wide scale event, so I thought I'd bring you back on, and maybe you can give us an update between March to now. What are some new findings regarding the sea star wasting event? I know that it's not done by any means, so what's been found recently?

*Pete Raimondi:* I guess there's really three things to talk about. The first is where it is and when it got there, and in March we were hoping that it was slowing down, and that we would be talking now about recovery, and not about the continuation of the impact, but unfortunately that's not the case. It spread both latitude, we've seen it move into further North, Alaska, and more reports from Mexico, and we've also seen it scaling in areas that it hadn't affected yet within that range. Again, most species that are what we call rocky substrate species have been shown to be affected, and what I'm talking about in particular are tide pool species, and those species tend to be in the kelp forest. It's pretty complete with respect to some species, meaning there are very few locations where they haven't been affected. So, that's the first thing. The second thing is that we have with a number of collaborators led by a guy named Ian Hewson at Cornell, who have done a bunch of epidemiological work and come to the conclusion that pathogen is likely, not confirmed, to be involved with the diseases, the densovirus, and that it is a virus that has been around for quite a long time. And that's important because it means that these animals were not likely to be naive to the virus, meaning that it wasn't an introduced species or one that had just made inroads into the areas, so they weren't naive, meaning that they were likely to be affected by it because they hadn't built up any immunity. This is a virus that if it's responsible, has been around for at least 70 years and they were unlikely to be naive. And so the big question becomes—and it was pretty much the same question back in March—well, if they had been exposed to it, why is this virus suddenly so virulent? And we're working a lot on that. But the third thing is a little bit of silver lining. Two pieces of information: One is we've been doing a lot of exploration of more remote areas along the coastline between Alaska and Mexico, and we have found in some very remote areas really healthy populations of sea stars, which we didn't expect, but which are true. So that's kind of good news. And the other thing is that we've seen in some locations, not many, but in some, huge numbers had babies over the last six months to nine months, which we also didn't expect

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given the severity of the disease. But we've seen huge numbers of babies of some species, so that gives us some hope that there will be recovery more quickly than we had first expected.

*Jennifer Stock:* Wow. Very interesting. This is like a marine pathologist's field day, honestly, because we talk so much about viruses and outbreaks and vaccines for humans, we don't talk about that with the ocean so much. And here's this virus that's in the ocean, it's been in the ocean a long time, and... wow, now there's this really interesting event. I find it fascinating in terms of all the factors that bring it up into affecting this predator in the intertidal area. Do you know how far deep observations have been seeing in terms of sea star wasting? I know with Cordell Bank, we have not seen an effect of sea stars on Cordell Bank itself, or the deep areas of the Bodega Canyon where we've been. But I'm curious from the surveys that have been done, do we know how deep it has been observed at?

*Pete Raimondi:* Well, there is a really interesting phenomena here. We have been one of the very best characterized marine diseases ever. But with respect to particular habitats where there's been a huge amount of assessment and monitoring over the last 10 to 20 years. So, as I was indicating, we have this really great information basis for tide pool areas and less of but still very comprehensive for kelp forests, but that's pretty much it. And we really are ignorant with respect to sandy bottom species, with respect to deeper species. Anything out of these habitats we have virtually no information. We do get reports from you guys sometimes when they're doing some ROV cruises, or when they're doing trawls. We get some reports from crab fisherman who have indicated to us that they'd pulled up pots where there's been disease or non-disease sea stars. But it's very opportunistic and not comprehensive at all, so we're just so unclear as to the extent of it beyond those two habitats.

*Jennifer Stock:* Now, one thing I read about this densovirus that I think is interesting is that to find out in terms of how far back this virus has been around, they actually went to, was it museum specimens?

*Pete Raimondi:* Yeah. So, we couldn't have done this 10 years ago, but one of the things that's really cool about the new approaches to genetics is that you don't have to have specimens preserved in very particular ways. Simple drying works pretty well, and what that means is that you have the opportunity to go back to these archival specimens, not to the virus but for the host, and retrieve the genetic material associated with them. And by doing so, Ian Hewson, the guy at Cornell, was able to screen for different viruses including the one that we think is the likely pathogen, and found it in not just that one dose of the result, but in other ones as well. And so it opened up a huge amount of information to us because we could clearly say that it was already present in the environment. And that really was a very important step, because it lets us follow a track from now on, which is to find out what is causing it to be so virulent. And I want to stress, that's the key question right now, because it will give us indication whether this is likely to be one awful event and it doesn't hold any importance to the future, or whether this is something related to something like climate change that could increase in frequency overtime, or would maybe give us information about whether this is likely to jump to other species.

*Jennifer Stock:* Right. Wasn't there a thought that it could jump to other echinoderms?

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*Pete Raimondi:* Yes. Yes. That was based upon past events, and in the past events we had no clear idea whether there's a pathogen involved in every one of these, because we just didn't have the approaches back then. But in the past events there was clearly a jump or at least a simultaneous impact on other species. We haven't seen that very much today. It's been largely restricted to sea stars. There have been some reports that have been coming out recently that suggest that perhaps it is jumping to other echinoderms, specifically sea urchins, but this is really, really just based upon a couple of reports here and there and we're pursuing. So I don't want to get people too excited about this, but there have been some recent reports that suggest that there may be a jump to other echinoderms.

*Jennifer Stock:* Interesting. Now, I know one of the thoughts was that perhaps a warming trend of the ocean could be a factor, but at the same time, when this started there really wasn't too much of a warming trend. How about the—this is probably too short term of an event to make any conclusions from, but this summer we had a very large warming event happening in this region, and was it warm enough for that to be a factor for sea stars as well?

*Pete Raimondi:* Well, two points on this: One is, you're absolutely right. We've seen a number of fortunately because as I said before this has been really well characterized because we've generated a huge amount of data from typical monitoring methods that have been done by scientists, but also from citizens who have sent in watch reports. We've actually had a huge amount of data that reflect where the disease initiated and the places and the times they were initiated. And we do not see a clear signal yet of temperature or ocean acidification or any of the obvious or likely environmental stressors. That doesn't mean that they're not there, it just means they're kind of cryptic at this point. With respect to warming in particular, warming all by itself, if you just take animals into the lab and you warm them up enough, they're going to show exactly the same signs. And so if you answer carefully with respect to warming, because they can act in two ways. It can cause the symptoms all by itself if you get animals warm enough. The second thing is that it will also cause a pathogen to become more virulent. It's a tricky one because we don't know which of the two might be operating if you see wasting in the presence of warming, whether it's just a pathogen that's made more virulent, or whether it's the warming all by itself that is causing the symptoms that we see. Because we do see in localized areas, some places where warming occurs, and you see wasting that follows, directly following it. But we also see wasting initiate in the middle of the winter when the water is relatively cold. And there's just no general pattern yet.

*Jennifer Stock:* So interesting. Thank goodness for the ongoing monitoring sites that are happening up and down the coast.

*Pete Raimondi:* Yeah.

*Jennifer Stock:* And great to hear that there's some recruits that are establishing themselves in the intertidal area again.

*Pete Raimondi:* Some right up near where you are, too. There's places up and down the coast. They aren't very common, but every once in a while we get these pictures from citizen scientists or own folks, and there's so many of them, these tiny

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little things that are the size of your little fingernail, all over the place. It's really amazing.

*Jennifer Stock:* Well, that's really good news. Sea stars are significant because they're a big predator, and have such an impact. Because this has been going on over a year, have there been any changes in these communities with the loss of these big predators? Or is it too early to tell?

*Pete Raimondi:* Well, again, we fortunately have these really amazing data sets from certain areas where we've not only counted sea stars for a long time and revised them for a long time and also the rest of the community, but even more importantly, we've mapped the rest of the community. So we know where everything was. And we are starting to see in a few locations the early signs that the community is shifting from one that was less dominated by mussels to one that is more dominated by mussels. And I'm talking about tide pool communities right now, because that's where we have the most information. So it's too early to say whether this is going to be a general phenomena up and down the coast, but it's not too early to say that we are starting to see that predicted change in the communities that comes from the loss of this keystone predator.

*Jennifer Stock:* Well, hopefully we'll be able to see these younger sea stars actually survive and that's a whole thing in itself that's interesting. You have these young recruits while there's this disease going on. How are they able to survive?

*Pete Raimondi:* Well, we don't know that yet. But we're tracking them. We'll let you know in six months.

*Jennifer Stock:* All right. So, are you still interested in hearing reports from people that are out tide pooling in terms of contributing their information? What's the website for that again?

*Pete Raimondi:* It's [seastarwasting.org](http://seastarwasting.org), so just spell it like it sounds. But most importantly now, we've added in another component to our website. In the past we've asked people, citizens to submit their records when they see wasting. We still want that, but now what we've done is we've added a new page which is a record that they can submit when they see babies. And to help them, we've put in a link to a catalogue of what baby sea stars look like for each species. So, if people see little babies, they can take a picture of it, or they can remember it and come back, look at our website and say, "Oh, that's *Pisaster ochraceus*, the common intertidal sea star," and submit a report indicating that, because now what we want to do is follow the recovery along the coastline. And again, the more eyes looking, the better it's going to be.

*Jennifer Stock:* That's fantastic. Great to hear. And that's giving me something to do over Christmas with my family for sure. So, thank you so much Pete for the update, and I really love hearing how science progresses, our understanding of these huge events. It's really fascinating. So, thanks for sharing all your information today.

*Pete Raimondi:* Well, thanks for having us. Thanks a lot.

*Jennifer Stock:* You're welcome. Have a great afternoon.

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*Pete Raimondi:* Okay. Bye bye.

*Jennifer Stock:* We've just been talking with Dr. Pete Raimondi from UC Santa Cruz, and getting an update on the sea star wasting disease that's really affected the west coast predominantly, all the way up from Alaska down to Mexico. And some hopeful news in that there's some little baby sea stars that are making their way into the intertidal habitats again. So that's really exciting. If you want to learn more about that whole event and ways to get involved, and report your sightings, you can go to [seastarwasting.org](http://seastarwasting.org). And there's great ID guides there on identifying sea stars, so great way to start learning more about sea stars in itself.

We are going to take a short break, and I'm going to come back, and we'll finish up the show with just some other announcements that are happening in our area regarding the ocean. Thanks for tuning in.

(pause)

All right. Some different things are going on that you might be interested in. I just learned of a 15-minute film documentary called *Racing with Copepods*, that is premiering this Thursday at a restaurant in Sausalito called Fish, and it's at 7 o'clock, and the screening is at 7:30pm. And basically the description of the film is 12 middle school youth take a race sailing course, where they study the fastest animal on earth, which turns out to be copepods which are zooplankton. And we have them here all over the place in the ocean and in Tomales Bay. And in the process they connect with the natural marine world and become advocates for its wellbeing. So, sounds like a really fun film. I know they have some big names in the film like Sylvia Earle. And it's a wonderful little piece that will be fun to see. I haven't seen it yet, but the preview looks great. You can go to the *Racing with Copepods* Facebook page. They also have a website [racingwithcopepods.org](http://racingwithcopepods.org). And check that out, but that's this Thursday, December 4th, at 7 o'clock at Fish restaurant in Sausalito. Catch some dinner, some drinks. There's a \$5 suggested donation to see the film *Racing with Copepods*.

The Cordell Bank National Marine Sanctuary Advisory Council is seeking applicants for three seats on the council. The council ensures public participation in sanctuary management, and provides advice to the sanctuary superintendent. And the seats that are available for applications right now are the primary seat for education, and alternate seats for Community at Large Marincounty and the research seat alternate. So, people can apply by getting an application at the Cordell Bank website [cordellbank.noaa.gov](http://cordellbank.noaa.gov). Applications are due December 31st. The council consists of 14 primary and alternate nongovernment members representing a variety of public interest groups. It also includes a couple of government seats representing the Coast Guard and NOAA Fisheries. It's always a really interesting meeting, very informational of things that are going on in the region, and it's really wonderful to have the participation of the community and helping to support management of this special place right off the coast here. So, if you're interested in learning more about that, you can go to [cordellbank.noaa.gov](http://cordellbank.noaa.gov). There's a link right off the homepage there to learn more about the advisory council. And there are always public meetings, which we usually have here between Point Reyes, at the Red Barn classroom at the Seashore, and Point Blue Conservation Science in Petaluma. The meetings are in those two places. So you can check that out.

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I just was thinking about Christmas is coming up. I can't believe it's almost there. And books and gifts. I just have two books that I want to share with you if you're looking for the right book for somebody that likes the ocean. One of them is a children's book, and it's called *Neighborhood Sharks: Hunting with the Great Whites of California's Farallon Islands* by Katherine Roy. This book just came out this summer, and it's a book that talks about the local white shark population here in our region, for kids. She vividly recreates a day in the life of a shark, and reveals why sharks are essential to our ecosystem, and deserve our protection. And I know through local shark researcher Scot Anderson, she did her research for this book, she definitely talked to the right people, the facts are right and it's a really great book for kids probably between the ages of 7 and 12. So, check that out. *Neighborhood Sharks: Hunting with the Great Whites of California's Farallon Islands* by Katherine Roy. Speaking of sharks, I'll add this one little note before I've got to sign off with our closing here, but I had a chance to go out with Scot on the boat last week to keep up on the research he's been doing with the local population, and I had a chance to finally see my first white shark and it was amazing. It was just outside Tomales Point, and it was definitely a new experience for me. I've heard about these things, I've talked about them, I've interviewed people all about them, and I finally got to see one and it was just outstanding. I was really glad to be in a boat because they're really big.

Another book that you want to check out either for yourself or for a gift has just been wonderful to keep up with. It's called *Blue Mind: The surprising science that shows how being in, near, on, or under the water can make you happier, healthier, and more connected and better at what you do*. The author is a guest I've had here on Ocean Currents before, Wallace J. Nichols. I had him on a couple of years ago when he was just beginning to explore this arena in terms of the neuroscience of the impact of the ocean on us as humans. It's a wonderful book, a great read, and I know there are some local organizations trying to bring Wallace J. Nichols to Point Reyes to do a reading and a little lecture about the work that he's doing, *Blue Mind*, and how this might help apply towards helping protect the ocean in a greater sense. So, books are wonderful for gifts. Those are two great ocean books that I recommend, *Blue Mind* and *Neighborhood Sharks: Hunting with the Great Whites of California's Farallon Islands*.

And that about wraps it up for me today. The Ocean Currents show is the first Monday every month. This is the last show of 2014. I'll be back in 2015. You can catch all the past shows that I've hosted here at [cordellbank.noaa.gov](http://cordellbank.noaa.gov) or subscribe to the Ocean Currents Podcast in iTunes. And we'll see where we go next year with more to bring to you about the ocean for KWMR here on West Marine Community Radio. Thanks so much for tuning in today, and I hope you have a wonderful holiday season. Thanks for tuning in to KWMR.