“Reeling In the Coral Reef Soundscape” Excerpt Transcript

Excerpt from (September 2, 2016) episode of Science Friday.

JOHN DANKOSKY	[WATER LAPPING] If you've ever been lucky enough to swim near a coral reef, you know it can be a calm, serene experience. Just the sounds of the water lapping around while you watch the colorful fish swim by your face. But if you listen closely at the level of the tiny sea life living on a coral, it might sound a little bit different. [CRACKLING] For the fish and the other animals, coral reefs are kind of a noisy place. Kind of sounds like fish frying I think. Those clips were captured by my next guest. He's recording the soundscapes of coral reefs. He's here to tell us what they can tell us about marine ecosystems. Max Kaplan is a PhD candidate at the Massachusetts Institute of Technology in Woods Hole Oceanographic Institution. Max, welcome to Science Friday. Thanks so much for being here.
MAX KAPLAN	John, thanks so much for having me on.
DANKOSKY	So first of all, let's play this recording again. Take us through what we're listening to here. Let's play the first one. [CRACKLING] So this is the reef-- what are we hearing right now, Max?
KAPLAN	Sure. So the sort of crackling sound that you're hearing is mostly snapping shrimp. So these are tiny little shrimp. They have an enlarged claw. And basically what you're hearing is the sound of an air bubble collapsing when the claw closes. It produces this big air bubble that then collapses and makes that crackling sound. I kind of think of it as a bacon frying sound, or like Rice Krispies popping, whatever kind of food analogy you want. And then at the lower frequencies you can actually hear these fish grunt. So these are sounds made by reef fish. They have a swim bladder-- so It's an air filled sack. And they have these muscles that kind of drum or knock on the swim bladder. It kind of acts as an amplifier. And so those are sort of the main categories of reef sounds that we were able to detect.
DANKOSKY	Let's actually listen to some of the fish here. [GRUNT]

KAPLAN	Exactly. So there you go.
DANKOSKY	That's the fish grunting right there.
KAPLAN	Absolutely. Absolutely it is.
DANKOSKY	I didn't think that's what a fish sounded like.
KAPLAN	You know, you'd be surprised at the diversity of fish sounds out there. There are about-- you know, there are about 12,000 fish species living on these shallow tropical coral reefs and a surprising number of them make sound. And so there is an appreciable diversity in sound production in these guys.
DANKOSKY	Well, tell us a bit more about how these coral loving fish, and some of the other sea life there, use sound. Are they communicating with each other? I mean, how does this work?
KAPLAN	Yeah, absolutely. So the sounds are actually used-- at least for the fish-- in a huge number of different behaviors. So certainly aggressive, like territorial, keep out displays. Damsel fish for example, which is one family of reef fish, use sounds for that. There are also sounds that are made in spawning aggregations or in mating displays. So really sound production is an important component of many key behaviors of at least many fish living on these reefs.
DANKOSKY	I'm John Dankosky. This is Science Friday from PRI-- Public Radio International. And we're talking with Max Kaplan. So, how exactly do marine animals hear? Is there something like the human ear that they have?
KAPLAN	Well, you know, that's a really good question. So there's actually a fair diversity of hearing mechanisms. So let's talk about fish first. So fish have otoliths-- these are hard calcified ear bones, basically-- and these are denser than the fish body. And so when sound propagates through the water, there's this vibrational back and forth movement of the water particles and the fish body. But because these stones are a little bit denser, they kind of lag behind, and that actually activates these things called hair cells that are sort of around the ear bones, and that's really what transduces the hearing response. Some fish are also able to sense sound pressure. Again, they're using the swim bladder as kind of an amplifier there. And so that's more analogous to what we hear. But certainly the vast majority, and at least for every invertebrate that's been studied so far, is that first sort of vibrational component that they hear. And

	that's what we call acoustic particle motion. And again, the back and forth movement of particles in the medium.
DANKOSKY	So I assume that you're doing this to try to gauge the health of reefs, because, obviously, they're endangered all around the world. How can you tell a healthy reef from a sick one? And can you do that just by the sounds that you're gathering?
KAPLAN	You know, that's the main kind of question that's sort of above all of the work that we've been doing in this regard. We've been taking a range of different acoustic recordings from reefs that sort of vary among each other, say, in terms of coral cover, or fish density, or species richness. And some work that we did in the Caribbean and the US Virgin Islands a few years ago demonstrates that actually yes, you can sort of tell the health of the reef by listening over relatively long periods of time and looking at what you see in the acoustic records-- which are these characteristic peaks in sound production at dusk and dawn. So basically when the light is changing most rapidly you have peaks both in the lower frequencies where the fish are and in the higher frequencies, which is more of the snapping shrimp. And actually the magnitude of that peak seems to correlate fairly well with the density of fish living on the reef or the amount of live coral cover. So I mean those are pretty promising results. And we're actually following that up with a relatively larger study right now taking place in Hawaii.
DANKOSKY	So I could imagine a series of these sound recording units at reefs all over the world where you could be watching on a computer screen to see where the sounds are dipping down. Maybe you can sense some trouble in advance.
KAPLAN	Exactly. You know, that's the sort of applied aspect of this. That's the general idea. This equipment is becoming cheaper and cheaper, and so it's relatively easy now to put out a bunch of these things, have them record, and then pick them up. Or you can even have buoys on the surface sending summary statistics to your computer exactly like you described. So that's the sort of long term hope of this work.
DANKOSKY	You know, we just have a little bit of time left, but obviously humans create an awful lot of the problems for the reefs. Do you have a better sense after having done this work of just how much things like boats going by and our activities can damage these reefs? Or damage the ability for these fish and shrimp to hear?
KAPLAN	Certainly there are some very loud reefs where there is a huge amount of human activity. And we do see a significant changes in the soundscape in

	the presence of boats. So much higher, higher amplitudes of background noise. And also the peak frequency is changing. And so you can imagine if you're trying to hear one of the other members of your species and there's a boat going by, it's probably going to be much, much more difficult. It's going to reduce what we might call the active space of communication-- so the distance between two animals over which they can communicate. We've seen overall that ambient noise in the ocean is rising largely as a result of commercial shipping activity. So absolutely that raises concern for behaviors and the ability of these guys to communicate on their reefs.
DANKOSKY	Well, Max Kaplan is a PhD candidate at the Massachusetts Institute of Technology in Woods Hole Oceanographic Institution. Max, thanks so much I appreciate it.
KAPLAN	Thank you.