GEOTRACES #3 – Oxygen Minimum Zones - Q & A Transcription

Q. Are there any actions that we can take or tell our students to take to stop mercury from getting into the ocean?

A. That's a great question. So the primary pollution sources of mercury to the ocean these days are the burning of fossil fuels, the burning of coal in particular. There's some people also who think that something called artisanal gold mining might be a source as well. Unless your students are going out and panning for gold on the weekend that's probably not something that they can do anything about. If you want to minimize your contribution of pollution mercury to the wider world, you might think about conserving electricity. Coal in the United States anyway and worldwide is one of the major fossil fuels that's used to generate electricity. It's not good for burning as a mobile fuel for cars and that sort of thing, but it's used quite prevalently to make electricity. You might want to think about conserving electricity and encouraging your electricity providers to put on the latest technology for scrubbing mercury out of their smoke stacks.

Q. Does methylmercury form in the water or is it formed prior to its introduction into the water?

A. That's a great question. So we think that in the coastal ocean anyway that most of it is produced in the sediments, and then it diffuses out of the sediments and into the water column. But the story in the open ocean is quite different. In that case the sediments are so far away from where most of the mercury methylation appears to be taking place that we don't think the sediments are very important. But it's a big mystery. We really don't know how and why mercury is getting methylated in the open ocean oxygen minimum zones. We know that it happens because we can measure increased concentrations of methyl mercury in those zones, but we don't know exactly whose doing it and why. We have a post-doc here Katlin Bowman who is about to go to the Arctic Ocean this summer, whose going to be looking at this process in great detail. So that's sort of a cutting edge science question, and I just don't have an answer at the moment.

Q. Are there websites where the oxygen or chlorophyll data or datasets or images are available? Is there anything kind of on the student level? Is there any other place that you go to get resources to look at data like that?

A. Yeah. It sounds silly, but a straight up Google search for ocean chlorophyll will usually give you a lot of results. NASA especially has a whole bunch of satellite products that will show you the chlorophyll from today almost anywhere in the world that the satellite passes over. Actually those types of maps are what we use when we are at sea to see whether we're sampling where we're supposed to be sampling. They're publicly available from NASA. One of the satellites is called MODIS, Aqua MODIS I believe. GEOTRACES itself, geotraces.org web site, the intermediate data product will show you the results of GEOTRACES sampling from all across the globe that is the most recent round of international data collection from the oceans in this scale. But there's also some older resources that might be a little bit more accessible that include the World Ocean Atlas, I think is a Google search you can pull. Those are compilation of datasets from the last couple of decades that include things like nutrient concentrations and oxygen concentrations—chlorophyll I'm not sure about. I'd have to search for something on the web maybe after the webinar. But yeah there's plenty of them. A lot of those satellite products are

beautiful depictions of chlorophyll and how it changes on a day to day, or a week to week cycle. And I think there is even some on the COSEE web site in the webinar assets. If you search for chlorophyll there's some animated pictures of where chlorophyll appears, and maybe some [?] pictures of where oxygen is low and where it is high.

Q. Is there anything that can remove mercury from the ecosystem, and trap it in either a more safe form or a more permanent way to get it out of the ocean?

A. That's a great question. It is naturally scrubbed out of the water column routinely, and will get buried in sediments ultimately given enough time for it to become sequestered. Actually there is a fair amount of research that suggests that it's sort of the freshest mercury that is being added to an ecosystem that is the stuff that gets methylated. So it might not take that much time once mercury gets buried for it to become relatively non bioavailable as we biogeochemist would say. Really if you slow down its input, if you start diminishing the anthropogenic inputs for example, the coastal ecosystems and the ocean as a whole will just sort of naturally clean itself up for us.

Yeah. There was a picture in one of the earlier webinars of how natural biological processes have removed lead from the surface of the ocean. Lead was a toxin that was added to lead gasoline for a long time, and it's also still present in coal emissions. Once we stopped adding lead to gasoline—I think in the mid-seventies—the concentration of lead in the surface oceans across the world has generally dropped. You can see that the only place that you have really high concentrations of lead any more are down below Where that biomass has sunk down and brought it to the deep ocean. So right now the surface ocean is relatively low for lead because of that sort of natural scrubbing that occurs.

That's a great example.

Q. How is mercury either controlled or detected in seafood? Is that something that is regulated?

A. Boy, that's a hot topic. It's not really at all, so write your congress people. Yeah, there is no routine monitoring. There has been a fair amount of data out there, so I think we have a pretty good idea like this figure is showing for example in these bar charts. We have a sense of what the numbers are. They're probably not going up and down and that sort of thing, but you can't for example go to the market and say, "I'd like your lowest mercury fish please." They do not do that kind of routine measurements at all. You just have to know. If you're concerned about these sorts of things the rule of thumb is to just eat low on the food web. So don't eat a fish that eats other kinds of fish if you want to decrease your mercury exposure.

Yeah Carl, isn't there like a little mercury pocket guide for types of fish and what the doses are for it. That something we should probably put on the webinar assets, right?

That's a great idea Dan. Yeah, there are a couple of different organizations. One is based here in California at the Monterey Bay Aquarium Research Institute which has a consumption guide which includes guidelines to help you know which fish are high in mercury, and which ones are low. They also

provide information on which fish are being harvested in a sustainable way, and which ones aren't. Yeah we can put those links up on the website for that.

Q. Does mercury leave the human body after it's consumed?

A. Yeah. That's a great question. It does. If you're worried that your mercury concentrations are high, and you want to lower them, just stop eating fish. It's as simple as that. I had a graduate student who is a vegetarian, and we we're both at a conference where people were measuring the mercury concentration in your hair which is a good indicator for your total mercury concentration. Mine, and I'm a fish eater—my concentration was 5 or 6 times her concentration. So all you have to do is just stop eating fish and your mercury will go down.

You don't have to become a vegetarian.

That's right.