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The thing we have been doing most recently is working on the problems of pollution of the sea. Humanity faces the possible loss of the major protein source from the ocean, the major animal protein source for 1.8 billion people, which is a lot of people.

The real problem that whales used to face was harpoons, but now there are 2 other threats that are more serious. In spite of the fact that whaling (was banned and) is returning, it's coming back. All international controls are about to be lost. These two other problems one is entanglement in fishing gear, and the second one is pollutants. Pollutants accumulate as they move up food chains. The result of that is the ocean is terribly polluted, and we don't know how badly. So about 8 years ago, I sent my institute the job of taking our boat, the Odyssey, around the world and collecting small biopsy samples from sperm whales. You shoot a dart into the whale. The whale usually doesn't even respond, and you get a tiny scrap of tissue. You can analyze it and figure out what sort of pollutants it contains.

What we have found to my absolute horror is far worse than my worst nightmares. The persistent organic pollutants-- things that are for instance hormone mimics are very bad. They are increasing, but it is metals that are the real problem, totally surprising. We all expected mercury in everything in the sea. But, we didn't expect such shocking concentrations of chromium, cadmium, aluminum, and things like that. These are coming in from industrial processes presumably, and the amounts that we have found are so high that nobody can even believe it. We checked by looking at further samples. We haven't completed the full analysis because it's still early after our return. We found that though we get between five and 15 times the concentration that kills sperm whale cells in tissue cultures, you also get 185 times the dose that breaks up chromosomes when cells are divided.

So is this a problem? Well, 1.8 billion people have as their principal source of animal protein, fish from the sea, seafood. What happens if you remove from those 1.8 billion people their major source of animal protein because it has become too poisonous to eat? Well, I think you have a problem.

I think you have what is probably the worst public health problem humanity faces today, or perhaps has ever faced, and that seems like a very irresponsible statement, but let me give you an idea of what I mean. The plague, the Black Death, killed in its total run, from when it first appeared in Europe, 135 million people estimated. How bad is that? Well, that's a 1/14 of 1.8 billion people who depend on seafood as their principal source of protein. And so if even a small fraction of those people die earlier as a result of this problem, I think you have the worst public health crisis around. It's on nobody's radar, nobody is aware of what's going on but it's a serious problem.

We might be able to adapt to a problem like this, but that might take another 6000 years. Certainly a great many hundred human generations. We don't have that time. We are talking about a problem that is going to affect my children. In fact, maybe even me, if I live that long. It doesn't seem possible, but I might, and it'll affect our grandchildren to a point where I wouldn't want to live their life.

One of the problems that people face right now is the fact that, into the ocean is going all of this CO² that we produce in cars, planes, houses, and everything we use for energy and electricity. That makes the ocean more acidic. Most of the species which live in the ocean, most of the plankton for example; little single celled organisms that float around in the ocean helpless, these plankton are in fact starting to have to live in more acidic conditions. It's all very well to worry about whales. But, the real problem is if we do something to destroy plankton, that's the whole ballgame, nothing will survive that.

Humpback whales is the species that has the greatest shot at sort of saving us from our own folly. We started with save the whales. I think it's may be saved by the whales. They are a species that is interesting enough to people; the songs they produce, the sounds they make, and their joyous behavior, or what seems joyous-- their breaching. Those behaviors, not the sounds (they make), are something that grabs people. It speaks to us in ways that we don't really fully understand. My theory is that man has in fact inherited songs and music from species that are vastly our forebears. One piece of strange evidence comes from humpbacked whales. It turns out that the laws and composition of humpbacked whales as they change their songs, and they are a rare species that does that--as they change their songs, they are (employing) the same laws of musical composition or many of them that human composers compose in their songs. For example ABA construction. A statement musically something that is a variation of it and a return to that first statement, that's fairly common.

My former wife, Katie Payne, discovered that in fact their songs contain rhyme. You don't have to understand a language to understand that it rhymes. You can hear the rhyme even though you don't know what it means. And even in your own language, rhymes don't have to make any sense. "Hickory dickory dock" doesn't make any sense at all, but it does rhyme with the "mouse ran up the clock." That sort of structure suggests that the things that entertain the brains of whales, and the things that entertain the brains of human beings, are pretty close to being the same thing, therefore are selected in the course of evolution. There is not the faintest chance that humanity could possibly know or have known what was going on in the world of whales or that, whales have known what was going on in the world of people when it comes to music. Yet they both moved in the same direction.

Years ago when I started working on my own, humanity was killing about 33,000 large whales every year. We got that down to 33. We thought, wow we won, but we haven't won. In fact we are losing now fast. I sit and watch my life's work undone before my eyes. The way it has happened is that the principal consumer of whales, Japan, has used its clout with developing nations, offering its assistance in fisheries, and building new

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docks and so forth. They have, in this way, managed to secure the votes of nations that don't know what the issues are at all. By using the international whaling commission, and a vote from, for example the nations of Antigua, Barbuda in the Caribbean, which is exactly the same amount as the vote from China where the population is many hundreds, even a thousand times greater than that in Antigua Barbuda, and so by doing that nifty trick the whalers have now got control of the international whaling commission.

We got the first vote won by Japan in 2006. What's going to happen now is we will see all meaningful international controls go away and whaling return. One can think well what's wrong with that? There's a lot more whales now than there were back in the last 60s when the "save the whales" movement began. What's wrong with it is that you would have to be a fool, or totally asleep, or just a dreamer, to believe that there is going to be any difference at all with the way the whalers will treat whales now than they did before. They cheated before with everything they had. I am sure they will cheat again with everything they have. That's what's happening now with whales. Whales aren't saved. They are in the worst danger I think they have been since I got started in this field about 50 years ago.

We know that climate change also affects whales. For example, we have good evidence now from a study that we have been doing for 35 years. It's the longest lasting study of a consistent nature on whales. It's been done in Argentina. By looking at the numbers of calves that females have, females that we know, that we have followed for many years, we discovered that they are responsive to things like El Nino, or the equivalent disturbance, which is in the South Atlantic Ocean. These whales that we study are in the South Atlantic Ocean on the east side of Argentina, of South America.

One of the extraordinary things which has happened recently is a piece of work, which shows that years ago before whaling had decimated the population of large whales in the Aleutian islands, the killer whales seem to have been principally feeding on large whales. Well when those were gone, the killer whales had to switch to something else. And, they switched to stellar sea lions largely. It's a huge species of sea lions – also quite rare, and eventually they clobbered that. Then they had to switch to the northern sea lion and eventually they clobbered those. And then they had to switch to something else to eat. Well it was the otters, but sea otters are in fact the major predators on sea urchins, and sea urchins eat kelp. So when the sea otter population crashed, the population of sea urchins exploded and ate the kelp forests down to their roots. Well kelp forests are principally involved in the economy of seas by the fact that they provide wonderful hiding places for larval forms of the fish that you and I love to eat. And so, if there is no place to hide, these larval forms get eaten easily by other predators, in fact long before they get out of the mid ocean.

The result is that there were no fish to catch in mid ocean, and the fishers in the 20th, 21st century started to lose their business, their jobs, close their doors and declare bankruptcy. Long ago the whalers thought that all they were doing was killing whales, but what they were actually doing was killing the whales, and stellar sea lions, the northern sea lions,

sea otters, and allowing the explosion of sea urchins and the destruction of kelp forests and putting 21st century fishermen in Alaska out of business. That sort of chain is probably going on all over the place. It just happens to be one of the ones, which have been most recently figured out.

I got going on this weird career of mine by listening to the single utterance of a whale, which was the most extraordinary thing I've ever heard. I couldn't believe it and, because I realized that whales were being destroyed, I thought I ought to stop doing what I'm doing, which was working on moths, owls, and bats, animals that had a lot of acoustics in their lives so to speak, and try to work on something that really has sort of some current interest.

So I went to Bermuda and I went on a boat, I used a hydrophone and I was working at the whale conservation society at that time. I was also working at the Wildlife conservation society at that time and the New York Zoological Society, and we began trying to record the humpback whales that I had heard were passing Bermuda each spring. A friend of mine, Frank Watlington, no longer alive, gave me a recording he had made on some naval hydrophones. He was an engineer working on completely unrelated stuff. And I began to listen to these, and discovered, my gosh, these animals are repeating themselves. When an animal repeats itself in a rhythmic fashion, you say that it's singing, whether its a cricket or a frog or a bird or a whale. So, these whales were clearly singing. Furthermore their song was the most beautiful, the most evocative, the most moving of songs that I had ever heard from any animal in nature. I thought, this is the way to, as a friend of mine puts it, get a listening. This is a way to get people's attention to this problem of whales being killed.

I spent the next two years going all over the country talking to everybody I could to try to put whales more into human culture. I spoke to musicians, poets, writers, dancers, and ministers in every place I could find. And played them the sounds to try to get them interested. One of the people that I got interested in this was Judy Collins. She made a record called whales and nightingales which was a great success. Then National Geographic got interested in it and we produced a flexible record in the national Geographic magazine. They had 10.5 million members at that time, so they sent in an order for it 10.5 million copies of this record, which remains to this day the single largest print order in the history of the recording industry. No, it's not Michael Jackson or somebody else. It's whales that got that particular distinction.

When you're a kid everything is new and wild and awe inspiring. When you are an adult, you are doing your best to hide all of those reactions or so it seems. And the result is that I think that the most susceptible people to the sounds of whales, the beauty of nature, of awe-inspiring things, are children. And so one of the things we are now trying to do is to express to the children in Japan what is being lost as a result of, for example, Japan's most recent decision to kill 50 humpback whales. Now when I talk about this I have to put my hand over my heart because I am now talking about science and Japan is doing science on these whales. It's the same people who, in fact, have been killing the same

whales and collecting the same information from the same boat and selling them to the same markets. But, no it's science it's not commercial whaling, heaven forbid. It's actually science. So this kind of utter sarcasm, this disgraceful sarcasm which is going on in Japan I think is something we can try to stop by getting Japanese children to listen to the songs of whales. They will talk to their parents about what they hear. And most parents I think will listen in a way to which they will not listen from other people.

Years ago I tried to get a message to George H. Bush, the first Bush president. I can't remember even now what it was about, but I talked to a friend of mine, a politician from Maine and I said: "How do you get a hold of Mr. Bush?" and she said: "I would talk to his grandchildren, probably they are the only people he listens to on a daily basis that he actually trusts." So many other people who just are selling something. So I thought right on. We're using that approach I think everybody needs to think about, 'What can I do?' and the answer is if you work, to learn about something in detail, you will immediately see steps you can take to do something about it. Educate yourself, learn about it, but nothing could be easier to use or better than the internet, and use that sort of information, good information from sites that you trust then you start to do whatever you can do on a personal basis. Somebody once said you know it is better to light a single candle than to cause the darkness and I think that's absolutely the truth. Act, move on it, you can change the world.

I now do a piece with my wife. which is all about this problem. She is an actress, We talk in the end about what people can do and when we started this piece I used to think oh it's hopeless, no way, absolutely that people can do enough and then she began researching things on the internet. She discovered there are thousands of people in groups out there all over the world doing things and making a difference, a huge difference and I am going from thinking it's hopeless to thinking it's simple actually. I think that all of humanity's self-imposed problems are solvable. That the solutions are simple and that science is strong enough to get those solutions started, it's just a matter of starting. Think of it this way. The problems that we now have are actually the single greatest opportunity for concern. The problems that we now face that we created are actually the most singular opportunity for greatness ever offered to any generation in any civilization. We could be the most beloved generation that ever lived or we could be the most vilified generation that ever lived, because people will know that we understood the problems and didn't do anything about them. Act — that's what's so important.

I think the real problem that people face right now about the seas, the most basic problem is the fact that the ocean is downhill of everything in life. That means that it is a victim of all of humanity's carelessness — of our worst habits, of our worst chemicals. You can be affected by everything, which is moved by any force at all, by wind, by water, by gravity, by catching a ride on some animal or plant or seedpod or spore or bacteria. Any of those ways of getting to the sea means that all of the restless ruthless stuff, which is on this earth, is eventually ending up in the ocean. What it does is it brings with it all of its chemical problems. That's what is affecting I think life more now than anything else.