Deep Blue

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Greg Dalton: Welcome to Climate One, a conversation about America's energy, economy and environment. To understand any of them, you have to understand them all. I'm Greg Dalton.

Today, we're discussing the blue economy of California and beyond. The Pacific Ocean is a big part of the California dream and yet many people have very little direct contact or knowledge of it beyond pricey property, pretty sunsets and tasty seafood. The ocean is a bigger part of California's economy than one might think and climate disruption is impacting the oceans and coasts in ways that many people are just beginning to realize.

Over the next hour, we'll look at the state of the ocean along the Golden State and what we can expect as global carbon pollution continues to increase temperatures and sea levels. Our Climate One broadcast today will include questions from our audience at the Monterey Institute of International Studies in downtown Monterey.

We're pleased to have with us three people deeply involved in understanding the economics and health of the oceans. Jason Scorse is Director of the Center for the Blue Economy at the Monterey Institute of International Studies; Mary Hagedorn is a research scientist at the Smithsonian Institution and also with the Hawaiian Institute of Marine Biology; and Michael Jones, the president of The Maritime Alliance in San Diego. Please welcome them to the Monterey Institute.

[Applause]

Greg Dalton: Mary Hagedorn, let's begin with you. If the Pacific Ocean was a patient, how would you assess the overall health of the ocean?

Mary Hagedorn: Oh, it's a good question. I would say that it's probably a middle-aged American that's probably eaten too many hamburgers and smokes. [Laughter]

Greg Dalton: Not too healthy.

Mary Hagedorn: No.

Greg Dalton: Okay. Average, okay. So we got that image of it. And what are the causes of that poor health?

Mary Hagedorn: Some of them are local and some of them are global. Most of them are caused by us humans and the local ones are caused by local pollution, sedimentation, poor farming practices et cetera, et cetera from sources like cities and farms and deforestation. The global ones are caused by our overuse of fossil fuels. And the fossil fuels are burnt, it produces CO_2, which goes up into the atmosphere and you can think of it as sort of blanketing the earth. It warms the earth and then, at the same time, it is sort of sucked down into the ocean so the CO_2 forms as a sink in the ocean and it's causing the ocean to become more acidic. And this acidity is corrosive to a lot of marine life in the ocean from the base of our food chain, all the way up to fish and whales and things like that. So it's having profound effects on every creature in our ocean.

Greg Dalton: And we'll get into some more of that in a moment. Jason Scorse, how is this impacting California? Why should an average Californian care about, well, the ocean is getting more acidic? Well, what's the impact?

Jason Scorse: Yes. The main reasons, if you want to think about the California economy, about three quarters of it is in the coastal zone and so it really is the economy is these few really precious miles, both the industry, the real estate, the tourism, the shipping and so pretty much the health of the costal ocean economy is the health of the California economy. And as mentioned, the prognosis is not terminal illness but it's not great and it certainly could be a lot better.

Also some of these global trends, especially ocean acidification and then sea level rise, also have some really potential medium and long-term cause that we haven't even began to address that anyone who cares about fiscal responsibility and things of that nature should really be paying really serious attention to these issues.

Greg Dalton: And we'll get into that shortly as well. Michael Jones, there is a lot of technology down in San Diego that the state of California a lot of people aren't even aware of. So tell us about the importance of sort of the blue tech economy in San Diego that's more of a positive side to the story.

Michael Jones: Right. Well, I think we all would agree that the oceans impact our climate. They impact so much that for us but we look at this and say that there's a tremendous opportunity. The hope is that we develop science-based industries and it turns out that San Diego, by virtue of the Navy and Scripps Institution of Oceanography and just a wonderful place to be, has developed the largest blue tech cluster so maritime technology cluster in the United States and it's growing very rapidly.

Until we did a study about a year ago with some partners, no one realized it was the largest industry in San Diego and it's growing between about 6 percent and 20 percent per annum. We've divided it into 14 sectors and it's a very diverse but it's very exciting. So we look at these opportunities, these problems that we're facing and hopefully we, as a state, can look at them and say, "Let's try and figure out how we can do it right and become a model for the country and the world."

Greg Dalton: And if I believe correctly that some of those maritime jobs are more export-oriented, right? And that there's lot of jobs associated with them in those industries.

Michael Jones: Yes. I mean two things that are really quite interesting. When you think about many wonderful high-tech industries, let's say biotech or telecom, often they are very white collar oriented, there's not a lot of blue-collar jobs. And we just finished going to about 20 different companies with a series of elected officials and economic development folks.

And one of the things that's very apparent when you're visiting these companies is that number one, this is probably the most export-oriented industry I've ever known. Hundred fifty-one countries border the oceans. It's about three quarters of the countries in the world and every country has water so they all need maritime technology. If we're the world leader, we're exporting all around the world.

Secondly, there's a lot of blue-collar jobs, which is really quite remarkable. So these white collar jobs are terrific but we want to really have across the whole spectrum of jobs for people and then 25 percent to 60 percent of the jobs in most of these manufacturing companies are blue collar jobs so it's really very interesting.

Greg Dalton: And are some of these technologies able to address the concerns that Mary and Jason mentioned which is acidification? Are they helping to understand what's happening in the oceans because of climate change? Can we get further knowledge? Or is it more about extracting resources from the ocean?

Michael Jones: Well, you can't. Unless you can measure something you can't really — you don't know how to deal with it. So ocean observation is the basis for, whether it's mapping and eventually marine spatial planning or it's finding out what the problems are. So we really have to go out, put sensors in the water. You have to understand. So you need that technology to be doing that. So whether it's a platform like an unmanned robot or it's the sensors themselves, what's the oxygen levels, the current, all the kinds of things that we need. You need the technology for that.

Greg Dalton: Mary Hagedorn, do you see a need for further research, other tools that need to be developed because we don't understand what's happening in the oceans because of climate change?

Mary Hagedorn: It's a very good question. The Smithsonian is just starting a really large program. It's called Marine GEOs and that stands for global earth observatory. It will be a long-term monitoring system throughout the world and it will be looking at just those things. It will be taking measurements in a very standardized way in different longitudes and different latitudes around the world to try and extract that information about what's happening in the ocean and where is it changing fastest and what does that say about the biodiversity. So we'll be doing that in a very systematic way across the ocean. We've actually just started in the last few months.

Greg Dalton: And Jason Scorse, let's get you on that. What do you think are the big unknowns about the oceans that we have to put more research and resources to understanding what's happening?

Jason Scorse: Yes. So I'll make two points on that. I think what now we're seeing and we're trying to work in the climate adaptation space so getting people to say, "All right, climate change is real, what do we do in the coastal zones?" And the level of detail of a lot of the science right now is a kind of more state level or large regional level. So your average city planner says, "Okay. I understand its happening but what does it mean for really at a fine level?" So that's really needed and I think that the direction is partly that the city managers can actually have some intangible.

I would make one other observation on which is — and this is why I think the center has a unique role in the space is because there's always going to be a lot of uncertainty in climate change but yet uncertainty can't be an excuse for inaction. And what we're trying to say is within some relatively reasonable range of consensus we know the costs are going to be so high that we can't wait for a level of precision that some people might be used to. And so that's a kind of a risk perception and a policy perception and it's changing the kind of the scope of thinking, which is a very challenging thing to do. So we need the precision but we also need to know that we'll never going to get the level of precision that we probably would want and yet we still need to act.

Greg Dalton: Yes. They say in the military, "If you wait until you're certain, you're probably dead." So you can't wait for certainty to act but what should a city manager in Monterey or Santa Cruz or what should they do right now? What kind of adaptation buffering against sea level rise, acidification? What can be done?

Jason Scorse: Yes. So it's a great question. So in California, this work is just really starting to be taken seriously. The nature conservancy is working with local communities on building some tools, some GAS tools and it's under the — the name is actually escaping me right now. Maybe we can put

a link on your website later where you can actually go and city planners can then look at scenarios and look and say, "Okay. Under this mid-level scenario, it literally looks census block by census block and how many, what's going to be underwater, what the hundred-year storm might look at." And they can take that and go, "Okay. Let's now have meetings and talk about 25-year plans and maybe we don't want to put that power plant right there or maybe the road — that new road. So start the conversation is part one.

And then, I think, the other thing is and we'll probably touch on this later is these costs, these are also opportunities and we want to think about also creating new ecological models, new interactions between the science and policy and such that people are living more in harmony with the coastal environments. That might actually open up a lot of business opportunity that we can then export and that's some of the stuff that Michael is talking about as well.

Greg Dalton: Well, let's talk about time scale because people often think of climate in terms of centuries or thousands of years and sea level rises like, "Well, what's the sea level rise has been seven inches in the last 100 years? It doesn't seem like much." Is this something that could really affect people in our lifetime? Is this going to be so slow and so incremental that, "Nah, we're not going to have to worry about it." Jason? And then we ask Mary.

Jason Scorse: I think it's sad that we need major natural disasters for people to kind of see it but now we are. And I think we're at that inflection point where people are saying, "When you get a thousand-year storm every 10 years, it's not a thousand-year storm anymore and you have to start changing your mentality."

I think when people see maps that the entire airport of San Francisco could be underwater in 50 years, which is one of the major transportation hubs for the world. When you start looking at the ports of Los Angeles and Long Beach being inundated, those are the biggest ports in the United States. So this is part of this awareness I think we are at the inflection point. So I don't want to hog the time here right now but I think yes. I think that this is immediate, this is now, this is accelerating and the good side is people realize that.

Greg Dalton: People realize that in Hawaii, Mary Hagedorn?

Mary Hagedorn: Oh, it's difficult to say and I have a brother who doesn't believe in it and he's in Hawaii. But I do agree with Jason. I think that, especially in the Pacific, you have a lot of violence that don't have very much — there's not a lot of surge, ocean surge. I mean they're less than a foot above the ocean. So seven inches is quite big for them and you should add a storm onto that that's really quite substantial and that means whole islands and whole populations moving. I know Australia has a plan for immigration for a lot of these people to move to Australia or they hope to move to Australia. So I think people are thinking about it. I think that especially in some of the smaller, lower lying islands of this Pacific, this is a huge concern.

Greg Dalton: If anyone hasn't seen the movie *Island President*, it's a fantastic documentary about the Maldives and the president there, and they're facing an existential threat from sea level rise and they moved to other countries. But what is — Mary Hagedorn, what is Hawaii doing to prepare for this?

Mary Hagedorn: I don't know the answer quite frankly. We certainly have a great awareness just from tsunamis. I live in the water and I don't live in a tsunami inundation zone but I know the map and it's in our yellow pages. So I can look in the yellow pages and I can say, "Well, this is a good place to go if you don't want to be hit by a tsunami."

I think people are seeing their houses being eroded. I mean there's been a lot of stuff because we get big ocean storms that come in the winter and those are really starting to erode the coasts, and people are getting very upset that their houses are now too close to the water. But I don't know the action plan in Hawaii but I certainly can find out and help you put it on your website.

Greg Dalton: Michael, San Diego big maritime town, Navy town. Is climate change sea level rise on the — they've just redone — put a lot of capital into downtown San Diego that's right along the waterfront. The people who made those investments, is their awareness of sea level rise in San Diego?

Michael Jones: I think we're a little schizophrenic right now. There's no question that there are people beginning to think about the Navy. The military is certainly going through processes thinking about, although our assets they have in Coronado and in Camp Pendleton because they're all going to be in danger.

The Port of San Diego thinks it's in the vanguard of discussing this but people haven't really started thinking about what are we going to do in the intangible sense of how far are we going to move inland as we begin to withdraw from the ocean? Is it half a mile? Is it a mile? Particularly, when you have a relatively flat landscape for the first mile or two, I mean how are you going to condemn all those places and say, "We're going to build another harbor." Those are incredibly important but difficult political, economic, social decisions have to be made.

We believe that one of the opportunities is large floating platforms that we begin to put desalination, harbors, airports, and let them float so we don't have to fight the battles of putting something on the coast and don't have to worry as much about how high is high when the water is going up and I think it is part of our future. Unfortunately, the United States is not really doing much related to large floating platforms yet.

Greg Dalton: Sounds cool. It sounds very expensive.

Michael Jones: Actually, it's not more expensive and you have to remember that in 1809, Bristol had the first floating harbor. If you go back to the Roman days, Carthage had a whole harbor that was floating. In the Second World War, the Germans weren't going to give us the keys to Dieppe and Brest so we built two floating harbors. And for eight months after the invasion, the British were still using their harbor.

So it's something we can build. We were actually under nondisclosure agreement for about a year with Lawrence Livermore National Labs. They've been looking at large floating harbors offshore and we need to build new harbors and most people don't want them in their backyard and there aren't many natural harbors.

And for both homeland security reasons and marine highway reasons, we should be thinking about building something 20 to 30 miles offshore. The cost to build a new harbor, forget whether or not it's the smart thing to do long term, the cost of building a new harbor is going to be as much to build it and float it as it would be to build it in Mexico and Punta Colonet, which is probably one of the places it would be built otherwise.

Greg Dalton: And you also think the same for desal plants? Desalination plants should be built offshore for the same reasons.

Michael Jones: Yes. I mean leaving aside the environmental issues for a second, which I personally believe, have been well addressed today about intake and output. Why are we putting a plant that costs half a billion or billion dollars on the shore and spending 12 years trying to permit it? And then having a pipe that goes out three miles to pull the water in and then a pipe three miles out to push the brine back out so it dissipates quickly when we could have a ship three miles offshore that pushes the freshwater in. And when Banda Aceh happened, the United States sent an aircraft carrier and they have enormous desal.

Greg Dalton: That was the Indonesian tsunami?

Michael Jones: Yes, the Indonesian tsunami. But around the world, the U.S. Navy, every cruise ship or mini cruiser, cruise liner, every Navy ship has desal and around the world there's over 15,000 desal plants. United States has not been very encouraging of desal, although we are the world leader in the technology. So we believe, to answer your question, that floating desal plants makes perfect sense.

Greg Dalton: Even though San Diego just spent how much on a desal plant it's like a bunch of money in the desal plant.

Michael Jones: The largest desal plant in the western hemisphere will be built 50 million gallons a day in San Diego County. I mean I'm personally thrilled that they're finally building it. It started 12 years ago.

So in the last 12 years, we didn't know a lot more about climate change and one of the things we have to say is that like knowing our own bodies. We've got much better on how we eat. We're just beginning to be able to measure the oceans the way we really need to. There are a lot of new tools. So I think we're much better and we're able to measure the kinds of things that we need to measure today.

Greg Dalton: Quickly, what's the price tag of that desal plant in San Diego?

Michael Jones: I think it's about $800 million.

Greg Dalton: Jason Scorse, is desal a good idea for the future water needs in California?

Jason Scorse: You put me on the spot here. I've been superficially involved with some of the desal plants in the area that's actually up where I live and in the water district that I'm in is one of the most impacted by potential droughts and desal is a serious option. I think I would largely side with Michael here that most of the environmental concerns have been addressed through some pretty good technology. The water comes in extremely slowly. The entrainment issues are on a huge deal.

Actually, the water they're putting in is actually a lot of times less, is more treated or less potentially toxic than anything that comes out of a typical water treatment plant. And for a lot of areas, they can be small enough that they're actually they not have a huge impact. What some people argue is the energy intensity. Getting water other ways can be pretty energy intense. And if we start building with solar and things like that, I think that addresses that.

So to answer your question, I think the main environmental marine impacts have been addressed and it should be considered, especially when the alternatives are sucking more water out of streams that then kill fish. Terrestrial habitats suck water in anyway because you get saltwater intrusion. I always think conservation is the first line but, for example, where I live, we've already are 40

percent lower in terms of per capita use in the entire state which is already ahead of the country so you're getting to margins which are pretty tight beyond but I would push the conservation to the limit before I was in favor of a desal. But then at that point, I think it's certainly viable.

Greg Dalton: If you're just joining us on the radio, Jason Scorse, the director of the Center for the Blue Economy at the Monterey Institute of International Studies. Our other guests today at Climate One are Michael Jones, the president of The Maritime Alliance in San Diego; and Mary Hagedorn with the Smithsonian Institution. Mary, let's close this out with would you support desalination in Hawaii?

Mary Hagedorn: Well, I was itching that you asked me that question because I have a question for them. There is a group in Hawaii that are talking more about water extraction technology and putting that into every house. The company that I spoke to said they can do close to 3,000 gallons a day of water extraction so that's enough for an individual house.

Greg Dalton: What does that mean extraction? Sucking it out of the ground, is that –

Mary Hagedorn: No, no. It comes out of the air so it's a dehumidifier basically and its pure water. So I wonder what your thoughts were on water extraction technology, especially in places like islands and remote areas that don't have huge populations but still have water needs.

Greg Dalton: Michael Jones?

Michael Jones: I have no knowledge of the economics of that. The problem with many of these is the waterpower nexus is what does it cost to do these things? And that's what I don't understand. The reason that people have built large power plants and large desal plants, typically, because the price point is so much lower and I'm a big believer in decentralized power or water, anything you can do like that but it has to be at a price point that we can live with. So I just don't know anything about the economics. I'd love to talk to a company though.

Greg Dalton: Jason Scorse, Michael Jones earlier talked about basically a managed retreat is the phrase that's used for moving homes and businesses back from the coast. Is that a foregone conclusion? Is California going to be walking back from the coast line in the next — during the 21st century is going to be a walk back?

Jason Scorse: I would say yes. I'd say less than some other parts of the country where it's going to be a real massive shift because of hurricanes and storms and much low. A lot of Northern California, as you can tell, is on cliffs and is above sea level pretty quickly inland so it might not be as dramatic here.

But yes, I think there's no question the economics of armoring of your very moderate armoring and maybe Michael knows something about more modern technology but right now is $10,000 a foot with maintenance, with maintenance cost and then with the storm surges the longevity can be as low as 20 or 30 years. You're talking about tens of billions of dollars to armor the coast then you have huge environmental impacts of the sand migration and huge problems with the coastal environment that's created by that. So I don't think if any running of the numbers we could do that up and down the coast. So some managed retreat, I pretty much think is in the cards.

Greg Dalton: And then also is the fact that if some people armored their property that kind of negatively impacts their neighbors because it just sort of shifts the water. You can protect yourself but you're really harming your neighbors.

Jason Scorse: Yes. And this is actually why I think and hopefully some of my students here will look into this some really interesting legal issues and also their kind of public interest, private right with real estate in particular. There is very strong private property rights obviously in the United States, in California and you right now have the — if you have the money, you can throw the riprap and the seawall, whatever it is.

But then like you said, you create the erosion increases around you and so you have these negative impacts and this still hasn't been fully worked out in the legal system where we don't really understand this. It's been I think at a low enough level that we kind of used to deal with them ad hoc. But I think going forward, it is going to be something that there's going to be — have to be a more systemic kind of regulatory government thinking on this because it's not sustainable.

Greg Dalton: There is a fantastic article in Vanity Fair a couple of months ago that showed Malibu and Nantucket, and it talked about ultra-wealthy landowners there trying to fortify their compounds and mansions. And a few of them doing that and futilely really that showed the width of the Malibu Beach 30 years ago was very wide and now it's down to just a narrow strip, which raised the question, Jason Scorse, of tourism and beaches in California what we're looking at in terms of economic impacts.

Jason Scorse: Yes. Well, let me say here's what I think the opportunity part comes in. California is a vanguard in public access to beaches and it's one of the greatest things about living in the state. And so I think this managed retreat that we're talking about are these rethinking of some of the infrastructure could come with actually a lot more public access, and it could come back with some ecological restoration.

There could be a lot of the technology to go with that and then some really — I mean I'm not an architect but I've seen enough cool architecture things of the future and green architecture. I could start envisioning some really cool, new restored wetlands with the kind of people move back in little ways and then you have some waterways, some boating or you have some — you shop some things intertwine with there and national parks that are much bigger and that should be very economically revitalizing for a lot of areas and very nice places to live. So I think you could really see a lot of opportunity there.

Greg Dalton: Then who buys out the property owners that are impacted by this? Michael Jones, is San Diego thinking about buying off coastal property owners that U.S. is doing a little bit of that and along the Jersey Shore after Hurricane Sandy but not everyone.

Michael Jones: Well, it's a very interesting question but I don't think anybody's got an answer in San Diego at this point. What I will mention though is to this point of re-sanding your beaches, Imperial Beach in San Diego spent $2 million to put the dredge and then put new sand down was gone inside of months. Florida recently there was an article saying that they're running out of sand to dredge to put on their beaches.

So we can only do this for so long before we create other problems for ourselves. What's so interesting in this whole area of marine spatial planning, we need to do a much better job of understanding how the interrelationships between what we're doing in the ocean and where we put things, and it all becomes one big bundle which makes it more difficult but it has to be done. We have to look at this in a holistic manner.

Greg Dalton: Mary Hagedorn, you said once that people have a greater understanding of forest and

the impact of forest on climate change than they do the ocean. And something you said to me when we talked earlier that half of the world's oxygen comes from the ocean — I didn't realize that. So do you think — is that true that people have a greater appreciation of deforestation than the oceans, which we don't see or interact with that much?

Mary Hagedorn: I think it's very true and I think very few people understand that every second breath comes from the ocean really. As you think about it, every second breath that you take, some creature in the ocean, some plant in the ocean has made that for you. And so the things that we're doing to the ocean, especially in terms of destabilizing ecosystems, we don't know how it's going to affect that very essential ecosystem service that the ocean does for us, such as creating oxygen. So that's the bottom line for us in all of this. I mean cities can move, people can move but if we ran out of oxygen, we're in real deep trouble.

Greg Dalton: And let's talk about coral, you're doing some research on coral, the base of the food chain. What's happening with coral and why is there a cause for a concern? And what's some of the solutions you're working on?

Mary Hagedorn: So as one of the ecosystems in the ocean that are having trouble, coral is one of them. It's perhaps one of the — one that's most extinction prone right now and coral basically are the apartments of the ocean. And so they provide houses and living places for many of the animals in the ocean. Twenty-five percent of everything in the ocean lives on a coral reef at some point. It may move away, it may come back but they're very important in terms of nurseries and maintaining our fisheries basically. And we're losing them because of temperature changes, because of as I said the local and global causes but also diseases are a big problem.

And so what I'm doing and all of this conversation is really focused on the future, which I think is fantastic. It's very hard to get people to focus on the future and act now, and to be thoughtful about the future. And so what we're doing at the Smithsonian is we've created a frozen repository for coral. We now have one percent, which sounds small but it's really quite big. One percent of all the coral in the world is now in a frozen repository. And what that means is that they're frozen but alive and the idea would be that if perhaps in the future the oceans were more like they were say 50 years ago, we might be able to use this frozen but alive coral and we see the ocean with it.

Greg Dalton: And so that's sort of a Noah's ark kind of thing planning for some dark days to bring back.

Mary Hagedorn: Yes, exactly. And it's not just coral we're looking on, fish as well and we're working on algae and a number of organisms in the ocean.

Greg Dalton: Jason Scorse, what does this mean the bleaching events and the deterioration of coral mean for subsistence fishermen that account for a lot of economies in Indonesia and other places? A lot of the world just relies on daily catch to survive.

Jason Scorse: Yes. The estimates are around a billion people who get a large share of their daily protein from fishing and from seafood. And so yes, it's pretty oblique for them and the one positive though is that we've seen corals grow back pretty quickly and be pretty resilient in some places where they are protected.

Now obviously a big macro phenomenon like ocean acidification and climate change is difficult to reverse. But with coral, I think people have seen and obviously, Mary, you're more expert of this than I but have actually rebounded a lot in my Micronesia where they've been under protection. We

work a lot with group protecting. So there's a happy story here.

I would also say that this kind of goes in with one other thing so just all of these challenges are also opportunities for business, are opportunities for new technology, they're opportunity for new legal policy frameworks and California should be the place where it's all done maybe Hawaii as well. And because really we're just at the tip of the iceberg and we want to be ahead of the curve thinking about this and I think California could be the place where all the solutions — where the solutions emanate from.

Greg Dalton: And so what should California do to advance this blue tech economy and to do that as California recognizing? Perhaps this is one for Michael Jones. Is California embracing the opportunity that Jason just outlined?

Michael Jones: I think it's beginning to and I'd like to make an observation. I think a lot of people or some people will use the word sustainability and what they mean is just, "Don't touch my ocean." That's not going to happen. The only way we can feed nine billion people is with protein from the ocean. And if we don't produce the fish and whether it's aquaculture or if we're fortunate, there'll be more coming back, they'll be catching them somewhere else and not using us through a science-based technology. So I want to just make the observation to Jason's point. We, in California, should take it upon ourselves both because it's the right thing to do to promote science-based ocean industries. It's also the right thing to do for jobs for us and for our children but we need to be understanding from technology point, policy point, legal point of view how are we going to grapple with these questions.

The state of California has begun to focus on the blue economy, the Governor's Office of Business and Economic Development has begun to focus, a number of universities have begun to focus, the San Diego Community College district has chosen Maritime as one of six areas going to focus on. We got several universities thinking about ocean engineering that doesn't exist in our part of the world today. So we got more and more people beginning to understand that A, it's critically important and B, we have to do it right. We can be leaders and that's something I think that we really need to do and it's one of the reasons that I wanted to come to this event tonight to talk about thus.

Greg Dalton: And how much of that work is aimed at harvesting kelp to make cosmetics or to harvest oil offshore? How much of it is extracted?

Jason Scorse: It's impossible to say what percentage is extracted but just to the point of kelp, for example. There is a company called CP Kelco that was harvested kelp in San Diego for many, many, many years, decades. And I don’t know, decade or years ago, they shut down because it was too expensive.

But at one point, they harvested a time that wasn't right, in other words its better when there is warm water than cold water and not when it mixes up. And they ended up harvesting in a time where they killed a lot of kelp and that turned a lot of people against them. And it wasn't that they did it maliciously, it's that the science wasn't there. They didn't realize what they were dealing.

And so scientist and business have to work together. I mean, again, we go back to the science-based industries. We have done things — nobody wants to hurt the ocean. I mean nobody walks up and says, "Tomorrow, I'm going to get up and hurt the ocean." But what they haven't understood sometimes is the implications of it and that's why I don't think university scientists need to be working hand and hand with the blue economy, the business side of this.

Greg Dalton: Jason Scorse, as a percentage of overall funding, how important is federal funding for oceans? Does the United States spend much money on understanding the oceans versus other areas?

Jason Scorse: Much less than it should. It's obviously been cut a lot both in the sequestration and actually before. And no, there's not the commensurate amount studying oceans, as there is anything terrestrial. It's still disproportionately terrestrial. There's that bias that's kind of built in because the ocean is out of sight, out of mind. I think, again, that's changing.

Actually, Michael just told me something interesting in the prelude to this talk that it's much harder to go down to the bottom of the ocean than it is to go to the moon and I didn't really understand that. And so part of it also has been technological limitations, I think, which are now being overcome. And I think part of our mission here at the center is to get the economic importance of the ocean on the radar screen to do things like push for more federal funding but also business investment and across the board funding because it hasn't had its fair share.

Greg Dalton: Michael Jones, the National Oceanic and Atmospheric Administration, it's actually a big part of the Department of Commerce, people often don't realize that's where it sits. So it implies a business function but is there a business case for NOAA and what it does in the oceans?

Jason Scorse: Okay, so two answers. In January 2010, I went to the Department of Commerce and had a person from NOAA there, two people of Department of Commerce, and then a division of the Department of Commerce called the U.S. Commercial Service, which is part responsible for helping U.S. companies export successfully. And they told me I was the first person that ever been there to talk about the blue economy in January of 2010. Now, this is one of the oldest industries in the world and I was the first person they said that had ever been there to talk about it.

Now the good news is that in the summer of 2010, the U.S. Commercial Service actually created a worldwide team — they now have 80 people in 30 countries trying to help U.S. companies export more successfully. So I guess the answer is — and the woman from NOAA said, "Gosh, we don't really do business." She was very nice but she's the worst scientist here.

Now fast forward and we were recently chosen to do a report for NOAA on the economic impact for the United States of ocean observation, and nobody has ever studied the economic importance of the work that NOAA has been doing for the country of ocean observation. And again, we just talked about why ocean observation is critical because if we can't measure it, we can't know how to replace it. We don't know how to deal with it but nobody has ever studied it before. So studies are now being done.

Greg Dalton: Something else that perhaps is understudied, I was in Fairbanks, Alaska last year and at the Arctic Research Center and people were talking about methane release from the ocean floor. And I've looked at a lot of reporting on this and it seems to be off the radar, Jason Scorse, in terms of the amount. This was a Russian researcher who said, "We don't know how much is there. We know it's a lot but we don't know how quickly it could be released. But if it happens quickly, the amount of methane that could be released from the ocean floor could be really significant." Is that under anyone's research radar?

Jason Scorse: I'm not a real expert on this. I do know that there's a lot of issues there in the permafrost as it melts that it has huge amounts of methane. Obviously, methane for the layperson is just think of your basic greenhouse gas times many orders of magnitude.

Greg Dalton: Fourteen.

Jason Scorse: Or an order of magnitude and so that it is. It's one of those they called the negative feedback loop. Actually, climate change can create conditions that actually exacerbate climate change. So that's one of those negative tipping points that absolutely I know people are very concerned but I don't know the science well enough to know where we're at on that.

Greg Dalton: And it's not on a lot of radars. Michael Jones, you totally believe that when NAFTA was formed, the North American Free Trade Agreement, there weren't even codes for ocean commerce which means that it wasn't even on the radar of people who created the sort of the taxonomy of commerce during NAFTA.

Michael Jones: Jason said it before that we live on land and that ocean is pretty and it's just flat out there, and somehow you assume it goes on forever. We don't really realize that we already are using it in many, many ways. But unfortunately, the people that — when we went from what we call SIC codes, the Standardized Industry Classifications, when NAFTA came along, we went to the North American Industrial Classification. The reason was because Canada, Mexico, United States wanted to be able to judge the trade between each other.

And unfortunately, they did not do a good job of understanding all of the ocean industries as a result to which in the study that we did a year ago showing 46,000 jobs and $14 billion of blue economy revenue in San Diego, they had to use 200 NAICS codes. That's an unheard of number because the government doesn't really understand how to capture the information. So again, you can't change — you can't promote what you can't measure and that's really unfortunate and it plays itself out in a number of ways.

Greg Dalton: Jason Scorse, anything further to say in terms of what ought to be done?

Jason Scorse: Yes. Well, that's a kind of great kind of wrap up for me in the sense that one of the big things the center does, we have the national ocean economics program.

Greg Dalton: The Center for the Blue Economy –

Jason Scorse: Center for the Blue Economy.

Greg Dalton: — here at the Monterey Institute.

Jason Scorse: Yes. And we were the first people to actually do this basic work that Michael is talking about, which is to start classifying the ocean and coastal economy. This methodology has now been copied and used by other countries, including now Canada and many European countries. And part of our expansion plans, now, are to create standardized accounts that account for all maritime technology and all the new industries emerging, internationalize this and really have a global body of data to really promote this work. And so that's kind of our next three-year mission.

Greg Dalton: Excellent. Also you've written that 80 percent of Americans live on coasts and along the great lake states, which produce 83 percent of the country's GDP and also the fastest growing. So that's quite a — in some ways obvious that people live along the coast but you think 80 percent, that's pretty darn big. What about the heartland is what I thought was –

Jason Scorse: Yes. Well, and it's also it's increasing. Not only is it that big but it's actually increasing that obviously the rest of the United States is extremely important. But if in terms of just

your kind of biggest bang for the buck in terms of understanding economic impacts, it's really from the coast inland, not the other way around.

Greg Dalton: We're talking about the blue ocean economy at the Monterey Institute of International Studies. I'm Greg Dalton and this is Climate One. Again, I'd like to invite our audience participation to come on up and join us for a question here for our experts about the ocean. Yes, welcome.

Matt Nicholson: Hi. Thank you to all of our panelists for joining us this evening. My name is Matt Nicholson. I'm a student here at the institute. A question about liquefied natural gas terminals, which in light of the huge fracking boom in the United States, I imagine will be playing a big part in the coastal economy in coming decades. I know there are a lot of proposed terminals that are being reviewed. Can our panelists speak a little bit about how those types of developments might affect the coastal economy and ecology?

Greg Dalton: Michael, floating LNG terminals, multi-billion dollar facilities.

Michael Jones: Yes. I'm actually not an expert of this at all but they are, in fact, increasingly trying to put those not in the middle of the harbor both for logistical reasons but also for homeland security reasons. And they are spending quite a bit of money to put them further offshore. Obviously, liquid natural gas is a cleaner fuel than others and it's good that we're able to export more. I don't know if they do a good job in the environmental side why it should be more polluting on the export than on the import and I think it's good for the country. So I like the fact that people that have money, oil and gas has money, will pioneer industries. So from my point of view, it's something that I embrace. I don't know if that answers your question but I do think it is coming and I think it's something that we need to live with and should support.

Greg Dalton: There's a lot of people who want to export natural gas. There's a big supply. A lot of suppliers would like to have international price, which would be helped, by having export terminals. You mentioned the national security aspect, is that because LNG is highly flammable, could be –

Michael Jones: Well, it's not that — I mean the answer is if it goes up, it can be catastrophic. There's only a couple of cases and I think it was one in Libya where a natural gas plant went up and blew up. But the biggest concern is that a terrorist would bring a bomb into a place like Long Beach where there's an LNG plant and can get close enough to create essentially a terrible catastrophe. So by putting the ships offshore and, again, there are logistic reasons to do that but there are also homeland security reasons that one would make that decision.

Greg Dalton: Mary Hagedorn, did you want to say something on LNG exports?

Mary Hagedorn: Yes. I mean I think we should diversify. But I have to say that in terms of the ecology of the extraction, I think we could do a much better job in how the chemicals that we use to extract the natural gas, I think, is very polluting to our water resources. And our water resources are going to be some of the most precious that we have in the next 30 years and natural gas will look like a joke. So I think we need to be very careful with our freshwater systems and our ecosystems, and we need to do a much better job in how we frack.

Greg Dalton: We're talking about the blue economy at a meeting of Climate One at the Monterey Institute of International Studies. Let's have our next audience question.

Nathaniel Maynard: Hi. My name is Nathaniel Maynard also from the Monterey Institute. Earlier, you were talking about some of the costs and benefits of desalinization and other blue technologies.

What are some guiding principles we can craft or influence that will help make sure that blue technologies avoid some of the negative conservation or environmental impacts that previous technologies have?

Greg Dalton: Michael Jones?

Michael Jones: That's a really interesting question. I think you have to look at two levels. You have to decide whether or not it is a good bargain today and then you have to decide whether it's a good bargain tomorrow.

So on the first case, I think the cost after all the financing was done is about $1,800 an acre-foot. And I think by the time you put all the cost together, remember water is free from the Colorado River and from the snowpack, you have to move it, there is a cost attached to it but God has given us this free resource so to speak, whereas we're desalinating water out of the ocean. But it's coming out to being fully loaded about the same cost, maybe slightly higher than to import that water from Colorado River.

The real problem is 10 years from now, 20 years from now when we suddenly have a drought like we had 15 years ago. I don't remember the exact date but in California where industries were leaving. I mean we can't live without water. And upstream, we got the whole southwest that is running out of water. So we live next to a reservoir, which is the ocean, and 97.5 percent of all the water in the world is in the ocean and we are over extracting on land and we're having less rainfall and things like that.

So the question is how are we going to deal with that, five years from now and 10 years from now? So there's a whole security aspect to this. And if we care about our brother, then we, that are close to the ocean, should be thinking about essentially helping the people that are upstream who can't afford to do what we have which is use the ocean.

So my answer is rather too leveled. We can look at the direct cost today and it's not terribly dissimilar from conservation and other costs but I think it will be quite a bit less expensive when it's going to be 15 and 20 years from now, particularly with droughts continuing. And the people upstream — I was actually at a conference and I talked to somebody from Southern Nevada Water and they're prepared to pay people on the coast to do desal to help defray the cost because they have no options.

If you're in Nevada, what are you going to do? So we're just going to tell them, "I'm sorry you're going to be without water because some 40 years ago signed a contract to get more of the Colorado River water." I don't believe that's the right way we, as a country, should be acting. So it's a very difficult answer to a very important question.

Greg Dalton: Some very tough water wars going on is what it was the state of Georgia tried to move its state boundary a mile north in a big water grab. It's in the court. It's going to be a hot issue. Anyone else on that before we — Jason Scorse?

Jason Scorse: Yes. I would just say there are some regions of the world where there are extremely water constraint. Obviously, the reason Israel is one of the leaders in desal is because it's a desert. In places that are less water constraint, I do think any time we're talking about an infrastructure that's going to be long term and that's high-energy usage, I'll go back to the point that I think the alternative conservation measures.

In the community that I'm and I'll use a very micro example, there are some pretty radical things you can do for gray water and catching rainwater that really reduce your water needs. And it also turns out when I mentioned that 40 percent, we have 40 percent lower level of water use than the state average so we have very little but there's a lot of variability there. It turns out a lot of people are doing their part and but there's still some people at that right end of the distribution that have the two swimming pools and the landscaping.

And the question is that have some interesting political, legal and kind of moral, do you just at some point say, "Hey, as a community, we've done our best. We're going to get a desal plant." Or do you say, "It's just not right that some people use a disproportion amount of a public resource and start on that." And I think there's just some interest and I don't know the answer. If that has the potential to make the need for desal plant less, then I think the question has to be asked.

Greg Dalton: Well, you wrote a book about "What Environmentalists Need to Know about Economics." Is pricing a tool so that make those swimming pools very expensive?

Jason Scorse: Well, I think this is a great question because yes, we already have tiered pricing. It's about 150 percent of the median usage for a family. You get a certain block price. It's low. It's for your showering or anything. And then above that, it goes up.

As we know, there are people with enough money but it doesn't matter. Mark Zuckerberg just bought a house in my area. We have the owner of Netflix in my area. There's people who you can raise price of water whatever; it's a rounding error to them. We have economic and equality in this country that has created an elite that can buy as much of whatever they want.

And so I come back which is do we just say, "It's a free market, we priced it and therefore if you're wealthy you can do it and we're going to look at other means. You can have your five swimming pools and your plum trees around your house." You can kind of tell with my inflection that I'm thinking maybe we need to question that when it's a public resource that has public implications, people who want to have their own things that don't have these impacts on other people; you want to have as many stamps as you want. You can have your stamp collection that cost you millions of dollars, I don't care. When it's water, maybe the state and the public has a say on how much is your fair share.

Greg Dalton: Let's have our next question. Welcome.

Tim Doughty: Hi. My name is Tim Doughty. I'm an alumni here. Going off from what Jason touched on with like rainwater, in terms of generating revenue to solve some of these complex problems, is the so-called rain tax which would be a tax calculated on impervious surfaces on a property lot, is that a viable policy tool in terms of generating revenue for us to solve some of these problems?

Greg Dalton: Rain tax, that's something a sure-winner in Washington. Yes, the first I've heard of that.

Jason Scorse: Well, I'll speak. Let me just take this as a moment to speak very highly of an organization that's in our wider community called Ecology Action of Santa Cruz. They're really one of the premier organizations that's pushing a lot of this amazing conservation efforts. And so one thing they're doing is actually working with developers to create permeable surfaces for driveways and for landscaping so that you get immediate recharge of aquifers. Because for those people who don't know, once you start paving over an area, that water then runs into the sea. It often runs with oil and chemicals. So it's polluted water in the sea, bad. It also doesn't allow the aquifer to recharge.

So then coming back to Michael, the technology, we have new technology now of these permeable surfaces and they're now tax incentives. I don't know anything about the rain tax but I know about the carat side of helping developers take it and giving them incentives so you kind of get this win-win.

So I think as much as many of these things here are challenges and their cost and we can kind of, "Oh my god, it's the environmentalists again telling us what we can't do," we want to change that. We can get — we can boost jobs and new technology. We can develop and have our houses and our businesses and then also prevent pollution. This is not rocket science, this is more a political will and a kind of a social transformation then that's really what it's more of the impeditive.

Greg Dalton: It's also a defensive part of that I believe where porous surfaces are less likely. They can slow down flooding if we're talking about and thinking the future that rainfall will happen in more intense periods, less predictable and come in bigger episodes. And then the less it's paved over, the more it kind of helps the flooding situation.

Jason Scorse: Exactly. I mean I hate to be cliché with win-win kind of thing but these are that fall into that category.

Greg Dalton: Paving stones instead of concrete. Let's have our next question. Welcome to Climate One.

Jordan Sanchez: Yes. I'm Jordan Sanchez. I'm a student here at Monterey Institute. And just kind of building on what Jason was just saying about social transformation and the political will, given the attention deficit of the American people and the media cycles that were li8ving in now and the political climate, obviously we just went through the whole government shutdown. How do you guys see the role of private industry in forging a path forward? And maybe Michael can kind of speak to this one.

Greg Dalton: Michael Jones?

Michael Jones: I think I need a little help. Give me a little more input. I mean how would private industry –

Jordan Sanchez: I'm saying that like given the gridlock in government, how do you see the role of private investment in moving a lot of the agenda forward in bluing the economy.

Greg Dalton: Bluing the economy. In the old days, the federal government would start with some big dollars to do something like this. That ain't going to happen these days.

Jordan Sanchez: Yes, that's exactly. Yes, that's better rephrase.

Michael Jones: Okay, interesting question, very difficult problem for us. First of all, there hasn't been a lot of outside investment in the blue tech for the most part. There are some sectors that have had some areas in robotics, certainly desalination has, but a lot of areas of ocean observation, many are small companies that don't get venture capital or there hasn't been banks that are focused on it. Part of the issue is very tangible how do you liquefy an asset if it's fish that are out in a farm, out in the middle of nowhere? So there's some very real issues in terms of financing this. So the private sector doesn't have — there isn't a private sector funding that might drive it at the state or federal level.

And then as I mentioned I think earlier, a lot of this industry is very invisible. One reason it's invisible is they're so export oriented that a company in San Diego — I was at the CFO of the world's fastest growing manufacturer of mini RVs so single-person employable tether robots. The company grew 20 percent to 40 percent for annum for every year of its life. We sold it a couple of years ago and grew a 100 percent the following year.

So fast growth but one percent to two percent of its sales were in San Diego, the balance were all around the world. As a result of which, those people don't belong to the Chamber of Commerce and don't belong to economic development corporation. So essentially, they have virtually no influence. It's going to be because economists and people like Jason and think tanks and elected officials and economic development people begin to understand the importance of the sector that it's going to start being noticed. Because the people that are in the sector, strangely enough, don't reach out the way accountants and lawyers and bankers in a particular region do reach out. And that's what makes this industry so interesting. It's so fast growing.

I tell elected officials and economic development people it's like opening up your door and finding a cornucopia of wonderful things that you didn't know existed there. As a child, I wanted candy. Today, as an economic development person, I want really good, sustainable, clean, fast-growing, export-oriented, blue collar driving jobs. But as a practical matter, those people don't belong to the Chambers of Commerce, they're invisible.

I don't know if I answered your question of what you expected but it's very interesting. The blue economy that's the reason it's not understood. Look, how does an industry that's this old not have? I got to the Department of Commerce and nobody has ever heard of it. The Department of Commerce paid Michael Porter to do his Harvard to do a study on all the clusters. They told me to register our cluster and there's like 47 industries. Maritime is not an industry you can register.

Now how is that? Three quarters of the world, I mean 72 percent of the world is water, 66 percent is ocean. Every second breath comes from the ocean. It's the fastest-growing industry in San Diego and it's completely invisible. So my own personal goal is to get the president of the United States talking about the blue economy.

Greg Dalton: Mary Hagedorn?

Mary Hagedorn: I would like to add to that too because I think it has a repercussion in terms of biodiversity and ecosystem's health and ecology. Because unless people value it and it's in dollars and cents, they will not pay attention to maintain it. And so having this kind of information, having these kinds of numbers are critical to maintaining biodiversity in our ocean. So I would second everything that we're talking about here is saying it's critical for all aspects of the ocean and certainly our health on the planet.

Greg Dalton: We have about four minutes left. Let's have our next question. Welcome.

Stacie Leininger: Thank you. I'm Stacie Leininger. I'm an intern at the Monterey County Weekly and I'm doing a blog on this discussion tonight and I'd like to get your best quote on blue economy from each of you.

Greg Dalton: Spot on best quote. Mary Hagedorn?

Mary Hagedorn: Oh dear. I don't work in the blue economy. I'll do my best. I think that I will echo

Jane Lubchenco's recent article and it say that it's time to stop arguing about global climate change, and start thinking about how we're going to measure it, and have action plans, and move forward with actually doing things to start changing things in the future.

Greg Dalton: Jason Scorse?

Jason Scorse: So goes the ocean, goes the world.

Greg Dalton: Michael Jones?

Michael Jones: California has an opportunity to be the world leader and in developing and promoting sustainable science-based ocean industries.

Greg Dalton: I'd like to ask each of you. We haven't talked much about aquaculture or fisheries, management of fisheries. As people who are really concerned about the health of the oceans, do you eat fish? What kind of fish? Mary Hagedorn?

Mary Hagedorn: I do eat fish and I eat a lot of pacific fish and –

Greg Dalton: Mahi-mahi from Hawaii.

Mary Hagedorn: It's very good mahi but a lot of that comes from the Marshall Islands. We fly them in. And so we do have a very robust aquaculture industry in Hawaii. I think people are very interested in it. It's highly priced. So I think that is an area that Hawaii would love to grow and even more.

Greg Dalton: And can that be done sustainably fish farming?

Mary Hagedorn: And we have a very good group, the Oceanic Institute, that's doing offshore farming. I don't know enough about some of the impacts but so far it seems to be doing pretty well.

Greg Dalton: Jason Scorse?

Jason Scorse: I've been vegan for 20 years. So no, I do not eat any fish but I think the main thing I think fish can be done sustainably and so my students are working on that. I give a plug for a local catch Monterey Bay that's really trying to promote this and it's local. The key thing with sustainable fish and I'll say this I'll get this out there is most of it is mislabeled. More than 50 percent of fish is mislabeled.

So even if you go through all this certification, you do everything, you read the Seafood Watch app, you do all that, more than half of the time it's not what you think it is so that undermines the system. So until we get the traceability right, which comes back to technology, a lot of it is the new technology and that is the big thing in sustainable fish, how can we know what you're getting is what you're getting? Everyone can recognize an avocado or a piece of bacon on their plate, how many people know what fish it is really once it's cooked? One out of a hundred.

So I'll still say go vegan. But if you're going to eat fish, go local with someone you can trust.

Greg Dalton: And quickly, is there something that you would recommend to be a smart fish consumer? For those people who do want to be smarter fish consumers, Seafood Watch which comes out of the Monterey Bay Aquarium, you mentioned that.

Jason Scorse: Yes, download the app for that on your smart phone and use that as best as you can.

Greg Dalton: Michael Jones?

Michael Jones: I eat fish and I believe that aquaculture is one of the solutions for the world. I don't believe we can create enough protein without it. We import $15 billion of fish a year right now. We're importing it from places that don't have the same science-based industries that we have.

So for all of you that at fish in the audience, the carbon footprint to bring that from Chile or from China or from Vietnam, leaving aside whether they fill it with melamine or not, we're not doing the right thing. And we have to use aquaculture as one of the tools for creating protein for the world and I would buy local.

Greg Dalton: Okay. We have about one minute left to wrap it up and end up on a positive note. Jason, you were very astute earlier of sort of turning things around to upbeat and solutions. So wrap it up for us and leave us on a high note.

Jason Scorse: Well, I'll just say that I think, not to be cliché here, but every challenge is an opportunity and luckily we see things aligning now. We see the science is aligning, industry is getting it and we have this amazing technological opportunity. And then in Monterey Bay area, we're generating kind of intellectual policy leadership to really take all these pieces together and then spread it globally. So this is the place to be if you want to do this.

Greg Dalton: All right. Thanks to our guests today at Climate One meeting at the Monterey Institute of International Studies. Jason Scorse is Director of the Center for the Blue Economy at the Monterey Institute; Mary Hagedorn is a research scientist with the Smithsonian Institution; and Michael Jones is President of The Maritime Alliance in San Diego. I'd like to thank you all for coming today and thank our listeners on KAZU and KSPB-FM. Thanks for coming everyone.

[Applause]

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