



# **Sustainable Aquaculture and Food Security**

## **Q&A Transcript**

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*Male:* Okay, as you might have noticed, we actually extended the time because of the content rich nature of the discussion today, so now, we're going to open it up for a Q&A. I would just like to ask that when you're asking a question, please state your name and organization before asking the question, and also to know that we're going to be moving between our in-person audience and our online audience. Our online audience has 70 people online joining us from around the globe. So with that, we're going to start with our first question.

*Male:* Good morning. My name is Thor, Lassen Ocean Trust. I have two questions. One is for the food output. We are familiar with salmon, shrimp, tilapia, their dominance and their importance in food. What do you see as the species coming for the future out of aquaculture that will begin to make its way into the market, and while I have the microphone, I want to ask a second question because I know these tools exist. What tools have the various organizations represented among the speakers been established to help guide a sustainable aquaculture development?

*Male:* Any guess on species, Randy?

*Male:* Maybe Richard can take that.

*Male:* I can start off, and the real aquaculture experts can provide supplementary information. The number of species being cultured is increasing all the time, and I think this increasing diversity is one of the great strengths for future aquaculture development. Obviously, in Asia, there's a big dependence on the herbivorous species and the omnivorous species. As my two colleagues here pointed out, there are great advantages in culturing those species which are less demanding on aqua feeds and so forth. And in Asia in particular, these species are in high demand, so there's a big – even though they're already very important I think in the future, they probably will continue to grow.

There's also increasing demand for more of the high value species, carnivorous species. They're particularly important for world trade, international trade. As I mentioned, international trade is really driving a lot of this future development of aquaculture because it is – fish is the most highly traded food commodity at

the moment. So there'll be diversification. I think there will also be intensification. There has to be, but this requires a lot of safeguards, and so for certain species, there are going to have to be very strict practices with regard to culturing species that are much higher densities, controlling the use of antibiotics and growth hormones and things like that, which we've seen as being such problems in agriculture.

With regard to the tools, I did I think mention the need – the importance of certification, and FAO is not a certification agency, but we have developed guidelines on aquaculture certification, and are now working on the framework for measuring the degree of compliance and uptake of these guidelines. So I think this is a key element in ensuring sustainable aquaculture in the future, particularly given the challenges of climate change, ocean acidification, habitat loss, pollution, and other such complicating factors.

*Male:*

I think I would quickly just say it depends on what market you're talking about as well, and I think Richard alluded to this that you're talking about the world market, and what's traded, and so forth. I think you may see some new species come into that play, but the main emphasis or the main changes that you probably see is the culture more indigenous species that are used for local markets. I mentioned some of the systems in Bangladesh where they have a cash crop and local market crop coming out of the same pond system.

We support – AID supports what's called Aquaculture and Fisheries Collaborative Research Support Program that's managed by Oregon State University and involves a number of US universities and their partners in about 15 or 16 countries. One of the things that they are looking at is domestication, if you will, of local species for those local markets. And many of those species also feed lower on the trophic levels, and so they're more efficient producers as well.

We also – Chris was also doing a lot of work on feeds and feeding methods for different culture systems.

*Male:*

No, go to the next question.

*Male:* We have a question from online.

*Female:* This is a question from Jeff Silverstein from USDA ARS. Can you comment on the potential for genetic improvement to increase sustainability, improved feed conversion, improved diseases resistance, et cetera. Estimates are that only about ten percent of aquaculture species have been selectively improved in this way.

*Male:* Yeah, that's exactly right. Essentially, aquaculture deals with wild animals. Domestic – other domestic animals, we have several thousand years of selective breeding. A lot of it was ad hoc, but it's becoming increasingly important in aquaculture. The farmed Atlantic salmon growth rates are two to three times what they were using wild fish. Tilapia, the World Fish Center has been running with the government of Malaysia and Philippines and some others a tilapia-breeding program that has produced nearly ten percent gains per generation of selection. The common carp, the fish that you see now that's grown on farms in China and South Asia bears only a very superficial resemblance to the wild animal.

And there are estimates of 100 to 300 percent improvements in growth efficiency that can be attributable to genetic improvement, and that's just straight selective breeding that's been used in the animal industry for many years. If we move into more sophisticated biotechnology, there's tremendous opportunities, but a lot of political opposition and concerns, health concerns, that have been associated with that debate across the agricultural spectrum.

*Male:* I would put a little addendum on that as well in that in many developing countries at least, there's a lot of gains that still can be made using the species that they're already working with, the varieties and so forth, just by better management of those ponds that this very – in many places, there's very little being done in terms of jacking up the production from those systems simply because the farmers don't have the inputs or they don't know the technologies or methods to do that. So there's lot more to gain, I think, particularly in Africa, I think, just by better management as opposed to improvement of species.

*Male:* And that includes genetic management. A lot of stocks of tilapia that are grown on farms in Africa are all inbred and are produced at 30 to 40 percent below even what the wild fish do.

*Male:* Chris Mann with the Pew Environment Group. It seems to me that one of the biggest problems we have is that the market is tending to drive aquaculture production away from sustainability in that a lot of the increase in production is for an export market. You know, 90 percent of the seafood in the United States is now imported. That's an amazing statistic, and over half of that is farmed, and it's mostly shrimp and salmon. So while we have more sustainable species and production practices, a lot of the signals being sent to the developing world are grow this stuff for the western market and you'll make more money.

And I guess the question is what can be done. In other words, we need to correct those signals in some way.

*Male:* I agree. I think if you look across the dietary spectrum, I mean ride the red line in the morning, and you can see that there are some real problems with our food consumption patterns in general.

*Male:* We have a question from online.

*Female:* This is a question from Marie Anne Sliwinski from Lutheran World Relief. She asks with typhoons and floods becoming more common occurrences, what are the common methods out there that help fishermen have a more resilient aquaculture livelihood?

*Male:* Well, it's – the – what aquaculture can do is it can help secure the value chain. That is the jobs and the fish that are being supplied to consumers that were traditionally sourced from capture fisheries. We don't really know what's going to happen to capture fisheries in light of climate change, except that they're going to shift around, and that means the places where like say Moratania, for

example, where there has been a traditional reliance on fish from the capture fishery for food security, they may have to start sourcing their fish from aquaculture or someplace else.

Another thing that's going to happen is as hydrological cycles shift in relation to climate change, there's going to be areas that, well, droughts are going to get dryer, and floods are going to get wetter. And the only thing that humanity has ever figured out how to do about either one of those situations is to build dams and water control structures. Dams and water control structures are a great way to wreck a fishery.

But they create opportunities for aquaculture, and I think what you're going to be seeing is as the impacts of shifting supply and demand are reflected in – resulting from climate change, you're going to see a more efficient utilization of these dams, reservoirs, and water control structures for aquaculture.

*Male:*

Yeah, okay. Yeah, if I could just supplement what Randy said, aquaculture is often seen as being the ideal alternative livelihood for the surplus fisher folk in the world. And particularly for small-scale fisheries, which account for 90 percent of those engaged in fishing. They're working in small-scale artisanal fisheries where there is generally a worldwide huge over capacity.

However, we see that aquaculture in terms of employment, as it grows, it obviously employs more people, but still, their numbers are small compared to those employed in producing equivalent quantities of fish in the capture sector. So it is part of the solution, I think, in reducing over capacity in the capture fishery sector, but it shouldn't be oversold as such. China has had a policy of trying to transfer fisher folk into fish farmers, and this has had some success, but it certainly cannot absorb the numbers required to reduce capture fishery capacity sufficiently to sustainable levels.

*Male:*

Elliot Masters with Apt Associates. First of all, I'd like to thank the three of you for some extremely compelling presentations, which I will take away with me with a lot of energy, and I thank you for that.

*Male:* We get royalties on those.

*Male:* There you go. Certainly credit where credit is due. Personally, I'm interested in multi-trophic systems at the interface between aquaculture, mariculture, and capture fishers. And I took the earlier question about the effects of typhoons in context of these systems in the Philippines say where these brackish water systems provide a real buffer in some cases, though they do present some vulnerabilities obviously. Of all the questions that I could ask, I'm going to call you to the carpet area on behalf of USAID. For those of us who follow Feed the Future specifically, I'm wondering what prospects you see for the sort of ideas and approaches that we're discussing this morning to be taken up with a higher profile under Feed the Future.

I know we can't predict the future at all, but I'd just love your input on that. Thank you.

*Male:* You're really putting me on the spot on that one. We've been trying – I mean through this whole process of Feed the Future and having it be based on host country, government plans, and that kind of stuff, when we looked at the – as that was progressing, early on in the different phases, I think aquaculture and fisheries both showed up a lot in the host country plans. As it went through the process of dwindling those down to a certain number of value chains that missions would concentrate on, several – lots of things fell out of that.

Livestock fell out of that. Animal production fell out of it period whether you're talking livestock, poultry, or fish. I think we're starting to make some inroads. My colleague sitting right behind you, Joyce Turk, is a livestock specialist, and we're starting to make some inroads, I think, in terms of getting livestock and fish back into the discussion. We – in a more practical sense on that, we have decided to – we're going to be extending that culture and fisheries collaborative research support program that I mentioned.

There are some missions that are starting to add aquaculture and fisheries things to their – at least to their discussions and incorporating them into things. So I think we're going to see an expansion on that. I certainly hope so. Just sort of historically, I mean AID was big in agriculture. A lot of the donors were, actually, back in the '70s and '80s. And I mean there were projects that AID funded that were tens of millions of dollar projects in different countries on large scale stuff, training facilities, hatcheries. In the Philippines at one point, AID was funding three different aquaculture projects that were within eyesight of each other.

So kind of duplicative, I think, but they were doing that. And you know, so we do have a history in it, and hopefully we'll get back to that. As I say, I think the fact that we're continuing with our research activities, trying to expand on those with rural fish as well as with the university community and so forth, I think we're on the way up, I hope. Unfortunately, I'm retiring in December, so I'm going to be seeing that from the outside perspective, I think.

But it is exciting, I think, as I'm looking at going out to know that the sector is at least being discussed again. But thanks for the question, and I'll probably get some heat from that. I hope so because I'm ready for it.

*Male:* We have a couple questions from online.

*Female:* Katerina Grigoryeva from the International Finance Corporation asks in your opinion, how will the natural capital accounting movement affect aquaculture since it is heavily dependent on natural resources and ecosystems, and in particular, do you see any short to medium effects on trade? And also, Arvin Bunker from Weidemann Associates asks increasing production can be a challenge without increasing water consumption. It was stated that recirculation is too expensive just now, but is increased effectiveness of aeration a potential solution to increased productivity?

*Male:* Well, in terms of water use efficiency, aquaculture, like other – as it's related to nutrients and other things can be extremely \_\_\_\_\_. You put fish in cages in a reservoir that's being managed for other purposes, there's essentially no net loss. Whether recirculation can be cost effective or not depends on the relative

importance of – the relative cost of energy versus water. A lot of aquaculture doesn't really produce a lot. It doesn't really use up that much water. You stick it into systems where water comes in one end and goes out the other with a relatively modest water treatment facility that is much simpler than domestic sewage or industrial sewage or agricultural.

This water can be used again. So water use in aquaculture is kind of a complicated issue. Surprisingly.

*Male:* The first question was – I didn't catch the first part of that.

*Female:* About the natural capital accounting movement.

*Male:* Natural capital. Well, if we can figure out how much ecosystem services really are worth, and this is a big if because in fact, we don't really understand how these ecosystems function. It's a nice idea, but you have two big problems. One, figuring out exactly how much ecosystems are worth, and then two, figuring out how you're going to pay for it. Who do you give the money to? How is that money going to be managed? And these are big outstanding questions. Theoretically, yes, it's extremely important to balance the ecological impacts of aquaculture against the benefits, and that, I think, is where we're headed with the ecosystems approach to aquaculture that is looking at how these things fit into the array, the economic, social, and environmental context of what you're trying to do.

But for the technical process of ecosystem service evaluation, I think that there's still a lot of research that needs to go into figuring out how that actually translates from a good idea into a cash flow model.

*Male:* Thanks for great presentations. I wonder if you could comment on the nutritional consequences of eating down the food chain. For instance, there were reports that farmed salmon have a much lower omega 3 content than wild salmon. Would you rather eat a schnook salmon from Alaska or Norwegian

farm salmon or tilapia? I think the answer is – I'd be interested in your comments on nutrition. Mike Colby from The Land Office at USAID.

*Male:*

I'm glad you brought that question up. Yeah, I mean because farmed salmon have less – they eat less fishmeal and oil than wild salmon. They do have a lower omega 3 content, and tilapias and carps and other white fish that don't use hardly any fishmeal, likewise, have a less omega 3. The good things about eating seafood are often not so much about what the good things in them are, but the bad things that aren't in them. So they still, even though they may not have as many of these highly unsaturated fatty acids, they don't have a lot of the big fat globs that clog up your arteries, either.

Fishing down the food chain, there's a lot of ecological interest in this right now, and I don't know that there's any actual consensus. On Lenfest, for example, has estimated that we should be – or figured that we should actually be concentrating energy on the top of the food chain. We could make more money growing fish that way or producing captured fisheries that way. University of British Columbia and some others estimate – or reckon that we should be fishing across the food chain, using more of the oily forage fish for direct team and consumption.

And if we can change human consumption patterns to reflect that, we may be able to find a balance that improves most of the nutritional profile and the sustainability of the fishery. It's an ongoing piece of work. I don't know that there's any ecological consensus, and – but it's an issue of concern. On the other hand, with the oils, because for the same reason that they don't have as much oil in them or omega 3s, they also don't have as many PCBs and dioxin as wild fish do or mercury either because that's also a key related of the food chain.

And to the extent that you eat wild fish, the more of it you're going to get, and that's less of a problem.

*Female:*

Hi, my name is Sabrina Dorman from Making Sense International. First, I want to say very nice tie. Appreciate the theme this morning. We're working on a

program in Nigeria focused on improving management practices for small fish farmers. I'm wondering if any of you can speak to some of the financial products that are out there, either for insurance or someone who is looking to start up a fish farm. It seems like kind of a lot of capital needs to go into that. If you could speak to something that's accessible for a small fish farm.

*Male:*

I don't really have – okay, ironically, in the last couple of weeks, the World Bank with the international finance corporation, with the African Development Bank, with the Development Bank of Southern Africa, and a Kneepad and the Program for African Fisheries have been discussing exactly this problem. Because the big financial institutions to get in, they want to – and because of the high risk that's associated or the perception of high risk that's associated with aquaculture, they don't want to get in for less than \$10 to \$20 million, and it's very hard to find aquaculture companies that are that scale.

They just don't really exist. Most of the aquaculture is small scale. So what we're talking about now is putting together some kind of an equity fund that would allow collectives of small producers or maybe not formal collectives, but groups of smaller producers to take advantage of some central fund that would actually put investment capital into the business. Interest rates, as you may know in African commercial banks, goes up to – averages around 30 percent, which is just not – and they want their money back in two or three years. So it's just not practical to exploit those financial resources.

It's not an easy thing. Most of aquaculture has been based on private equity. You know, farmers that save enough money doing something else, and they put it in fish farming. But we're trying to find a model that can push down our traditional investment strategies so that it's more available to at least the medium scale farmers. Maybe not, you know, the 200 or 300 square meter operations in Ibadan that are producing catfish, but certainly, the scale of say Durante, which is also in Ibadan, but is producing 2,000 or 3,000 metric tons.

*Male:*

USAID has a program, the Development Credit Authority Program, where the US government basically backs loans – loan programs in developing countries. In probably the last six or eight months or so, I've talked to several people from DCA about including aquaculture and so forth in those packages. But again, it's

for the larger sort of farmers. If you're talking small-scale folks, it's – that's a difficult thing.

I remember when I was a Peace Corps volunteer in Cameroon, we had – it was a monthly drinking club, actually, where we all joined with a certain amount of money, and each month, one person, one member of the club would get that money, and that was a good way for some of the farmers that were in those groups to actually get a pot of money that they could invest in their bonds. So maybe some of those small-scale things. I know the Grameen Bank in Bangladesh has had programs that support small-scale aquaculture as well.

So I think they're out there. In Nigeria, who knows?

*Male:* We have time for one last question from online.

*Female:* This is a question from Allison Myers, who is an aquaculture company owner, and asks how will increasing CO<sub>2</sub> or carbon dioxide levels in waterways affect the opportunities for aquaculture, and can seaweed and micrology harvest impact or decrease CO<sub>2</sub> levels.

*Male:* Hi, Allison. Yeah, that's a good point. We didn't really talk much about algae forming. It is an up and coming industry. The fish nutrition sub-sector is very interested in exploiting the fatty acids that are in algae to replace especially fish oil in carnivorous finfish diets. The omega 3 fatty acids that were referred to earlier aren't actually produced by fish. They're accumulated in fish. They're produced by plankton, and there are a number of mostly pilot scale, including some here in the Chesapeake, that are looking at producing – reducing – well, producing a product that has interesting market value while improving the eutrophication status of our waterways.

There's one going on in Long Island Sound now that's being run by, I think, the University of Connecticut. As Allison is well aware here in the Chesapeake, and globally around the world. Up in the University of Maine, there are some of these multi-trophic aquaculture systems that are being piloted where you grow

salmon in the middle, and then you put algae around the outside, micro algae, kelp, seaweed and stuff around the outside so I can absorb the nutrients. The Chinese in the Yellow Sea are trying to at the very largest scale integrate their aquaculture production system. So they have carnivorous finfish with filter feeding shellfish surrounded by macro algae, and I mean these things are – you could only do it in China where you could organize things on that scale.

Tremendous potential. A very exciting new development has been some technology that came out of a little group called Val Biotechnologies, I forget exactly. University of Berkeley. And they have a – they have genetically modified I think it's an e coli that can take the polysaccharides that are locked up in seaweed – because most of the sugars that are available in seaweed are locked up in these very complicated molecules that we can't – it's not easy to break down.

But they found a gene, and they stuck it into e coli with another gene that was developed by DuPont, mixed it together so that you could feed them seaweed, and it puts out alcohol. And the – they're piloting that now. Of course, in the United States where you can't get a permit to do anything, they couldn't do it here even though they have a Department of Energy grant to work on it. So they have a license. They're piloting it down in Chile. And this could be an extremely exciting opportunity for algae farming worldwide, could address some of the bio fuel issues, and address some of these issues associated with use of animal proteins and animal feeds.

*Male:*

With that, I'd like to have our – thank our speakers for a great presentation and great Q&A. So please take a moment for those of you in person to fill out the evaluation forms. For those of you online, we have a link that you can go to to actually fill out those evaluations. We do take these seriously. We just did our review of the past year of Ag Sector Councils and went through the evaluations and looked for ways that we can improve and take your suggestions into mind. Actually, this presentation here is a result of some of that feedback because after our fisheries presentation, we had several of you who requested that we have something on aquaculture.

So we are taking your suggestion seriously, and we do look to improve. So please, help us out. And all the resources will be up on Agrilinks. We'll have the Power Point presentations up there probably by the end of today within about –

*[End of Audio]*