SUSTAINABLE FISHERIES AND AQUACULTURE FOR IMPROVED FOOD SECURITY AND NUTRITION
Panel Moderator: ***Per Pinstrup-Andersen***
October 15, 2015 – 2:15 p.m.

Introduction:

Margaret Catley-Carlson
Advisory Council Member, World Food Prize Foundation

I'm Margaret Catley-Carlson. I am on the Advisory Council of the World Food Prize, a proud member, and delighted to be here for the umpty-umpth year. And I was asked to present the panel this afternoon, which I'm doing with great pleasure.

It strikes me that, when we listen to the presentations and they talk about food and agriculture, far too many of us have waving fields of grain in mind. There's enormous diversification. I mean, the last video that we just saw had livestock and even some sheep and chickens and all the rest of it. But there's one food resource which we hardly ever really think about or talk about, and yet is traditionally the single-largest source of protein for the poor people of the world. It's also a food source that, in helping to solve, we saw one of our major environmental problems, which is the depletion of the wild fish stocks.

So clearly I'm an enthusiastic listener. I'm delighted that there is a whole panel on aquaculture, which you're just about to hear. It's many years since we had a laureate that was working in fish, so it's a good thing to bring this back. The panel is going to be led by another laureate, Per Pinstrup-Andersen. Per, do you want to come up? And he is familiar to many of you. He's literally a great Dane, i.e., very tall and Danish. (You like that? Oh, good.) And he has been successful in so many enterprises related to food and agriculture, the academic, being the director of IFPRI, which is one of the absolutely most important food policy research institute back in the academic world, taking the message out. He's almost perfect, but he does have a considerable flaw. If he crosses his knees, you may notice he wears pink socks, pink socks. So just see if you can watch that while you're listening about the fish.

Per, you're going to introduce your marvelous panel, and we really look forward to hearing what you've got to say. Please welcome…

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Panel Moderator:

Per Pinstrup-Andersen
2001 World Food Prize Laureate

Panel Members:

Jeppe Kolding	Professor, Department of Biology, University of Bergen
Árni M. Mathiesen	Assistant Director-General, Fisheries & Aquaculture, Food & Agriculture Organization, United Nations
Shakuntala Haraksingh Thilsted	Senior Nutrition Scientist, WorldFish

Per Pinstrup-Andersen

Thank you very much, Margaret. This is the first time that I have caught you in making a mistake. My socks are red, not pink. Could I ask the panel members to join me up here, please? And while they're coming up… Well, maybe we should have you seated. Please come up.

Let me begin with some good news and some bad news and a challenge.

The World Development Goal to reduce by half the prevalence of poverty between 1990 and 2015 has been achieved. It was achieved ahead of time. We still have until the end of this year to achieve those goals. The goal to reduce by half the prevalence of hunger has almost been achieved; we are very, very close to achieving it. We will not achieve it by the end of the year, but it's very close. And, as you know, these Millennium Development Goals end at the end of 2015.

The bad news is that more than 10% of the global population still do not have enough to eat. And between 20 and 25% of the global population suffer from nutrient deficiency, deficiency of some nutrient, could be a mineral, could be iron, could be a vitamin.

Now, let me suggest the challenge. The new Sustainable Development Goals that were agreed upon by the members of the United Nations two weeks ago in New York, and they will take effect at the end of this year, call for, and I quote, "Ending all Forms of Malnutrition by 2030." Can we do this? I don't know, but we ought to make every effort to try. And this is where fish and seafood come in. As Maggie already mentioned, fish and seafood occupy an extremely important part of our daily diet, and these commodities or these foods can do a lot more.

One of the things we need to do as a community is to integrate into the debate about food security and nutrition fish and seafood, fisheries and aquaculture. These things need to be integrated, and I really applaud the Ambassador Quinn and his team for organizing and suggesting this session, because that is a step in the right direction. Also, having fish integrated with a wonderful soybean-based lunch is another step in the right direction. That part we haven't had much trouble with. But when it comes to talking about—how do we solve the food security and nutrition problems, we frequently talk about fish and aquaculture and fisheries over here, and then we talk about everything that is not swimming over there. We need to bring these things together, and in this symposium we are of course making a step in the right direction.

We're in for a real treat during the next hour. We've got three world-renowned experts in the areas, in the sectors of fishery, aquaculture and nutrition and related matters. We only have an hour, so we're only going to talk about some of the most important issues, and we're going to focus on what needs to be done in order to achieve the Millennium Development Goals that I just mentioned.

So we can't get into a lot of details, and that's why the World Food Prize agreed to include in your packet this report from the High-Level Panel of Experts on Food Security and Nutrition, which gives you a lot more detail. I should mention that the High-Level Panel of Experts on Food Security and Nutrition was created by the United Nations Committee on Food Security to develop evidence which the committee can use for making recommendations and decisions. This particular report was initiated under the chairmanship of Dr. Swaminathan, and I was fortunate to take over after M.S. Swaminathan to finish the report.

Let me now introduce the three panel members. Let me begin with Árni Mathiesen. He's an Assistant Director-General of the Fisheries & Aquaculture Department at the Food and Agriculture Organization (FAO). He holds degrees in veterinary medicine and aquatic veterinary science. After completing his studies, he worked as a veterinarian, specializing in fish diseases, for ten years and was also the managing director of an aquaculture firm combining theory and practice. In 1991, Mr. Mathiesen was elected to the Icelandic Parliament. He served as minister for fisheries and subsequently as minister for finance. He has been in the decision-making position and the advising position in the practical aquaculture position, and he is eminently qualified to talk about how these things all fit together. He joined FAO in 2010.

Jeppe Kolding, specializing in small-scale fisheries in developing countries and the ecology and exploitation of fish, is currently a professor in the Department of Biology at the University of Bergen in Norway. He's done his research on fish stock assessment, ecology, harvest strategies and management of small-scale tropical fisheries. He's been a member of the Fisheries Expert Group of the International Union for the Conservation of Nature since 2008, where he, among many other things initiated the work on balanced harvest. He told me just a few hours ago that, in addition to his expertise embodied in what I just mentioned, he's also a nurse and a midwife, and he has actually practiced both of those occupations in Africa. And he tells me that that's kind of the beginning of his interest in the nutrition and subsequently in fish as it relates to the wellbeing of people.

Last but by no means least on our panel, we have Shakuntala Haraksingh Thilsted. She's a senior nutrition scientist at WorldFish, which as you know is one of the CGIAR Centers. Her area of research and expertise is within food-based strategies for improved food and nutrition security in low-income countries. She focuses on the potential of micronutrient-rich small fish and fish products in supplying essential nutrients for improving nutrition and health, especially in women and young children. Shakuntala and I were on the faculty together at the University of Copenhagen for a period of time, and I know her expertise is really outstanding, not only in nutrition as such but also as it relates to fish.

Now, what we would like to do during the next 55 minutes, or whatever time is left, is to first have a round of up to five minutes each, basically talking about what really is the role of seafood, or if you want to look at it from the production side on the fisheries and aquaculture in achieving food security and nutrition for all, and any other aspects that relate to that. So I'm

going to ask each panel member to speak up to five minutes on that to kind of set the stage for the discussion. Then I'll come back with some questions, depending on what they tell us. And then hopefully we'll have some time to go to the audience for some additional questions.

So with that, Árni,

Árni Mathiesen

Yes, thank you, Per. If I may start by echoing your appreciation of the organizers for setting up this panel and inviting us to be here. That's much appreciated.

The importance of fish, fisheries and aquaculture, as you mentioned lies primarily in nutrition but also in the livelihoods it provides, and in the cultural effects and influences that fish have.

I'm not going to go deeply into nutrition, because I suspect that Shakuntala will do it after a little bit, in a little bit more detail. But I can't refrain from mentioning it a little bit from the point of view of the omega-3 fatty acids that fish provides us with, almost exclusively. My friend, the medical professor, Michael Crawford, of Imperial College, he maintains that our species, homo sapiens, didn't start to think rationally until they moved down to the waterfront and started eating fish, and that basically our brains are made of omega-3 fatty acids. And he further maintains that the future of mankind is therefore based on fish.

But the livelihood aspect is not to be neglected, because there are calculations to the effect that twelve percent of humankind base their livelihoods on fisheries, and the fisheries' economy. And if you look at the cultural aspect, we only need to look to Asia, particularly East Asia to see the growth in the middle classes and the subsequent effects on fish consumption where fish is held in very high regard.

So, therefore, the status of fisheries and aquaculture is of high importance to us—the status of the stocks, the status of the catch, and the status of the production. We have for 20 years experienced a leveling out or, some would say, stagnation in the growth of wild catches. There have been now for 20 years, around 90 million tons per annum, for 20 years before that—so a very rapid increase in catches, which were obviously unsustainable.

What followed on this rapid increase in catches was an increase in the number of stocks that were fished beyond biologically sustainable levels. However, for the past 20 years, the number of stocks that are beyond biologically sustainable levels have been roughly the same, just under 30% of the stocks. That is not a good situation for us. We should be able to improve that, but relatively speaking, I think most of my friends in the biodiversity sector would be happy with having the same situation today as they had 20 years ago. Aquaculture has, however, been the fastest-growing food sector in this 20-year period. And the growth in aquaculture has been such that the supply of fish has probably never been greater, touching now 20 kilos per capita per annum and the production of 70 million tons annually.

What then lies in the future, or what can we expect of fisheries and aquaculture, and what do fisheries and aquaculture have to provide us with? We have done a range of calculations with a number of partners, and we have come to the conclusion that the production needs to increase somewhere between 50 and 100 million tons per annum by the year 2030. If we are to avoid that

the regions that are most susceptible to lower fish supply but are consuming least today, are going to see an even lowered consumption, that is to say, Sub-Saharan Africa.

How do we then supply these extra 50 to 100 million tons? If we are very, very good at managing our fisheries, we could expect maybe 10 to 50 million tons additionally from catch fisheries. We could expect to get 15, 20 million tons from reduction in waste and possibly another 10 to 15 from transferring from nonfood consumption to human consumption. But the bulk of the increase would have to come from aquaculture. So there is a lot that we are asking this relatively new sector to do, and we need to all come together in making sure that we develop aquaculture to meet these goals in a sustainable way.

Per Pinstrup-Andersen

Thank you very much, Árni. Jeppe.

Jeppe Kolding

Thank you very much, and thank you, Per, for inviting me and Ambassador Quinn.

It is true, I started my young life in Africa as a nurse and a midwife. I was a volunteer at that time, and I was posted in Northern Kenya next to a lake called Turkana, which is the fourth biggest lake in Africa. It was one of the worst droughts in recorded history at that time, and I was posted there in a hospital. There were no doctors. I was alone with another Danish nurse. (I'm a small Dane, by the way. Per is a great Dane, I'm a small Dane.) And people were dying of hunger. We heard yesterday about people who had witnessed people dying of hunger. I've seen it also. And there we were next to this great lake, the fourth biggest in Africa, and it was relatively full of fish. It just crossed my mind—how can people die of hunger next to a lake with fish in it?

So later, for various purposes I changed my path, and I ended up as a biologist, a fisheries biologist; but I've kept working in Africa. I spent all my professional life in small-scale fisheries primarily in Africa and in Southeast Asia. And it's always been sort of a puzzle to me why fish is going under the radar—why is it not recognized as more important? And particularly when you think about the productivity that is available to us. Seventy percent of our planet is covered with water, and yet the fisheries only contribute about 2, maybe 3% of the human food consumption in the world.

The primary productivity, the basis of all what we eat, I mean, what is created by the sun and photosynthesis, is about equal on land and water. The oceans and the terrestrials, environment, they each produce about 50 billion metric tons of carbon per year. And we eat directly from that on the terrestrial face, 2½ billion metric ton. We are 80% herbivores. We are vegetarians, basically. But if the oceans are so productive, how come that by only a hundred million tons, we are claiming they are overfished, we're depleting the fish stocks? There must be a huge potential out there that we are not utilizing.

That's always been a puzzle to me, and I've been studying, working on that. I've been sort of trying to understand it. And then I understood that these two ecosystems are quite different, and the way we're utilizing the land and the way we're utilizing our waters are completely

different. We have this trophic pyramid most people know about. I mean, we have the primary producers, the photosynthesis, and then we have the herbivores, and then we have the carnivores. And most of our food is, or as I already said, it is vegetarian, and then we have our domesticated animals that is providing a certain amount of protein.

But the difference between the land and the water and which many people forget is that we don't have any big plants in the water. Limitations of photosynthesis in the water is light, and if you are not close to the shore somewhere, you have to be floating; and in order to survive as a floating organism in the water, you have to be very, very small. Can you imagine if all our grasses and trees, we needed a microscope to study it or to see them even? It would be… I mean, there are not great herbivores in the water. There are no elephants and ox and cows and things like that. So the food chain in the water, after a few millimeters of size, or even one millimeter of size, it becomes carnivorous. From then on, everything that is eating everything, they eat meat. And when we get to the level where we start fishing the fish, for like salmon or tuna or every day things, we are at the tropic level of four to five. We are fishing at levels that we don't even see on land. We are fishing on the mythical animals on land that would be eating lions. Because the cows in the water are zooplankton, and they are a few millimeters thick. So when we are harvesting cod, as we do in Norway, we are harvesting at a trophic level that we don't find on land.

So we have a huge potential, but we have to go down in the food chain in the water. We have to change our way. We have an inverted pyramid in the water in our fisheries. When we talk about overfishing, yes, we are overfishing some stocks with automation, but that is the tip of the iceberg. The rest of the iceberg, the 90% of the iceberg, we are not touching it, and we have the potential of utilizing that. We can utilize that for either consumption directly or for the increased aquaculture that we need.

So I wanted to start my talk about that, because I think it's very fundamental that we understand this big difference between land productivity and water productivity.

Per Pinstrup-Andersen

Okay, thank you very much, Jeppe. Shakuntala.

Shakuntala Haraksingh Thilsted

Thank you, Per, and thanks for the organizers inviting me to be on this panel.

I'll begin with telling four different short stories of why I work with fish, and why I work with fish and food and nutrition security.

I am from Trinidad and Tobago, and I remember as a child one of my uncles won the island scholarship. And my grandmother was interviewed by the national newspaper. I don't remember all what she said, but I remembered clearly her saying that, "My child is intelligent because I fed him fish when he was a small boy." And that stuck with me.

Then many, many years later, I worked at the very renowned institute, research institute in Bangladesh, called the International Centre for Diarrhoeal Disease Research. And I was working

with nutrition rehabilitation. That's at the stages when children come in when they can't even move and they have to be rehabilitated, suffering from undernutrition. And it was very frustrating, because about 7,000 children came into this center every year, two-thirds were boys, one-third girls. And usually they were so sick and so undernourished that they were brought in at a much, at too late a stage, and many of them died. And I was extremely frustrated working at this end. And I wanted to work much further up where I could do something for them.

And my background is in agriculture from the University of the West Indies. There aren't many women in agriculture in the West Indies, and there aren't many women, even today, working with fisheries. And one of the scientists at the ICDDRB who had in fact patented the soil sugar solution for diarrhea said to me, "If you really want to do something for these children, you should work with making sure they eat fish, and that would help with their undernutrition." So I went back to work in Copenhagen at the University of Copenhagen, and I decided to work with fish and food and nutrition security.

Many years after, now I still work in Bangladesh, and some of the issues are the same. I work in an area in Northwest Bangladesh where the poverty levels are very high and the undernutrition rates are very high. And when you talk to women in this area (they are extremely poor), they tell you that, "We do not have enough food to feed our children," that "We do not have enough time to prepare foods for our children." And with this focus on the first thousand days of life, I decided to work with women and the nutrition of these women.

So we, together with colleagues from Bangladesh, we developed a fish chutney. A fish chutney is the same, the same process as you make with a mango chutney. In Bangladesh to suit the culture, to suit the food traditions, there's, of course, a lot of chili in the fish chutney. One tablespoon of the fish chutney is equivalent of 60 grams of raw fish, and we have introduced this and done focus group discussions with these women who tell us they are less tired, they produce more milk. We feed it to pregnant and lactating women. They produce more milk. They can see that their children are healthier. They grow stronger, they cry less. And in the villages where we were, these children, of course, *pusti bachcha* children, *pusti bachcha* meaning well-nourished children. We have done no interventions with the children but with the mothers, with the pregnant women and the lactating women after six months after birth.

Even with all these reports we have from the mothers, as a scientist, if I need to talk about the results of this, I must be able to publish it in international journals. In order to publish it, I must do an efficacy study. I must show that women who have got this fish chutney compare them to women who have not gotten the fish chutney, and do studies, see what differences there are in milk production, in milk composition, in their body weight mass.

To do these studies require quite a lot of money; a really rigorous efficacy study can cost up to one million U.S. dollars to do all the tests. And sometimes I wonder in exasperation, why do I have to do this when I could remember quite clearly what my grandmother said when I was small—"I fed fish, and this is why my child is intelligent."

Per Pinstrup-Andersen

Okay, thank you, very much Shakuntala. Let me follow up with you on the first question. When I read the popular press, I hear that we shouldn't be eating fish from aquaculture, yet Árni is telling us that the future demand for fish would have to be met primarily through aquaculture. If I eat fish from aquaculture, I'm consuming a lot of pesticides, a lot of antibiotics, and the fish are polluting the water in aquaculture, they're polluting the river. This is really a terrible situation. Tell us why that is all wrong.

Thilsted Aquaculture is much more complex and much more diverse than producing, for example, salmon in Norway. If you look again from Bangladesh, Bangladesh is now the fourth-largest aquaculture-producing country in the world. Of course, China is number one and much higher than all the rest. But the aquaculture in Bangladesh, the majority of aquaculture in Bangladesh is small scale; and there are many different approaches that one can use.

When Denmark many years ago, 25 years ago, began supporting the growth of aquaculture in Bangladesh, it was all about pond, polyculture of carp. And the one way that you did this was that you went in and poisoned the ponds and removed all the indigenous small fish. Then you stocked with carp and you grew the carp to large size, four or five months, and this is what people sold, and this is what they ate.

When you start from a different point of view, if you start, for example, with the consumption of fish in Bangladesh, you would see that the majority of fish that's consumed is small fish. And when I started working in Bangladesh, since it was a Danish project, I could very easily go in and try to influence the project. So we took out ten ponds and we said, "What if you don't poison these ponds but you let the carp grow together with the small fish." What did we see? We saw that we got the total and increased production of fish, total production of fish; and the nutritional quality of the total production improved, because the small fish has a much higher nutritional value than large fish, mainly because they're eaten whole but also because they feed differently, as Jeppe was saying, and they have higher micronutrient contents.

And if you see now, if you go in to consumption studies in Bangladesh and you remove the fish, the small fish that the poor eat, you are removing more than 30% of the calcium and about 50% of the vitamin A. So a diversity of systems in aquaculture is very important in order to meet the nutritional needs.

Pinstrup-Andersen

So, Árni, can we change the demand structure so, instead of demanding salmon, we're going to demand smaller fish; or are we stuck with the current demand structure for future generations? How do we solve this problem? If I want salmon and Shakuntala is telling me I would be much better off with smaller fish, how do we change that consumer behavior? Or is it something else we need to change?

Mathiesen Of course we can change it. If you look 20, 30 years into the past, we weren't eating salmon; there was hardly any salmon to be available unless just during the height of summer when the angling season was. So we can definitely change it. And in fact the salmon industry has itself changed quite a lot and is totally different today from what it was before.

I however, agree with the sentiment of your question, but we have to change our aquaculture if aquaculture is going to meet the goals that I was mentioning. And that's basically because of environment of restrictions on the meat. And we will more and more have to go into low input aquaculture with fish that are lower on the trophic pyramid or lower trophic levels and to a large extent into a non-fed aquaculture where at the same time as we are producing food we are in fact cleaning up the environment. And this we can do both in monocultures and in polycultures. So there are a lot of opportunities to change.

How we, however, do that, that is a much bigger and a more difficult question. And if you were really, sort of serious in changing our consumption habits in that way, we would probably start with some other species and with fish and aquaculture species and start to try and change our consumption patterns. But I don't think that is necessarily, necessary or realistic to do.

So I think we should concentrate on sort of the leading edge where we are developing the future products, and in that way gradually we would re-educate future consumers and possibly effect change. Even in the U.S., the consumption patterns have changed over the past 20, 30 years, and there is not so much consumption of beef and far higher consumption of chicken and, of course, a far higher consumption both of salmon and shrimp.

Pinstrup-Andersen

Okay. Well, I have a suggestion. Up until three years ago, I liked salmon a lot and I never ate sardines. Then I got involved in this study, and now I eat sardines and very few salmon. So if we could get everybody to eat this way, we might be on our way.

Jeppe, you mentioned to me just before this session that aquaculture hasn't really caught on as much as you would like in Sub-Saharan Africa and fish catching is a much more important source. What can government do, the African government, what can they do to promote sustainable ecology-friendly aquaculture in Sub-Saharan Africa so that people can meet more of their nutrient needs? And generate income for small farmers, by the way?

Kolding I don't think Africa is ready for aquaculture yet and Shakuntala said just before, it will not be ready for the next 20 years, and I tend to agree with her and for some very simple reasons. First of all, the wild capture fisheries in inland Africa are not overfished, far from it. The recorded amount is about 2½ million tons, but we can probably multiply that with an order of magnitude to get to the actual takeout, and

we can probably even increase that by another order of magnitude almost from the captive fisheries that is there.

Fish, particularly tropical fish, are incredibly productive if they have the right conditions; if there is water, if there is rain, then they will multiply. Another difference between fish and terrestrial animals is that they have millions of eggs. They are so reproductive that, if the conditions are right, they will explode.

I had a situation; I was working in Botswana. One of the lakes there was virtually dry; it was a dry pond for 30, no 20 years. It was a dustbowl. And then they had a good flood, and the lake filled up. About five months after the pelicans moved in; and one month after the pelicans, the fishes moved in; and they're now taking out bumper yields. I mean, it is so productive.

Aquaculture in Africa and aquaculture in the world in general… I mean, fish are carnivores, as I said. Even the tilapia, low trophic-level fish in Africa, they need about 50% of the diet has to be protein and fat. And which small-scale farmer in Africa can afford to give his fish more nutritious food than he can give to his own children? And he can take his net, and he can go out to the nearest river or lake or small water body, and he can catch six, five, eight kilos of fish in a day, which the Malawian aquaculture farmer, he makes twelve kilo in a year, after heavily subsidies from the international community. The economy is not there, the food is not there, and the wild capture fisheries are still so plentiful that there's less risk catching fish than growing them and will be for a long time yet to come.

So we have these ideas—we are over-depleting, we are fishing it down, and things like that. It is true in some of the cases, but it's not true in inland fisheries in Africa yet, and that's why it will not work.

Pinstrup-Andersen

Okay, well, let's follow up on that then. Árni, what kind of international action is needed to make marine fisheries sustainable again? You talked about over-exploitation, and we're all familiar with all of the unsustainable activities in marine fisheries. What is it going to take from the international community? I presume we are talking about international action, because water doesn't stop at the country border. And I'm not sure how freely you can speak, since you do come from an international organization—and I can't tell you it's off the record, because that would be a lie. But come as close as you can before you get in trouble. Or you can call one of your friends and they can answer it for you.

Mathiesen No, no, no, no.

Pinstrup-Andersen

No, no, okay.

Mathiesen I don't think there's any risk in this. Seventy percent of our fisheries are utilized within biologically sustainable limits, and this situation has been stabilizing over the last 20 years. So I would expect that, within the time limit we have set for ourselves in the SDGs, we could reach the goal by using the same methods that we have been developing over the past 20 years.

And the action has primarily to take place at the country level and inside the exclusive economic zones, because most of the fish countries of the world are inside the economic zones. Most of the productive areas on the oceans are close to shore in the shallower area; the deeper you go out, the less productive the fisheries are. So this has to happen at the national level, and I think we can manage it within the time limits that, like I said, we're already using.

Pinstrup-Andersen

You would not be in favor of putting a chip on every ship that does any kind of fishing and keep track of where they are at all times, and if they're in the wrong area, they'll be fined? Would you like to pursue that kind of approach, kind of tough love at the international level?

Mathiesen I did that in Iceland. I had a computer screen on my desk in my office in the Ministry in Iceland, and I could pull up every Icelandic ship and see where it was fishing and what it was doing. I could see from there. This is what is happening all over the world. This is what all the countries are trying to do. They have variable resources to do it, so those with little resources, they will do it if they could be supported in doing it.

Pinstrup-Andersen

But you're not worried about free riders?

Mathiesen There is, of course, always that possibility, and it doesn't matter in which sector you're working. There are always people that break the law and are free riders. But I don't think you need to have any more severe policing in fisheries than you need to have in society in general. So I don't think we should criminalize those that are involved in this industry beyond what is in general in our societies.

Pinstrup-Andersen

Jeppe, do you want to add anything to that?

Kolding Yes, I'd like to continue the line that Shakuntala talked about, the small fish and the women. When I was doing my master's in Africa and I was out with my professor and there were some women and some children fishing along the shore with very small mesh-sized nets, cast nets. And we looked at their catches, and it was tiny, small fish. And my professor said, "Look, they are overfishing—they're catching the babies. This is destructive. This will destroy them. We have to stop

them and they have to use large mesh sizes. They have to let the babies grow up to become large."

And I swallowed that, but then later I figured out he was wrong. Because these small fish, yes, some of them were babies, some were just small species, but they were actually much more numerous than the large ones; because, to make one large salmon, you have to give it five kilos of small fish or one large caught is five or six kilos more fish.

So, yes, we can take one large fish, but then we can take five or four kilos of the small ones also; and these are much more nutritious. They're much more environmentally friendly, because you sun dry them as you said; you eat them whole. And they're like instant noodles—they don't take much energy to cook. You don't have to cut down forests to smoke them like we do the large fish. They are perfect vitamin bumps, but we are not allowed to catch them because we are catching the babies. They have mesh size regulations in every country in Africa, and that is a disaster.

Pinstrup-Andersen

Okay. Árni, do you agree with that? We should just catch the babies? Or Shakuntala, take it, go ahead. And, Shakuntala, as you know, malaria nets are being used for catching fish, and they are catching the babies. Is that okay?

Thilsted Well, first of all, there is a diversity of fish species. Again, going back to Bangladesh, where I have done a lot of my work. Just the freshwater species, there are over, close to 400 species. The majority of them are small, meaning less than 20 centimeters, even as adults. So there's a great diversity, which means that you can develop different production technologies that are appropriate.

When we look at the consumption patterns in Africa and in many Asian countries. The large majority of fish that's consumed, especially by the poor, is dried fish. Or in some Asian countries, it would be dry fish that's then made into fish paste or fish sauce as well, but it starts with dried, small fish.

And so, if you want to meet the needs of the poor, it has to be… there is a distinction between what the poor eat, what they can afford, also because you can buy very small quantities of dried fish. And dried fish is, as Jeppe would say, it's a vitamin and mineral bump because you have removed the water, so the nutrient contents are extremely high and concentrated. And if you can have production technologies which both produce large fish for income, for sale to urban markets or for export and at the same time have systems that produce small fish for local consumption, especially of the poor, then, of course, you have a much more sustainable system and a system that meets the needs of many.

Pinstrup-Andersen

Is the term "sustainable intensification" used in the fishery sector like it is used in crop production, and is it a relevant concept as we develop aquaculture that is sustainable and takes care of the food safety? Is that an interesting concept in the fisheries sector, or do we just leave that for the cropping people? Does anybody want to address that? Go ahead.

Mathiesen Yes, that's definitely a concept that is being used in aquaculture and within the so-called "Blue Growth Initiative," which is sort of the overarching initiative that we are running in FAO. We have a regional Blue Growth Initiative in Asia which is particularly focusing on sustainable intensification, using the same amount of inputs, same amount of water, same amount of feed, same amount of land to produce more.

Pinstrup-Andersen

And, Jeppe, is this a concept you have ever used or would use?

Kolding I have used it indirectly, because I think we can, as I've tried to explain, already, I'm a firm believer that we can increase productivity in the fisheries a lot. We can increase by change our fishing patterns. I mean, I think we are fishing wrong. I mean, imagine… There's a lot of farmers in this room, or most people here have experience with farming. Imagine that your cow or your sheep or your pig got a hundred thousand small babies, and not only they got a hundred thousand small babies, but these babies were eating each other and the mother were eating the babies. That's how fish live. We would not wait for these small cows to grow up and be big before we took them. We would eat babies, just like we do with plants. We're eating the plant babies whenever we eat seeds of cereals, of corn or apples or oranges or whatever—it's the babies.

So the problem with fish is that they are animals, but they're breeding like plants and they're eating like lions.

[applause]

Mathiesen I'm not saying that Jeppe is wrong, but we are fishing at least between two and 3,000 different species of fish, and we are farming around 700 species of fish. So there is a great diversity in this. And back in Norway and the University in Bergen, I'm not sure that it would be appreciated if Jeppe would start telling the Norwegians to catch the cod when it is about this big. But they all go out and catch capelin when it is about this big, because these are two totally different species, with totally different natural histories; and you have to manage them differently.

And it is quite likely that somewhere in Africa there are the wrong methods with regards to managing these fish, and I agree with them, that the small fish is very important, and how we treat it is extremely important. That's one of the big projects that we've been running there, is to train people in drying fish in a more hygienic and for more food safety kind of a way and by that to increase the value of it by tenfold.

And there is a very interesting sort of a social even familiar story that Shakuntala's boss told us at our Oceans Conference in Washington last year, how you split the big fish in the household, compared to when you're cooking the small fish. So there is a lot going for the small fish, but it's not necessarily a general solution in every instance.

Pinstrup-Andersen

Okay, and as in most other cases when we talk about food security and nutrition, there's a lot more complexity underneath the statement than we have time to make during one hour.

Q&A

Pinstrup-Andersen

We have eight minutes left, and I would like to turn to the audience if there are any burning questions. I have lots of questions I could ask, but I would rather hear from the audience. I don't see anybody at the microphone. If anybody wants to go to the microphone, now is a good time. In the meantime, Shakuntala, you were going to say something about sustainable intensification.

Thilsted Yes, we've heard a lot since we started and from many different presenters about the demand for food and how do we meet the demand in 2030, 2050 with the population growing? Very quickly, the demand is equated with increased production and productivity. I would like us to think much more about using our investments and resources in reducing wastes and losses, rather than jumping first to trying to increase production and productivity. And if we do that, that's going to help a long way into having sustainable food production.

Pinstrup-Andersen

How much are we losing? What percentage?

Thilsted That's again a big problem, because within fisheries, within the fish sector, there's a dearth of data. But just the Chicago Council just put out a report, and they said up to one third of fish is lost.

Pinstrup-Andersen

That's what we found in the HLP Report on food losses and waste, about one-third. Yeah, but is that your number?

Mathiesen I agree, about 40 million tons.

Pinstrup-Andersen

About 40 million tons. How many people would that feed?

Mathiesen [inaudible]

Thilsted But then again, what do you feed. Do you want to feed quantity, or do you want to feed nutrition or quantity? They are two very different parameters.

Pinstrup-Andersen

Absolutely. Go ahead.

Q Keith Fuglie with the USDA. One of the concerns about the growth of aquaculture is that it hasn't really been a substitute for wild catch because of the need to feed the farm's fish with wild-catched [sic] fish. So I was wondering if you could talk about the sustainability issue there.

Pinstrup-Andersen

Okay. Feeding fish to fish. Jeppe.

Kolding That's correct. Initially, when we started aquaculture, we were feeding the salmon in Norway at least with fishmeal from Peru and West Africa. There was a huge uproar around that. So now they are pushing this burden of feeding the fish on land from soil. And that's of course an economic choice. I mean, the fish can tolerate the soil. It's not as happy with soil as it is with wild fish, of course. You have to clean it. But we already have a lot of pressure on land. I mean, we're already… I mean, we're talking about feeding the world and nine billion people, and now we are taking prime soil and giving it to a carnivore. It's a like a farmer came to you and said, "I want to breed lions, and I want to feed it meat and protein." I don't really see the point there. If we want to… I'm perfectly happy with aquaculture, but we can still feed them from the ocean—there's plenty of protein in the oceans that we are not utilizing. We don't have to push it on land.

Pinstrup-Andersen

Okay, and anybody else who would like to… Yes, go ahead.

Q That was actually a very nice transition to my questions. Because we heard a lot about aquaculture, but if we decide to focus on Africa, which has the warmest coast that one can think of, yet the fisher industry is almost absent. And one question I have for the panel is—what can Africa actually learn from a country like Iceland, which has a well-developed culture and industry of fishery to actually exploit those warmest coasts? Because I'm always positive when I travel across Africa, I see European Union and the West Africa, Senegal, I see Argentinian boats in the coast of Angola, the Chinese on the Mozambican side; yet, the continent itself not really fully exploiting what it has, which could actually be a tremendous engine to boost the blue economies and address many challenges facing country within that continent.

Pinstrup-Andersen

Okay. Thank you very much. This is a very important question. We've got 30 seconds to answer it. Who would like to answer it?

Mathiesen Yes. Technology and governance and primarily to make sure that you keep the resources in your own hands. Every successful fisheries country in the world—that's including the USA and including the Norway and Iceland—have kept the resources in their own hands.

Pinstrup-Andersen

Let me just… See, you can't see this, but I can see it, and my time is up. So let me just end this wonderful panel discussion with a plea. From now on, when we talk about how to deal with food insecurity and malnutrition, let's not forget fish. Let's incorporate fish into those discussions. And I am making the same plea to the people who talk a lot about aquaculture fisheries and fish—don't forget that there's life outside of the water. Let's see if we can integrate these things in both ends.

Please join me in thanking the panel members for an excellent presentation.