

## The Big Fish Series

# Is Aquaculture Breaking Into the Global Food System?

Tuesday 30th March 13:00-14:00 (BST)

**Event Title:** Is Aquaculture Breaking Into the Global Food System?

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Further information can be found in the article recently published in Nature 'A 20-Year Retrospective Review of Global Aquaculture'.

### **Audience Questions and Answers**

1. Is Fish In/Fish Out (FIFO) the metric to be used given most academics are using forage fish dependency ratio (FFDR)?

*This was used in the 2000 paper that is built upon. So for comparison the same was used. The use of processing wastes is also discussed in the paper.*

2. And ASC recommend FFDRmeal & FFDRoil to get an accurate dependence?

*Yes, see previous answer.*

*FFDR separates the meal and the oil and can result in double counting. FFDR is a measure of dependence, whereas FIFO is a better measure of efficiency.*

3. Are antibiotics used on commercial fish stocks in the same way it is for land livestock? And if so, do you foresee that antibiotic resistance will be a growing endemic issue in years to come, if not currently?

*We still have poor knowledge about antibiotic use within the aquaculture sector - but many studies are ongoing. Some studies extrapolate use but that can result in a skewed picture.*

4. Forage fish used in fish feed has gone down but fish meal and fish oil use in aquaculture production has increased, so if forage fish aren't being used as much, what are the major sources of the fishmeal and fish oil now?

*Trimblings from fish processing plants (both wild and aquaculture processing) is used more widely in the production of fishmeal now. The data are in the paper.*

5. Are there any successful examples of mollusc aquaculture being able to generate revenue from nitrate credits?

*There have been attempts but this has not played out as expected.*

6. How can supply chains and market incentives better support sustainable aquaculture?

*There has been a large emphasis on certification to incentivise sustainable aquaculture production. But this, as Roz (Roz Naylor – see presentation <https://www.youtube.com/watch?v=wXfmcMKFEvw&t=1s>) outlined, remains limited in its impact on a global scale. This isn't to say that consumers don't demand sustainable products. But these consumers remain relatively limited in number and geographically biased to North American and European markets. How then to enhance support? One major shift for value chains, to more effectively support sustainability, is for markets in Asia to make sustainability demands. There are in roads from ratings and certification. But overall volumes remain limited. Another way for scaling up chance is to shift focus away from market incentives alone and to ensuring there is support by both large companies, but also governments to build the capabilities that sectors (not individual producers) need for improving sustainability performance.*

7. What do you think about the bacteria technology, will this help to solve the aquaculture problem?

*Please see a paper published in the recent issue of the Journal of Shellfish Research by Suzanne Bricker and colleagues on nutrient credits from shellfish aquaculture (Parker and Bricker (2020) Sustainable Oyster Aquaculture, Water Quality Improvement, and Ecosystem Service Value Potential in Maryland Chesapeake Bay. J. of Shellfish Research, 39(2):269-281 (2020). <https://doi.org/10.2983/035.039.0208>).*

8. Actual volumes of fishmeal and fishoil use by aquaculture have flatlined (or even decreased) since 2007, despite that total feed production has boomed to ~60Mtonnes per annum, of which fishmeal and fishoil only contribute 3.5M and 0.8Mtonnes respectively. So given that, how can we say that aquaculture is still "dependent" on these resources? They have a useful niche, but for most species we can fully replace them now IF we have to.

*Aquaculture is still the main user of these resources.*

9. What is the prospect of survival of small scale aquaculture in South, Southeast and African countries?

*I think it is good considering the different values these deliver. Diversity is one of the aquaculture sectors strength.*

*We see small scale aquaculture in a lot of industries as highly persistent. Having said that, it is not a given and attention is needed by policy and governance to ensure that investment etc is maintained that can enable their ongoing persistence.*

10. One of the main questions is what sustainability means. what definition are you using?

*Always an important question. We are viewing sustainability in terms of the resource use in aquaculture— can aquaculture grow without depleting the resource base, including wild fish, on which it depends? We are also looking at the economic sustainability- how economics drives the*

sector in its current direction. Our paper focuses less on the social sustainability, so there is much more to discuss.

11. If you think about the sustainability of aquaculture and inland fisheries. You should look at how your regulatory framework i.e. aquaculture strategy and policy even the capacity building etc.

*In fact, more attention needs to be given to understanding the capability of producers and sectors as a whole to make the changes necessary. This is in some ways an obvious statement, but market and government regulation still work on the basis of punitive regulation and setting often high level standards. Less attention goes to how policies are written, what capacity development programmes are provided etc that are fundamental for regulation and standards to be complied to or reached.*

12. Welfare considerations in aquaculture is a cross-cutting solution for biosecurity, disease, water quality, food security, food safety, etc. Why is aquatic animal welfare not mentioned when we speak of sustainable aquaculture and sustainable fisheries?

*Really good comment and I agree this is utterly important for biosecurity.*

13. How can investment into sustainable aquaculture production be facilitated?

*Internalizing environmental costs and benefits, have strong policies in place that favour sustainable systems.*

*One point is to include the environmental value for extractive species to increase the production interest.*

14. How do you see animal welfare being integrated into the aquaculture industry? What role do you think it will play going into the future?

*It is very likely to play a larger role - especially in terms of slaughter techniques, stocking densities etc. (Organic certifications take these up to some extent). But I suspect that this concern will follow similar patterns to sustainability. Animal welfare is currently growing (albeit from a relatively small market share) in the US, UK and Europe. But for a major, global shift in concern will require the major consumer markets to take this up as a core product quality. Without that demand it won't be an issue that will create wholesale change in the industry.*

15. Also, if you look at African aquaculture and fisheries sector you should look at finance, fish feed plant including raw materials, even hatchery system.

*Enabling funding and access to various resources and infrastructure are all important.*

*Biosecurity and vaccine developments are needed.*

16. With the growth of farmed tilapia in Africa and elsewhere in the world, there has been the rise of Tilapia Lake Virus (TiLV). What measures would you advise for farmers especially in Africa to adopt?

*This is a big problem and besides taking measures at farm level there is a need to find solutions also at higher system levels.*

*I agree, an ecosystems approach needs to become implemented, nevertheless this is technical complex and interaction between stakeholders may bring major difficulties.*

17. Can you speak more to where and how you think technology could have the biggest impact in aquaculture over the next 20 years within the context of aquaculture operations? Is there any role technology could play especially to help prevent following the footsteps and adopting poor practices we have seen in large-scale commercial agriculture?

*My first thought is yes, science and technology has a major role. The development of offshore and large-scale RAS technology is a move in this direction. But on the other hand new issues are arisen that requires demonstration that these new technologies are more sustainable.*

18. What is the prospect of small-scale fisheries in south Africa?

*This is outside the papers focus but an important question.*

19. A lot of the scrutiny on aquaculture is based on looking at its environmental sustainability, and you have mentioned that it is leading the way in many aspects. However, the human sustainability is considered less so (although appreciate it is considered in some of the certifications) - what should aquaculture be doing in terms of improving standards in occupational health and safety within the industry as for many countries (especially developing nations) this area is either not legislated for or poorly enforced.

*This issue has got more focus lately and that is good. Need to look at aquaculture out from a broader social-ecological system perspective. See for example recent paper by Farmery et al 2021 (Anna K Farmery, Karen A Alexander, Kelli Anderson, et al. Food for all: designing sustainable and secure future seafood systems. Authorea. October 20, 2020 <http://doi.org/10.22541/au.160322471.16891119/v1>).*

*The comment is relevant but from my perspective you cannot separate both issues. Environmental effects will hit human health and economy in one way or another.*

*Aquaculture has in fact done better in terms of setting standards (e.g. Aquaculture Stewardship Council, ASC) for social sustainability than a lot of other sectors. There is variation amongst the standards, but in key sectors like shrimp these standards were important when they came along. But as we've seen in many regions around the world social issues are far from perfect. In fact, they are a real concern. Here the market can play a role through standards, but ultimately it requires multiple governance interventions. In Asia we've seen huge change as a result of market pressure, but also pressure through trade agreements (e.g. with the EU and US). Combined these markets can play a role. But ultimately, labour rights and demand for OH&S needs to emerge from the markets in which poor practices emerge.*

20. Should we be concerned that fish is now fed with high levels of rapeseed oil, and possibly less nutrient dense than previous?

*If taking salmon as an example - even if omega 3 fatty acids been reduced when feed formulation changed it is still a product that is rich in omega 3. But feed formula will have an impact on nutrient content.*

21. What about the use and impact on the environment? Is this sustainable?

*This depends on siting, type of species (consumers vs. extractive) and scale. If you assure that you are doing it in a correct way you can have a safe production system.*

*Yes, if done properly. Every form of food production has a footprint, the goal is to minimize that footprint and maximize production. There is also a vast difference between small farms and industrial farms with regards to impacts on the environment.*

*Use of resources in addition to external impacts on the environment and human health. Some of the big impacts include nutrient and chemical loss to the environment, habitat change, species invasions etc. Much more is documented on the marine side than on the freshwater side. Antibiotic use can impact human health.*

22. Will the big fish group focus on the organic cage culture globally?

*Thanks, this is an interesting and relevant area to look at for future events.*

23. Do panellists believe that the consumers need better access to non-bias information about aquaculture in order to drive a demand for sustainable production practices? Or is a top-down approach via governance a better approach?

*I personally believe that education is a strong tool and if consumers understand the processes, they will drive reasonable legislation to simultaneously encourage more aquaculture and protect the environment.*

24. How far can market based-governance (ratings & certification etc) influence behaviour in non-certification centric markets?

*There is minimal growth in market demand I think we can argue. That means, I think, that we have to look for other approaches - especially given 90% of production doesn't cross an international border. Part of this response can remain in and through the market - but pressure is going to have to shift attention from farm level assurance, to area, or regional approaches which focus on establishing durable policies, farmer organisation and conditional finance. Here I think government will also play a key role over the long term in partnership with the private sector.*

*I believe that the market-based governance ratings programs can and do large-scale aquaculture; small-scale growers can use the general principles applied to improve their management practices and these efforts are seen in many small-scale farms globally as it is in the best interests of the growers to use their local environmentally responsibly.*

25. In a recent nature article, it has been claimed that edible food from the sea could increase by 21–44 million tonnes by 2050, a 36–74% increase compared to current yields. But there is criticism of these claims as researcher says this exaggerate mariculture's true potential. This is perhaps because increasing mariculture in a sustainable way is fraught with challenges and farming fish in fresh water is more affordable and sustainable than in the ocean. What is your opinion on this?

*I agree that some projections may not be reached, but I would suggest that for this projections look on the methodology and technical solutions to detect the feasibility of the proposal.*

*That's the theoretical maximum potential. I agree inland aquaculture is more affordable at this stage but I don't think it is more sustainable than mariculture. Freshwater aquaculture is also facing lots of sustainability challenges as well, such as wastewater discharge, so its growth potential is also limited in many countries due to stricter environmental policies.*

26. Fish need nutrients and not ingredients, so is it correct to say aquaculture is less dependent on fishmeal & fish oil when we only look at volumes of ingredients and not their dependence on nutrient?

*The paper discusses fish nutrition requirements and reviews the science in this area. Also look at the scientific citations in the supplementary information.*

27. It surprised me that fish welfare was not addressed in the paper. Yet it has risen on the agenda to become a mainstream topic for practitioners. Is there a reason why it was not mentioned?

*There are several aspects that could not be covered in this review due to space limits in Nature. Social aspects and fish (and not only fish, other organisms deserve to also be considered) were some of these examples.*

28. Globally, small scale aquaculture has the greatest production and environmental impact. What is the role and capability of governments to provide support / outreach vs private sector to improve, when private sector there is highly fragmented and as such low budget.

*A very good point - I believe that education is key here and it is in the best interests of farmers, large and small, to utilize their environment responsibly and sustainably and management practices continue to improve on all scales.*

*Whether small scale aquaculture has the biggest impact depends on your measure of course. Regardless, how to improve capabilities is the key question. We need to move away from setting targets and focusing on regulatory compliance and shift to designing institutions that can support capabilities for change. This means, for instance, focusing on the positive feedback between finance, regulation and market demand (including standards, but also the developmental role that buyers can play). There are in fact some great examples in other sectors of such work - even extending to the furniture making sector.*

29. If nutrients will be prioritized over ingredients, would that affect animal welfare?

*The farmers are seeking optimal feed with best nutritional profile. When changing what is naturally fed by a species and what it is adapted to will imply challenges for optimal growth.*

30. Will the Atlantic Ocean start salmon cage culture in future?

*Seems to focus only on extractive species but I do not know about their plans.*

31. Well, I would say if you look at the African continent, Egypt, Nigeria, Malawi leading this sector, even still 2.5% production level out of global production. Hence, we are driving this sector huge potentiality of African catfish and Tilapia. How can you panellists provide us with any road map to improve this sector. We also assisting by SADC, NEPAD, WorldFish and FAO but eventually not getting any sustainable fruits on the table.

*Further education will help growers on all scales to utilize their environments efficiently and sustainably - but one cannot compare large-scale commercial culture with small-scale and local efforts, the problems, challenges and rewards are all so different.*

*Yes, I think African continent has more growth potential and should learn from Asian countries to avoid the pitfalls and promote truly sustainable systems.*

32. What trends do you see with land-based systems, like RAS and biofloc, in Asia?

*Its happening and I think we can foresee further development in many different countries.*

33. If stronger traceability is implemented in aquaculture, do you think this could do away with the need for certification in supply chains and potentially open up market opportunities for aquaculture producers for which certification costs can be prohibitive?

*Possibly. But, and its a big but, traceability is not necessarily cheaper. The outcome could be a similar pattern as we've seen with certification. The key remains market demand. Who is demanding these systems? Who is going to fund these traceability systems?*

34. With the current situation on certification (3%), what other options to drive real environmental and social sustainability?

*Internalizing the environmental costs.*

35. Take your point about more area-based management - what about scope for regulation of the fishmeal trade? - 'About a quarter of all fish caught globally at sea end up as fishmeal' & this extractive trade supplying global aquaculture is having a particularly detrimental effect on African livelihoods. <https://www.bbc.com/future/article/20210323-the-factories-turning-west-africas-fish-into-powder>

*And all fishmeal doesn't go to fish - pigs, chickens, etc. This all comes into play and it becomes a commodities game. I am keen to see more education at all levels and a continued and escalated effort to help the non-industrial sized farmers improve their situations.*

36. Smallholders have poor linkage with the backward and forward sites of value chain. Do you think smallholders who are mostly producing nutrition sensitive items with minimum environmental footprint can really survive against industrial aquaculture systems?

*Question answered earlier - different systems generate different kind of values. Finding ways for internalise benefits will be important.*

*I sincerely hope so. I want to believe that there will always be a place for the small-scale farmers, and they need our support.*