登壇者への質問 / Question for the speakers	回答 / Answers
1）10%ほどしか漁獲量を増やせる漁業資源がないと言われています。人口増加で予想される増加する水産物消費にどう応えていくべきでしょうか。 2）水産物供給に期待される養殖にあっても、必要な飼料が依然として漁獲物に依存している現状は打開できるのでしょうか。 3）気候変動の影響を受ける海洋生態系の中で、種組成や漁獲量が変化してきている水産資源に漁業者や流通・加工業者はどのように適応していくべきでしょうか。	1）需要と供給の問題で、需要が増加すれば価格は高くなりますので、そうなると今まで直接食べなかったような安い魚の価値が高まり、例えば、養殖の餌となっていた魚、未利用・低利用魚介類が利用されるようになると思います。 2）漁獲物の依存度を低下させる代替飼料の普及や開発は進んでいます。ミール（一部）の代わりに植物性タンパク質、植物油、昆虫などを使っています/研究開発しています。1）とも関係ありますが、養殖の餌（魚）も食用に利用される可能性は将来あると思います。その場合、代替飼料の普及や開発はさらに進と思います。 3）現状の状況をしっかり把握し、また分析し、自然・社会・市場環境順応型経営戦略を展開することが求められると思います。
Aquaculture becomes popular and practiced in many African countries so far , yet most of these countries do fin fish Aquaculture and left behind shellfish. Why is that so ?	
How can we adapt and enhance sustainable development in Small Scale Fisheries and Aquaculture through Sufficiency Economy Philosophy and Regenerative Agriculture/Aquaculture/Ecosystem?	I am not an expert about the concepts you mentioned. But as I understand it, I believe that these are rooted in a common understanding of the virtue of "being contented" and "being moderate". Such virtues are important in ensuring long-term sustainability of resources for future generations. These are especially important for small-scale fisheries and aquaculture which involve the extraction and modification of natural resources and the environment. So, through scientific assessments we can understand the potential limits of the natural system, where we are extracting from. Then, we will be able to recommend the optimal degree of fishing and aquaculture. Such a balanced degree should provide sufficient levels of economic benefits, while ensuring that the system will be able to recover and sustain itself in the long run. In my lecture, I discussed the potential of reducing the number of fishing gears in our study site from an average of 5 units per fisher to only 2 gears. This can be realized because after successful stock enhancement programs, fishers are expected to harvest larger and more expensive shrimps, thereby only 2 gears will be sufficient for them to satisfy their basic economic requirement. These reduction of gears can significantly reduce pressure on the environment and help in promoting the recovery of the site.
Merci infiniment pour cette chance que vous m'accordez à ma modeste personne. J'aimerais savoir quelle formule de composition alimentaire serait le mieux pour l'optimisation de la croissance de nos sujets.（被験者（魚？）の成長の最適化に、どのような配合の食品（飼料？）が最適か、教えていただきたい）	飼料の最適な配合に関する質問と理解します。魚種によってタンパク要求量などが異なりますので一概には言えませんが、肉食魚では飼料内の粗タンパク含量＞40%、雑食・草食魚類では25～30%で対応できると思います。
世界の漁業生産と養殖生産の内訳をみてみると、漁業生産では海水性魚介類が多く、養殖生産では淡水性魚介類が多い。海水性魚介類の需要が多いと思われますが、その養殖生産量が淡水性魚類よりも少ないのは海水性魚類の種苗生産が生物餌料に依存していて、淡水性のものより困難であるからと思われます。このような課題を早期に解決するには、どのようなアプローチが望ましいのでしょうか？	世界の養殖生産で淡水魚が多いのは、中国の淡水養殖が圧倒的に多いためです。 養殖されている魚種はコイやフナ等が大部分を占めています。 これらの魚種は広い池を使って水中のプランクトンや藻類を餌にして粗放的に養殖されています。 また、種苗生産方法は海産魚類に比べて容易です。 海水性魚類の養殖生産量を増やすためには、需要を増やすことが重要だと考えています。 需給のバランスによって需要が少ない魚種は生産量が増えると単価が下がるので、 生産コストを下げることに加えてマーケットを拡大させなければなりません。 日本では、海水性魚類としてブリやマグロ、ウナギ、マダイ等の比較的単価の高い魚類が養殖されていますが、 これらの魚種ではエサに使用する魚粉の確保が大きな問題となっています。 将来の食糧やタンパク供給を考えると、淡水魚のコイやフナ、ティラピアと同じようにタンパク質の含有量が少ない餌（海藻も含めて） でも育つ魚種、低コストで育てられる魚、一般の人が普段の食べ物（加工品としても）に利用する魚種の養殖が必要になると思っています。 「ハレ」の日に食べる魚と「ケ（普段）」の日に食べる魚をバランスよく生産することが重要になると考えています。 海面養殖を拡大すると、糞や残餌による環境への影響を軽減する必要があります。 そのためには、養殖場の場所の選定、沖合養殖などの新たな養殖場の開拓、魚の飼育方法の改良が必要です。
地球規模の温暖化による海水温の異常上昇が長く続くと今後、海の動植物への影響はどの様な事が想像されるでしょうか？	水産資源分布や生産量の変化が起こることが予想されています。より適した温度帯へ移動することが考えられ、浅いところから水温のより低い深いところに、あるいはより水温の低い北方へ移動することが考えられます。また、南方は多種多様な魚介類が生息する一方で、その漁獲量は多くなく、北方の多様性は南方ほど高くないが、漁獲量が多いので、単純に生息環境が北上すると、漁獲量が低減する可能性があります。
八木信行先生に対して，漁獲漁業と養殖漁業の関係について，その生産量のバランスが将来的にどのようになるのか，なにかお考えがありましたらお聞きしたいです。	世界的な生産量として、漁獲漁業については、現在以上の伸びは見込めないと思われます。また養殖の中でも、給餌養殖も現在以上の伸びは難しいでしょう。というのも、エサの多くは天然魚由来のものだからです。しかし、無給餌養殖（海藻養殖や二枚貝の養殖など）は、現在以上に伸びる要素があります。よって、今後も養殖業生産は全体としてのプル可能性があります。
養殖業における飼料の安定的確保は、小規模生産者の多い地域ではどうされているのでしょうか？What is being done to ensure stable feed in aquaculture in areas where there are many small-scale producers?	Small-scale producers are less dependent on commercial feed, as compared to large producers. We have observed, in communities, small-scale producers coming together to form cooperatives to buy feed in larger quantity with lower cost. Next, there is also a global push to replace ingredients, especially fishmeal and fish oil, with more sustainable and cost-effective alternatives such as insects. Lastly, there are initiatives to establish and strengthen circular economies within production systems, whereby resources are better managed, while reducing waste. These actions are already happening to ensure that small-scale producers have access to stable, cost-effective feed for the system.

Whether overuse of chemical fertilizers harms fish population?	陸域から海に流出する窒素やリンは海の生物生産に必須です。 日本では、海水中の栄養塩不足が大きな問題となり、従来の排水浄化の基準を見直して栄養塩を海に供給することが検討されています。 同様に農業用肥料も栄養塩供給の役割を担っていると思います。 ただし、化学肥料の中に魚介類に悪影響を及ぼす物質が含まれていたり、閉ざされた湾内に高濃度で滞留することは避けなければならないので、 研究機関と行政、生産者が協力してモニタリング調査を念入りに行う必要があります。
Is there any possibility of significant changes in fisheries and aquaculture due to climate change?	It is recognised that all food production systems, including fisheries and aquaculture, are currently or will be impacted by climate change. There are documented examples of this occurring for fisheries due to species redistribution, changes in productivity, changes in body size and changes in catch composition. Predicted changes for fisheries due to climate change highlight: Decreases in global fisheries catch potential of between 2.5-5.3% by 2050 although those changes will vary among regions with some regions more impacted (tropics especially South Pacific) and other regions less affected or may even benefit from climate change (high-latitudes). These changes in catch largely reflect the redistribution of species as oceans warm and other physical changes occur (e.g. dissolved oxygen, ice cover, salinity, currents) as well as changes to primary production (especially phytoplankton but also macrophytes). For aquaculture, the effect will differ with the species being cultivated and region of cultivation. Temperature extremes can cause thermal stress but other factors linked to climate change (ocean acidification, harmful algal blooms, hypoxia, salinity, disease and invasive species) also threaten aquaculture. All of these factor threaten production. Adaptation of aquaculture to climate change is critical and adaptation strategies include technological solutions, selective breeding of tolerant strains, management and governance. Some excellent recent scientific papers highlighting the effects of climate change on fisheries and aquaculture are below. Blanchard, J.L., Watson, R.A., Fulton, E.A. et al. (2017) Linked sustainability challenges and trade-offs among fisheries, aquaculture and agriculture. Nat Ecol Evol 1, 1240–1249. https://doi.org/10.1038/s41559-017-0258-8 FAO (2018) Impacts of climate change on fisheries and aquaculture https://agris.fao.org/agris-search/search.do?recordID=XF2018002008
To Pro. Yagi Nobuyuki, Notsuke FCA has planted tree for the aims of maintenance of sea water quality. I heard this is effective(maybe called "Satoumi" "Satoyama"), but are there any clear data that shows improvement of water quality?	Please look at a website <https://fserc.kyoto-u.ac.jp/wp/blog/archives/27640> that explains connectivities among land, river, and ocean.
To Dr. Miyata Tsutomu, Thank you for presentation. In philippines, over fishing leads to poverty. It's very interesting data that tolerance time against the reduction in catch. My question is what is difficulty of introduction of IMTA to natural field. I heard several oraganization progeressing IMTA in some countries. But in Japan, I'm feeling it's slow to introduce. I think the reason of delay is environment(strong water current), technique(maintenace), stock of baby oyster, and law or culture to accept it. What condition is needed to put IMTA succesefully?	Thank you for your commnets and question. Your question may depend on the definition of IMTA. In Mie, Miyagi, and Iwate prefectures, shellfish, seaweed, and fish aquacultures are conducted in a bay, and I think it is IMTA. Finfish aquaculture puts a huge burden on the environment, so it is necessary to conduct seaweed and shellfish aquacultures on a huge scale in a bay, which would be difficult to conduct IMTA for a single individual farmer. The majority of aquaculture farmers in the three prefectures are family-owned scale, and such a large-scale IMTA is not feasible for the farmers. In the case of IMTA in a bay, flow of water is important, thus the farms are limted. However, there are not big issues on technique(maintenance), stock of baby oyster, and law or culture to accept it.
to the last speaker, would you also consider habitat rehabilitation to facilitate stock recovery in addition to stocking of farm raised juveniles?	Definitely, yes. Habitat restoration can be a part of a series of interventions to ultimately restore a given area to be self-sufficient, depending on the baseline state. In areas that are not heavily modified, simple fisheries management may be sufficient to sustain the resources, and stock enhancement may not even be required. However, in heavily-modified areas like when nursery grounds have been transformed (such as the case in our study site where natural mangroves have been converted to fish ponds), natural recovery of stocks will be difficult and may require assisted stock enhancement by releasing hatchery-reared juveniles. But the restoration does not stop there, because stock enhancement is only an intermediate solution and cannot be done forever. In the long term, habitat rehabilitation and restoration are needed to slowly bring back the natural nursery grounds (like the mangroves in our site). Only when sufficient environmental restoration are made can the stocks naturally recover as well.
To Dr. Altamirano - with the site specific and species specific assessment approach how is it possible to understand the impact to other species and other places because the impact to that particular site may also affect other sites? Wouldn't it be important to also understand the effect to other species and sites as well?	The site-specific and species-specific assessments are important in understanding the needs of both the target species and the target site BEFORE the actual stock enhancement activities. Now, monitoring of impacts is a different story. You are correct that these impacts will be in a much broader sense and scale. So, I agree that impact monitoring should be done in as varied as possible in terms of species and as wide as possible in terms of site. In our study (although I did not not have enough time to show everything during the symposium), baseline assessments and impact monitoring are not only limited in terms of biological and environmental aspects, but also needs to take into account the social, cultural, economic and governance aspects of the site.
To Dr. Shakuntala Thilsted - I have question regarding the cultural acceptability. (1) I wonder with the agenda of increasing fish consumption is it possible to extend the cultural acceptability to different communities in order to increase the diverse consumption of aquatic foods? if so, how should it be done?	All approaches have to be context-specific and culturally acceptable. However, it is not impossible to extend the cultural acceptability to non-traditional consumers. This can be done through several strategies. Firstly, we can work with chefs and nutritionist to design new recipes, or adapt traditional recipes, to include fish and other aquatic foods. Next, we can strengthen nutrition messaging across various channels, including to healthcare centers and schools, to affect consumer behaviour and demand for fish and aquatic foods in the diets. Lastly, we can incorporate social behaviour change communication strategy across various levels – household, community, sub-national, national and global levels – to increase acceptability to diverse aquatic foods.

(2) How is the cultural acceptability defined for global food system that is very diverse?	We must acknowledge that the global food systems are diverse – made up of many components and influenced by many factors, including people and culture. There is no 'one-size-fits-all' approach or definition for global food systems and cultural acceptability, but it should be embedded in holistic global food systems transformation to reflect diversity and inclusivity.
To Pro. Morioka Shinsuke, Thank you for presentation. I realized that value of SIF(Zako) especially in the aspects of nutrition. But it seems taking time to establish status of SIF in market because main fish for consumption may be Tilapia or Carp, sea water fish in each countiries. I have question or suggestion; ornamental fish(like Gourami) can be SIF? They can have two aspects; foods and pets. So market is not only for foods, but also for pets in domestic or other countries. It can be alternative income.	ベトナム・タイ・カンボジアでは、小型魚類食に関する文化は特に地方部で濃厚に残されています。言われる通り、メジャーな食品魚としてはナイルティラピア・マゴイ・ハイブリッドヒレナマズが目立ちますが、小型魚にも市場性は残されています。栄養に関する啓蒙（小魚食によるミネラル・ビタミン摂取増による効能→幼児成長不良/女子貧血率の改善）が今後進めば、市場価値は徐々に高くなるものと期待します。 観賞魚についても良い考えかと思います。希少性が高く観賞魚としてのポテンシャルを有する小型種の増養殖は我々も検討しています。