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Are marine conservation and sustainable food production on a collision course?: Experts respond

In the previous edition of MEAM, Jake Rice, Chief Scientist with Fisheries and Oceans Canada, presented a bold argument. He suggested there is an "inseparable tripod of issues" facing marine resource management -

- Aquatic biodiversity conservation;
- Sustainable fisheries and aquaculture; and
- Poverty alleviation and food security amid a changing climate

- and that these issues are effectively on a collision course ([Letter to the Editor](#), MEAM 7:1).

The strict harvest reductions that are needed to rebuild fisheries, said Rice, will be devastating for global communities dependent on fish protein and fishing income. At the same time, pressures from population growth and climate change will lead to even greater dependence on protein from capture fisheries and aquaculture. As a result, social and business pressure against biodiversity conservation efforts like MPAs may increase. According to Rice, painful choices are going to need to be made among these issues, and discussion of those choices has been lacking to this point.

At MEAM, we agree this issue needs serious dialogue. We asked a diverse group of marine experts whether they agreed with Jake Rice, and if they did, what policies they would suggest implementing to address the conflict. (If they did not agree, we asked them to explain why.) The responses were provocative and highlighted a variety of facets of this issue, including the increasing importance of aquaculture to global food sustainability and the relationship between conservation and food security. While there are no quick fixes to this issue, the respondents suggested several possible policy solutions and next steps. Their responses follow:

Need, greed, and speed: We have to face the reality of human systems

By Meryl Williams, Director, AsiaPacific-FishWatch (asiapacfish.org)

Jake Rice is essentially correct. As he implies, the conservation movement tends to promote desirable win-win solutions where resources, biodiversity, and people's needs are all met by magic bullet interventions, such as marine protected areas, or using poles and lines rather than fish aggregating devices. In reality, trade-offs may be more the norm than win-win.

But even if we did have a good set of win-win options, the crisis would still exist. At the heart of the problems of sustainable food production and marine conservation is not just the increasing human population, but the other drivers of exploitation with which conservation has to battle or work. If we only wanted enough fish to eat and to make a reasonable living fishing or fish farming, then we might have more win-win scenarios. However, the drivers of marine resource exploitation are more complex than these simple basic needs, and have been so for millennia.

I caricature the drivers as need, greed, and speed (www.slideshare.net/Genderaquafish/need-greed-and-speed-what-history-tells-us-about-fisheries-and-aquaculture). "Need" includes the demand for food, employment, income, tax, rent, and social and moral status. "Greed" includes wants, market demand, profits, and market control. "Speed" can refer to competition for resources and technology innovation that increases harvest rates, productivity, and economic efficiency. Sustainability and conservation are relatively more recent drivers, sometimes protected by government, community and company norms, and typically advocated by activists and scientists on the basis of principle and knowledge.

The conservation movement must look more deeply at the human drivers and the human systems within which they work. Advocacy and public education will only go so far. Exploitation and policy-making respond much more to the need, greed, and speed drivers than to future sustainability visions.

Increase investment in spatial marine protection/management and the collaborative process

By Katherine Short, Principal, F.L.O.W Collaborative, a sustainable fisheries organization in New Zealand

Dr. Rice highlights several critical challenges, and I agree with his concluding "inseparability of: poverty alleviation and food security in a changing climate; sustainable fisheries and aquaculture; and aquatic biodiversity conservation." Further I agree there are no easy solutions and many hard choices.

I take issue, though, with the subtle undermining of those promoting spatial marine protection (NGOs) and how his letter appears to create divisiveness where none need, and in many cases does not, exist. In fact, many of the international policy-makers (government) and planners to whom Dr. Rice refers strive to overcome these divides through compromise and adaptability that enable progress and workable outcomes. For example, fisheries entering Marine Stewardship Council assessments are in a standardized process, but the many models of fisheries improvement leading to that require huge stakeholder adaptability.

Dr. Rice is a long-standing, influential, senior, government, fisheries scientist who has seen - too often no doubt - the negative impacts of "us and them". As I have written about ecosystem-based management frameworks, there are commonalities throughout that are important to identify to deliver wins for the marine environment and associated communities, including increasing aquatic protein. To achieve these multiple results, increased investment in the full range of measures, including both spatial

protection and management, and in the underpinning collaborative process is essential. However, Western definitions determining optimal fishery economics can undermine decision-making by those most directly associated with fisheries, particularly in developing countries. Although mistakes are made, we all have to consciously learn from them. Surely this is one way that the painful decisions mentioned can be addressed?

Excerpt from comments of Christophe Béné, Research Fellow at the Institute of Development Studies (www.ids.ac.uk).

See his full response at <https://www.openchannels.org/node/4226>

In his analysis, J. Rice stressed some important points that are worth reiterating. First, the over-simplistic narrative according to which food security is ultimately a resource conservation issue. As we all know, marine resource sustainability is a necessary but far-from-sufficient condition to ensure food security. Other critical aspects related to distribution and governance are also essential, a point that big philanthropic conservation organizations too often choose to ignore. It is indeed (politically) easier to fight for the protection of fish resources than to address the reasons why the rent generated by the exploitation of these resources does not benefit the local population who initially depended on these resources for their livelihood and food security.

Second, he recalls that fisheries governance reforms have so far been generally justified from an economic and ecological perspective, but failed to account for the social dimension that is again often conveniently eluded in these documents by sentences like, "It will be important to analyze potential impacts of policy change and to identify mitigating measures as necessary" - see discussion in Institute of Development Studies Policy Brief 40 ([http://www.future-agricultures.org/publications/research-and-analysis/policy-briefs/doc_download/1417-caadp-and-fisheries-policy-in-africa-are-we-aiming-for-the-right-reform\[SC1\]](http://www.future-agricultures.org/publications/research-and-analysis/policy-briefs/doc_download/1417-caadp-and-fisheries-policy-in-africa-are-we-aiming-for-the-right-reform[SC1])). Yet as we showed in a recent study (<http://onlinelibrary.wiley.com/doi/10.1111/j.1467-7679.2010.00486.x/abstract>), the social costs of implementing these global reforms would far exceed the economic benefits that one could (in theory) expect to generate from unconditionally implementing these reforms.

Open ocean aquaculture can fill the void

By Neil Anthony Sims, Co-founder/CEO, Kampachi Farms (www.kampachifarm.com) and President, Ocean Stewards Institute (oceanstewards.org)

Dr. Jake Rice laments the incompatibility of marine conservation and sustainable food production. Well, that holds true only if you consider seafood production as an extractive industry. Think of it as nurture, and the possibilities are manifold.

As Dr. Rice says, we face challenges from climate change, declines in grain production, and resulting limitations on the practice of livestock farming. If we are concerned about the former two issues, then we shouldn't even want the latter. Terrestrial livestock is an inefficient use of agricultural proteins and oils, and adds greatly to greenhouse gas emissions. Conservation International's *Blue Frontiers* study (2012; www.conservation.org/publications/Pages/blue_frontiers_aquaculture.aspx) had it right: aquaculture should not just meet the shortfall, but must instead start to supplant terrestrial animal proteins.

Our company - and other researchers - have recently been able to culture high-value marine fish on zero-fishmeal diets. Monitoring and modeling demonstrate that further offshore, in deeper water, aquaculture's impacts on water quality or substrate health are literally undetectable. New robust mesh materials on net pens now reduce to *de minimus* escapement or entanglement concerns.

Open ocean aquaculture can also be a conservation tool, providing structure and nutrients that stimulate productivity and foster biodiversity in the blue desert. Responsible aquaculture could have synergies with marine protected areas and supplant Dr. Rice's feared lost seafood production and "economic displacement", from the fishing "harvest reductions needed for rebuilding."

And once geneticists turn their attention to gene-splicing *E.coli* to bio-digest macroalgae, then ocean afforestation could become commercially viable - providing food, feed and fuels, and countering ocean acidification naturally. This would use the twin engines of the profit motive and primary productivity to pull CO₂ out of surface waters.

Expand participation in this discussion and look for truly creative solutions

By Bonnie McCay, Professor, Rutgers University, US

The "inseparable tripod" described by Jake Rice and supported by several global-scale studies calls for difficult, indeed painful, choices among sustainable production, food security and livelihoods, and biodiversity conservation. Deliberations at the level of the UN, nation-states, even MEAM are needed. But we should not forget how essential it is to expand participation in these discussions to fisherfolk and others on the front line, and to seek a larger and more diverse set of approaches to the problem.

Just one example comes to mind: how can local fishers accept the need for cutbacks in catches of overfished or threatened species as a tradeoff for future improvements in harvests, when they lack secure rights to future harvests? The only "standard" answer to this question now in marine economics is privatization of fishing rights, through individual transferable quotas. However, that solution can jeopardize the futures of poorer and smaller-scale fishers, the ones for whom livelihoods and food security are most at stake. What alternatives can they, and we, come up with? Some sort of community-based tenure might be an answer. But the general point is the need for truly creative and participatory deliberations on this most serious set of questions.

Fish aggregating devices and marine spatial planning offer opportunities to reconcile agendas

By Johann Bell, Principal Fisheries Scientist - Climate Change, Secretariat of the Pacific Community (www.spc.int)

I agree with Jake Rice! We must reconcile the agendas for food security and biodiversity conservation. Compromises will be needed on both sides - the challenge will be to minimize these compromises.

As populations grow, we will need new systems for managing coastal ecosystems. We will have to intervene in the management and allocation of natural resources on unprecedented scales, and in ways that are resilient to, or preferably enhanced by, climate change.

The use of fish aggregating devices (FADs) anchored in deep water close to shore in many Pacific Island nations is a potent example of such "win-win" interventions. Inshore FADs increase the access of rapidly growing coastal communities to the rich tuna resources of the region (projected to become more abundant around some islands as the climate changes), thereby creating the opportunity to increase fish supply while reducing fishing pressure on coral reefs.

Expanding the vision for marine spatial planning (MSP) promises to be the most powerful way of reconciling the agendas for food security and biodiversity conservation. Practical zoning schemes are needed to allocate the use of coastal waters for both purposes. MSP must strive to reduce any effects of land use on coastal ecosystems, limit negative interactions between zones allocated for different purposes and capitalize on potential synergies between activities in different zones. It is also clear that zoning schemes need to match national needs and will differ among countries - more space will need to be allocated to food production in developing than in developed nations.

Intensify investment in sustainable aquaculture

By Mark J. Spalding, President, The Ocean Foundation (www.oceanfdn.org)

Fish are the last wild animals that we humans hunt at a global commercial scale. Those who believe we can both maintain global scale commercial catch of wild fish and sustain marine biodiversity are sadly mistaken. We, the broader marine fishing, philanthropic, and non-profit communities, need to be realistic about the real choices we face, including about the 15% of the world's population that depends on seafood to meet its protein needs.

Marine fishery management schemes have an uneven, mostly poor, track record, ignoring science at the expense of long-term fishery sustainability. The recent World Bank *Sunken Billions* report (<http://siteresources.worldbank.org/EXTARD/Resources/336681-1224775570533/SunkenBillionsFinal.pdf>) implies that reducing waste in wild fisheries catch could meet more of the need - an admirable strategy, but dependent both on smoke and mirrors. The global fishing industry is overcapitalized and way over capacity. There is no real political will to implement any kind of moratorium at a scale that allows the ocean's biomass to recover.

Aquaculture now provides more than half the seafood consumed globally. UN FAO says aquaculture must grow by 10% a year just to keep up with population growth, which does not consider the need to balance the negative effect on wild fisheries of changing ocean temperatures, chemistry, and depth.

Food security underpins all other security. Decentralized aquaculture production reduces vulnerability to multiple stressors from climate change and other instability. We must intensify our investment in technologies with which even wild fishery-dependent communities can produce some fish on land sustainably. For those of us with a choice, the aquaculture choice can and should be made today. Healthy ocean animal populations should be the goal for our legacy, not a temporary solution for human food security.

Good governance can maintain fisheries, and aquaculture can meet increasing demand

By Modadugu V. Gupta, World Food Prize Laureate and Former Assistant Director General, WorldFish Center

I do agree with Jake Rice with respect to the situation as it exists and is laid out by him, but I am not as pessimistic as he is. We need to think of a way that will not further exacerbate the loss of biodiversity or alleviation of poverty and food security. We may not be able to restore stocks to levels that can produce maximum sustainable yields by 2015 as suggested by the World Summit on Sustainable Development in 2002 - that would imply substantial reduction in fishing pressure and/or banning fishing during certain seasons or geographical areas. In spite of the alarming situation not only with regard to marine but also freshwater stocks, some progress is being made in reducing fishing pressure and restoration of over-exploited stocks (such as implementation of the Code of Conduct for Responsible Fisheries, etc.).

In India, for example, there are indications of recovery of inshore stocks to some extent with the implementation of a ban in recent years on fishing inshore areas for a period of 45 days coinciding with the breeding period of fish. With needed policy implementation and strong political commitment and good governance at local, national and regional level, it should be possible to maintain at least the present level of about 80 million tons from marine capture.

Production from aquaculture, which is increasing at a faster rate than human population growth, should be able to meet the demand from increasing population in the near and medium term. More data/information is needed on the impact of climate change on marine fisheries.

Conserving biodiversity promotes adaptive capacity

By Tim McClanahan, Senior Conservation Zoologist, Wildlife Conservation Society (www.wcs.org)

Social and ecological adaptive capacity needs to become the emerging management paradigm to navigate the coming collision of food security and biodiversity conservation. Diversity is a key element of adaptive capacity and supports food security particularly when the climate is changing - diversity creates the portfolio for adaptation. Increasing climate uncertainty and risk require the potential to respond, provided by a fully diversified portfolio of social and biodiversity assets. Social and ecological adaptive capacity contains the elements of assets, organization, learning, and flexibility. Ecological diversity is also linked to social assets, in that it provides flexibility and even the ability to learn as people find uses and rely on ecological services as conditions change. Consequently, human food security requires biodiversity.

A recent study of social and ecological adaptive capacity in Kenyan fishing communities showed reduced vulnerability to climate change among communities living adjacent to national and community closures (www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0074321). So while there is a potential collision, their reconciliation is critical for adaptation. Communities that make the sensible choices to protect biodiversity are going to reduce their vulnerability and fare best as climate change creates new risks and challenges. Those not recognizing how climate change requires adaptation and the management of a full adaptive capacity portfolio will find the future more challenging to navigate.

No-take marine reserves are effective tools for fisheries management and conservation

By Angel C. Alcala, Chairman, Silliman University Angelo King Center for Research & Environmental Management (Philippines) and Garry Russ, Professor, James Cook University (Australia)

We disagree with Jake that food production and marine biodiversity conservation are on a collision course. Our long-term studies of two Philippine islands, Sumilon and Apo, show that no-take marine reserves are effective tools for both fisheries management and biodiversity conservation in developing countries heavily dependent on reef fisheries (Alcala and Russ, 2006, "No-take marine reserves and reef fisheries management in the Philippines: a new people power revolution," *Ambio* 35(5):245-254).

Through sustained protection from fishing by empowered local governments and local communities over the years, the biomass of targeted fish in the no-take marine reserves (25% of Sumilon fishing area and 10% of Apo fishing area) was enhanced significantly. A parallel trend of increasing fisheries catch outside of reserves was seen at Sumilon but not at Apo, which showed a stable fish catch over 18 years. Areas outside of no-take reserves were fished using traditional, non-destructive fishing gears and were also protected from physical disturbance.

The mechanism we proposed to explain the increased or maintained catch levels outside these reserves in 2005 and 2006 was spillover of adult fish from reserve to fished areas. We have recently been able to show a second mechanism of positive connection between no-take reserves and fished areas in the southern Philippines - export of larval fish, with subsequent potential increases in recruitment to reef fisheries caused by no-take reserves. However, typhoons occasionally hitting the two islands could negatively affect food production at the islands. One of them (Apo) was affected by a typhoon in 2012, destroying the no-take marine reserve. Post-typhoon observations indicate that some reef fish moved to areas of the island unaffected by the typhoon.

How much biodiversity is enough?

By Ian Perry, Research Scientist, Fisheries & Oceans Canada

Jake Rice correctly identifies three critical challenges for marine ecosystems and their management: human food security; sustainable fisheries and aquaculture; and the conservation of biodiversity. He further notes that these intersecting challenges will be made more severe as a result of climate change. A theoretical optimum for the supply of fish to ensure food security, the amount of fishing to ensure sustainable fisheries/aquaculture, and the amount of biodiversity to ensure production of ecosystem goods and services, can probably be calculated (e.g., for terrestrial systems, see <http://predicts.org.uk>).

But what Dr. Rice has pointed out is the (likely very large) gap between achieving such an optimum at some point in the future versus the need for people to feed their families today. This is a problem of intergenerational discounting, in which today's needs outweigh future needs. In short, these three critical issues are approaching us on different time scales: food today versus consequences of biodiversity loss in the future. This is a social-ecological systems problem, which requires a solution that goes beyond ecosystem-based management thinking to fully involve people. Hard choices will need to be made.

However, if today's world leaders cannot agree on goals to mitigate the (perhaps more obvious) threats of climate change, then human food security and marine biodiversity

conservation are indeed on a collision course, in particular when the question of "How much biodiversity is enough?" is not resolved. This is an issue that should be addressed by the new Intergovernmental Platform on Biodiversity and Ecosystem Services (www.ipbes.net).

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