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Sustainable Aquaculture in the North Central Region U.S.—A Review of Perceptions and Recommendations from the Aquaculture Community

Abstract

Aquaculture remains the fastest growing food commodity in the world and is expected to have an important role in food security in the future. However, for the aquaculture industry to grow, it must do so in a sustainable manner. From an Extension standpoint, this presents many challenges. This article discusses the concept of sustainable aquaculture and how it is perceived regionally and presents a model that allows for increased focus towards three principle components: environmental conservation, social benefits, and economic viability. This article seeks to help further dialogue towards sustainable aquaculture and other industry development in the U.S.

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Introduction

The Food and Agriculture Organization (FAO, 2005) of the United Nations defines sustainable development as follows:

> The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Such sustainable development conserves (land), water, plants and (animal) genetic resources, is environmentally non degrading, technologically appropriate, economically viable and socially acceptable.

This definition has roots with similarities to the work of previous authors (Feenstra, 1997; WCED, 1987), but for sustainable aquaculture advocates it is a rather ambiguous and difficult message to

disseminate to, and find commonality among, the general public, members of industry, and state and federal agency personnel. Whether one believes aquaculture development is more likely to greatly improve or threaten human security as debated in Hughes and Rose (2011), the following points are hard to dispute:

1. Food and water resources around the world are approaching critical limits;

2. Farm-raised seafood is undoubtedly going to play a major role in meeting future protein demand for human consumption; and

3. U.S. aquaculture remains at a mere 1% of global production.

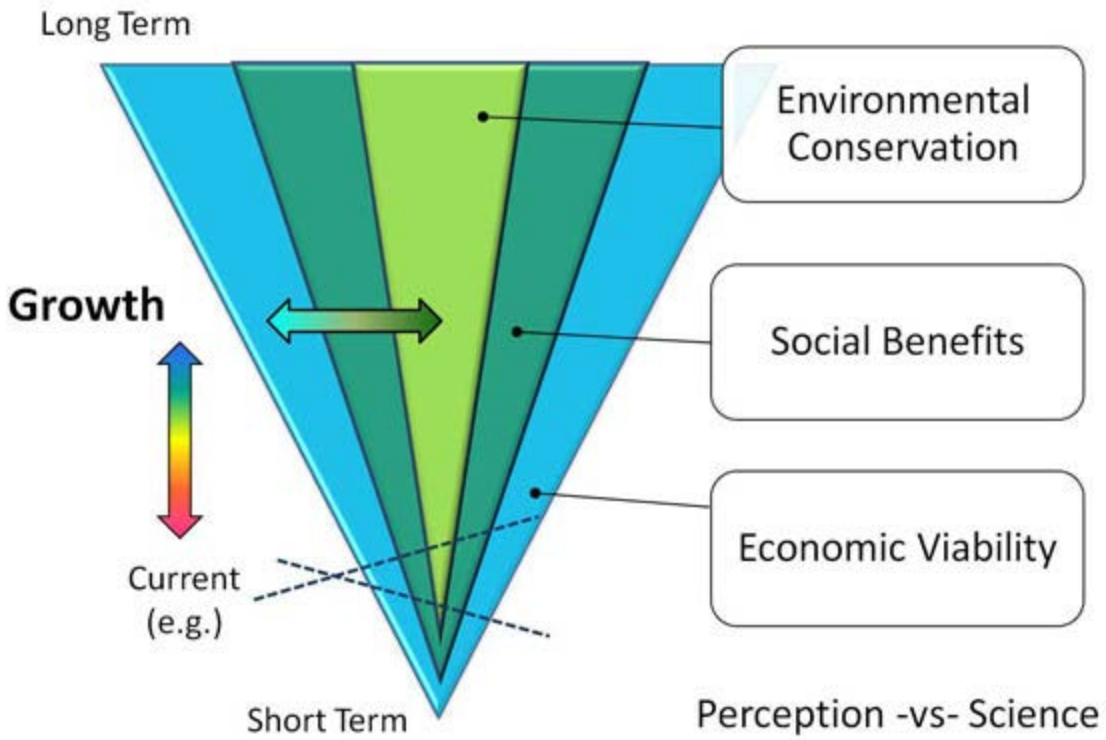
It should be becoming obvious now to most Americans that future investment towards U.S. aquaculture is extremely important, if not ultimately crucial. However, resource vitality is highly dependent upon human manipulation and social response. Thus, it should be just as obvious, if not more so, that for industry development of any type to occur, it must do so in a socially acceptable and environmentally sustainable manner. This article discusses the concept of sustainable aquaculture and how it is currently perceived by the author and the aquaculture community in the North Central Region (NCR). The intent of the article is to help further dialogue towards strategic planning needs of a sustainable aquaculture industry in the NCR; however, this discussion is also applicable to industry sector development in general.

Addressing the NCR Aquaculture Community

From February - March 2012, a workshop-style discussion on sustainable aquaculture was presented at state association meetings in Kentucky (tri-state conference with OH, IN, and KY), Michigan, and Missouri. In the presentation, a preference for using the term "sustainable aquaculture" rather than "aquaculture sustainability" was brought forward. Sustainable aquaculture better describes a proactive effort: (to make) *sustainable* (for) *aquaculture*. Adding the word "practice" at the end also implies application—as in *sustainable aquaculture practices*. Also during the workshop, a graphic model was presented showing an interpretation of sustainable aquaculture (Figure 1).

Figure 1.

Conceptual Representation of Sustainable Aquaculture



It seems intuitive that sustainable aquaculture would include a temporal association: from say short term (today), to a much longer time frame (10-20+ years). Also, from definitions for sustainable development across different industry sectors (FAO, 2005; Hansmann, Mieg, & Frischknecht, 2012; Konovalchuk, Hanson, & Luloff, 2008; Kates, Parris, & Leiserowitz, 2005), we can identify three critical accomplishment areas that sustainable aquaculture must strive to achieve: environmental conservation, social benefit, and economic viability.

Taking this further, we then should try to address the following two points: 1) who actually is in position to determine what "sustainable" achievement levels truly are, and 2) what basis should be used to make such determinations? The answer to the first question is made clear in Figure 1. Advocates for environment conservation, society as a whole, and facility and finance partners must benefit overall from sustainable aquaculture practices and development. Therefore we can reason that pretty much every stakeholder on the planet should have equal opportunity to establish criteria for sustainable aquaculture. Due to vast (extreme) differences in opinions across stakeholders, we can conclude that consensus will be difficult if not impossible. Unfortunately, it appears to be this very point that is derailing efforts for aquaculture promotion in the U.S.

I propose that we can simply continue forward with the understanding that criteria of, and achievements towards, sustainability will be based on varying individual preferences and principles. Thus, as a partial answer to question 2, we should anticipate that the basis on which sustainable aquaculture will be measured for acceptance will be through a wide range of perceived attitudes and ideals intermixed with science. We should also keep in mind that attitudes are likely to play as important a role as sound science in the positioning and acceptance for a growing sustainable aquaculture industry in the U.S.

It is also important to remember that environmental policy in the U.S. is often dictated on the premise that restriction is the best approach to prevention. Developmental strategies must therefore

anticipate and account for the likelihood that regulators will attempt to employ increasingly restrictive measures on the industry, regardless of rights in commerce or the actual effectiveness of a regulation. It is much more difficult, however, to impose potentially unjust and ineffective regulations on a sustainable activity. Hence, one could make strong argument that perhaps the best way to shift regulatory control from that of *restriction* towards *promotion* is through increasingly more proactive efforts by industry supporters in sustainable aquaculture development, practices, and promotion.

Finally, considering the discussion points above, we should expect progress towards sustainable aquaculture to be a moving target and likely to change over time. For example, on any given day (see "Current" position and arrows in Figure 1), a commercial fish hatchery will most likely have a different set of sustainability values than a state or federal facility, local community, or environmental group. Moreover, even individual groups should be expected to adjust personal values under varying circumstances (e.g., economic hardship). If an economic crisis cannot be avoided today, there is no way to improve upon environmental conservation or social benefits believed necessary tomorrow.

One last point worth mentioning in regards to Figure 1 is that this interpretation makes no reference to the "technological appropriate" wording in FAO's definition for aquaculture sustainability. Certainly technology is destined to play a big role in sustainable aquaculture development. I caution, however, that those who believe that sustainable aquaculture must utilize leading research technologies and high capital investment reuse systems. At the present time, based on the model presented here, what would be considered more sustainable on large commercial scale: a cage culture system raising salmonids, pond system raising catfish, indoor recirculation system raising yellow perch or tilapia, or urban aquaponics? I strongly believe each of these examples has sustainable attributes. However, the most important message to carry forward is that in order for aquaculture development to remain sustainable, each and every facility and the aquaculture community as a whole must strive to address all three principle accomplishment areas over the long term: environmental conservation + social benefits + economic viability.

Input from the Aquaculture Community

Perceptions and recommendations regarding status of sustainable aquaculture in the NCR by individuals attending the 2012 aquaculture association meetings in Kentucky, Michigan, and Missouri are provided in this article. This workshop exercise was intended to provide an example of how to establish sustainable goals and objectives on a farm-by-farm basis by making similar lists. Judging by the responses from attendees, it appears that collectively the NCR aquaculture community has a good grasp on sustainable aquaculture issues.

Audience responses to the questions posed during three state association meeting activities are listed in Tables 1-5.

Table 1.

Participant Perceptions of Sustainable Aquaculture

What does Aquaculture Sustainability mean to you?	Sustainable aquaculture is important for my business because…	Sustainable aquaculture is not important because…
Responsible use of natural resources Economic success Human and environmental interaction Social benefits	Expansion difficult w/out positive perception Protect environment	It is cost prohibitive
Keep it going Renewable resources Minimum environmental impact Cost effective Local resources	Economics Profit Jobs Family employment and keepsake Locally made Keeping US profitable Protection against regulations	Depends on definition Depends on views of local populations Cost effectiveness with fuel costs I do not put pressure on resources
Low energy use Conservation of waste Sourcing local produced feed Reducing fish meal Renewable inputs Environmental protection Economic viability	Market demands it Decreased feed costs, transportation costs Long term feed availability/dependability Public perception Return on investment We need to consider a balanced environment	Expensive Consumers only care about price Certification requirements are not relevant, inconsistent, and often unachievable False labeling reduces impact of sustainability Energy is affordable, therefore, not as important

Buy local Reduce pressure on wild stocks Low environmental impact ∘ Ecological (invasive species) ∘ Waste Safe food Education of public Involvement of the business community Development of infrastructure Simplicity	Sustainability adds value Adds to the overall positive perception of the entire aquaculture industry Supports additional research and development Provides better opportunity to secure financing Law requires it/regulations Fully using your inputs/co-products (green)	

Table 2.

Participants Were Asked to Identify Short- and Long-Term Economic Benefits They Hope to Achieve at Their Facility

Economic Benefits: Short term	Economic Benefits: Long term
Food on table Jobs Exposure to product Pay bills (feed)	Maintaining what works Learning curve value of knowledge Profit Investment for future (research) Stability Jobs

Increase profit Market growth Demonstrate quality Healthy product Employment	Increase profit Market growth Demonstrate quality Healthy product Employment Business and industry growth Decrease imports
Jobs Consistent fingerling availability Waste reuse Vertical integration Premium pricing Premium quality	Reasonable regulations Fair trade policy Genetic improvement Species specific feeds New species Disease resistant feeds New product identity Learn from hog industry Consumer education Economies of scale Financing Fish CAFOS Labor force

Table 3.

Participants Were Asked to Identify Short- and Long-Term Social Benefits They Hope to Achieve at Their Facility

Social Benefits: Short term	Social Benefits: Long term
Jobs Community tax base Education Charity donations Community value	Human health Education Save wild fish populations Attitudes Water resource Better jobs More jobs Political support
Maintain current employment Add jobs on farm Add jobs to supply chain Diversity economy Healthy product Reduce obesity	Conservation of resources Human health Recreation Agro-tourism
Improve nutrition of consumers Reduce effluents Increased productivity Provide jobs Provide education Decrease reliance on imports Provide safe/healthy foods	National security Food security Healthier population Reduce health care costs Maintain family farms Job security Promote private enterprise Reduce national seafood deficit

Table 4.

Participants Were Asked to Identify Short- and Long-Term Environmentally Sustainable Practices They Hope to Achieve at Their Facility

Environmentally Sustainable Practices: Short term	**Environmentally Sustainable Practices: Long term**
Filling out water use reports Industry image Freedom to operate Public perception of product	Local water quality Freedom to operate Waste management
Save energy Reduce fuel use Conserve ground water Reduce operation costs	Less emissions Meet customer demand More protein out per unit area
Pay no fines No neighbor complaints No discharge/eliminate effluents Freedom to eliminate predators? Alternative energy	Reduce impact on wild fish Increase wild populations Lower disease incidence Develop realistic alternative energy Maintain environmental resources Reduce imports Sound science conservation and education Maintain environmental services (e.g., utilizing wetlands for waste management)

Table 5.

Participant Recommendations for NCRAC Extension and Research Programs for Promoting Sustainable Aquaculture Development in the Region

Recommendations from states to NCRAC regarding sustainable aquaculture development
Responsible practices realistic expectations Unified regulations Operating as a region Reliable studies and sound science BMPs Stewardship More discussion Research for quality farm products nutrition Financing Farm succession Economically sustaining
Inform public through education and other means Limit frivolous governmental regulations Think about what we say and see in terms of business Get more involved
More funding Education/lenders, environmental groups Establish a self-policing organization (i.e., regional certification program/enforcement program/inland water stewardship programs)

Promote science-based information about aquaculture

Need for liaison to interact with environmental groups

Future Work Planned

The next step planned for this project is to seek regional consensus as to how we might effectively promote or improve development towards sustainable aquaculture. Two big questions that come to mind are: 1) is aquaculture in the U.S. being adequately promoted, and 2) how might we collectively improve conditions such that we can confidently promote sustainable aquaculture in the NCR?

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