More information:

Stephen G. Newman Ph.D.
President and CEO
AquaInTech Inc. USA
Web: www.aqua-in-tech.com

Aquaculture is agriculture in water based ecosystems

Global production of protein from aquaculture has increased between 5 and 10% per year for the last few decades with no immediate end in sight. There are many reasons for this although some would argue that this growth is occurring in spite of how things are being done and that it is far from sustainable. A number of NGOs have appointed themselves as experts and there are a number of programs that claim, if they are followed, to lead to true sustainability. Much as the term organic is bandied about as if it actually means something (it has a legal definition although nothing that is even remotely universally agreed upon) it is indeed unfortunate that the term "sustainable aquaculture" remains largely an oxymoron.

A compelling argument could be made that given the extreme diversity of production systems, incremental progress is important and perhaps all that can be expected. However it seems that the vast majority of these self-anointed groups of experts have specific areas that they focus on often missing the big picture. Critical elements are ignored in favor of focusing on social, cultural and environmental issues and not what actually constitutes sustainability in the field. Too little to no emphasis is placed on the pivotal role of animal health and the need for science based proactive animal health strategies. The current system favors a medieval approach to the movement of animals and thus pathogens between and throughout the global aquaculture production system.

Aquaculture practices that are not geared towards sustainability pose a major challenge to aquaculturists everywhere. Shrimp exports are a very valuable source of US dollars and there is no doubt that shrimp farming has enriched the lives of many. It is indeed unfortunate that there are far more farmers who have little understanding of the science of aquaculture, an absolutely essential element of true sustainability, than do.

Farming shrimp is not the same as growing rice. In many areas of SE Asia, far too many rice farmers are growing shrimp simply because it pays better when it succeeds. While it can be relatively easy this rarely persists beyond the first few cycles. Aquatic environments are constantly changing in response to inputs. Most farmers are ill prepared educationally and economically to deal with this. Perhaps the single largest barrier to true sustainability (which I define simply as the sum of cultural practices that ensure that environmental impacts are negligible-this can encompass a wide range of issues- and that control the impact of diseases ensuring that farmers can produce consistently cycle after cycle) is ignorance. This is fueled by a multitude of companies and individuals many of whom are self-styled experts knowing little about aquaculture, peddling adulterated "magic bullets" to unwitting farmers.

Diseases are an inherent part of all agricultural processes. Terrestrial monoculture agriculture relies on chemicals, pesticides and other tools to combat the propensity for disease. These are not as readily applicable to water based production systems. Production in aquatic ecosystems has the added element of water and a multitude of chemical processes that do not occur in land based systems. Failure to consider how diseases gain entry into production systems, how they are spread and failure to adapt to the altered conditions

of culture that they might impose is the norm for many paradigms. In my opinion, for any segment of the aquaculture industry to be considered truly sustainable, they must address these critical elements.

Perhaps one of the most recent examples is that of a wide spread disease (apparently a toxicosis) that is still spreading and has had huge negative financial consequences on the global farmed shrimp industry. The disease, initially coined Early Mortality Syndrome (EMS), largely because early observations of the disease occurred within the first 30 days of stocking, and subsequently renamed Acute Hepatopancreatic Necrosis Syndrome or Disease (AHPNS or AHPND) has been determined to be the result of the presence of a strain of Vibrio parahaemolyticus. This strain carries genes that encode for a bivalent protein toxin that targets the hepatopancreas specifically damaging it with resultant impacts on the shrimp ranging from high levels of acute mortality to sluggish growth and poor overall productivity.

The first published reports demonstrated that this bacterium was transmitted via infected adults to PLs that succumbed shortly post stocking. We now know much more about this disease process. The pathogen moves through the environment and this very rapidly growing bacterial strain favors accumulated organic matter and detritus. Notably, in some areas of the world a change in the production paradigm has successfully mitigated the The steps that need to be taken fall into general categories and in the case of EMS quite a few specifics. There are things that can be done to minimize the chances of this happening. They start with a better understanding of some fundamentals. If you are operating a hatchery/maturation facility with no microscope, no ability to do basic problem. It looks very much like the presence of the bacteria responsible for EMS can be impacted in a number of ways. However complacency is unwise as it is probable that something else will come along that thrives on some elements of these eco-manipulated pond ecologies and kills shrimp. Efforts must be taken to permanently break some elements of this cycle.

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microbiology and water chemistries, then you clearly have not gotten the message. Proper use of the tools of science is the only path to sustainableproduction. This list is not all inclusive but consider these highlights as described.

1. There should be no unrestricted movement of broodstock. Producers should be regulated and only those producing animals under biosecure conditions with appropriate histories, operational SOPs, etc. should be allowed to sell adult animals. This includes tracking animals performance in the field to ensure that the problems that do occur did not originate in the broodstock. The use of wild broodstock should be illegal.

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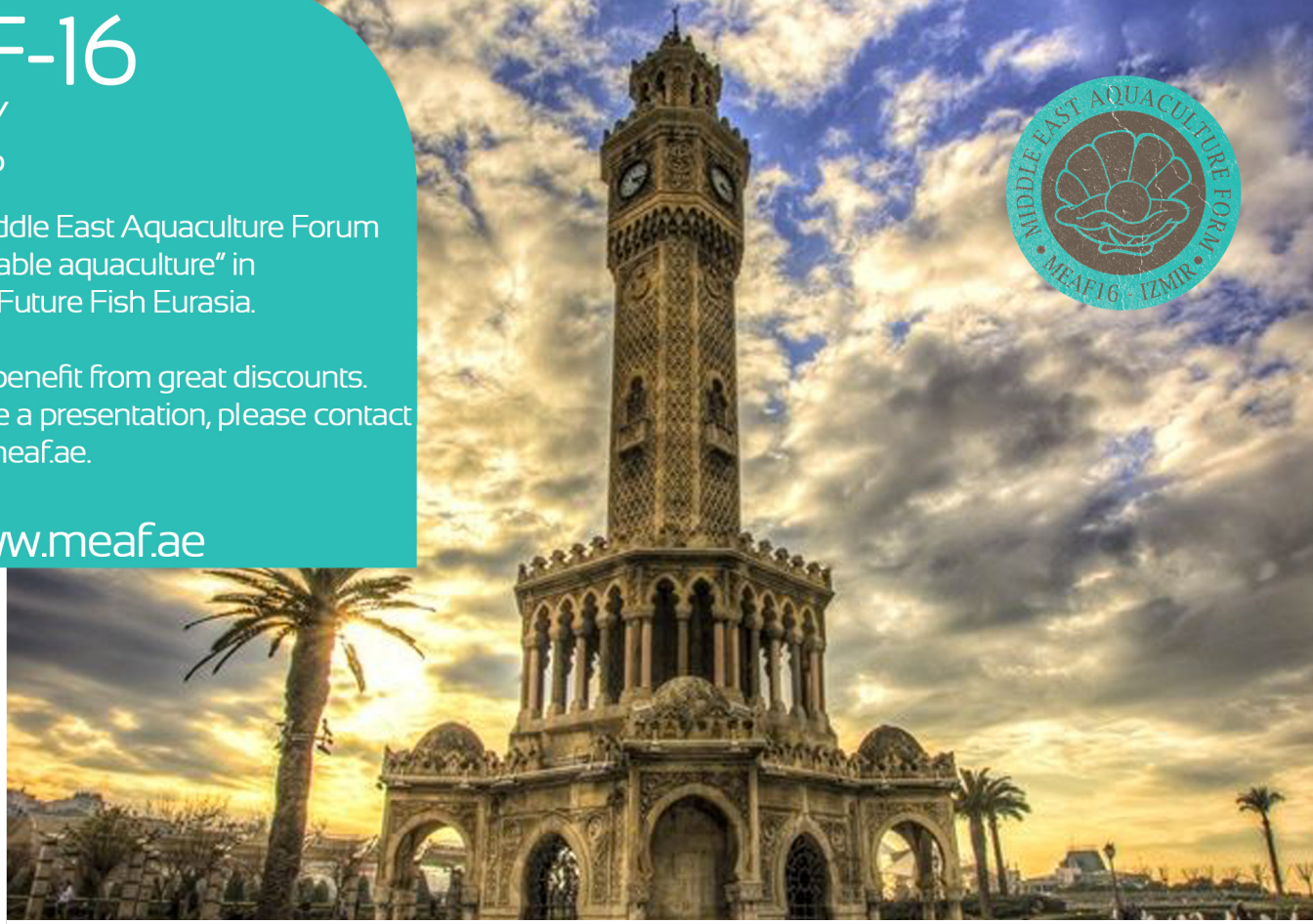

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2. The use of pond reared broodstock that are held in non-biosecure environments should be strictly forbidden and heavily enforced. PCR screening of animals on a population basis is not a suitable barrier. In fact it is all too often represented as being such and has done massive amounts of harm to farmers.

3. Pathogens can appear suddenly and evolve very quickly given the right conditions. “New” pathogens can easily slip through many different barriers, much as has happened with the microsporidian that causes EHP. Vigilance and consistent use of science based tools is critical for proactive disease management.

4. Hatcheries need to be “regulated” as well. Archaic outdoor culture of Artemia and algae ensures high levels of bacteria are present, often vibrios species (the major source of problems for farmed shrimp). These bacteria are cultured in production systems and the PLs carry these potential pathogens into the production systems (as is believed to be the case with EMS). A microscope and some tools for counting bacteria are critical tools.

5. Standards need to be enforced for acceptable quality and survival during production. Low survival tanks should be destroyed and not pooled. They died for a reason even if the cause is not readily apparent to the hatchery staff.

6. The proper use of certain products (such as our PRO4000X) in the hatchery tanks along with the use of certain chemicals-not antibiotics-but disinfectants that break down rapidly in the environment should be routine when other measures fail to control potential pathogen loads. There are far too many products in the market place of questionable usefulness and many that are useless.

7. Biosecurity needs to be a routine part of production processes and enforced. It makes no sense to go through the many steps needed to ensure that animals are truly free of specific pathogens only to undo it by ignoring protocols when PLs are harvested and packaged for delivery to farms.

8. Certification by audit while it could eventually be a useful component of this needs to evolve and deal with culture realities. Failure to ensure science based production is not consistent with sustainability.

9. Stocking of PLs on farms needs to be coordinated in a manner that ensures that the PLs are not overly stressed during transport and immediately post-stocking.

10. Reasonable limits need to be set on farm numbers, size and geographical distribution. These need to be enforceable. Farms should not be on top of each other.

11. Outdoor production systems are biosecurity risks. This is inherent in their nature.

12. Proper pond design and preparation are essential. Organic matter should not be present at the start of the cycle and every effort made to ensure it does not accumulate. Responsible removal to ensure no environmental impact is important.

13. Stress reduction at all levels of the production process by the proper use of aeration, not over fertilizing, use of water exchange (depends on production system), proper nutrition, etc. is essential for the ability of shrimp to realize their genetic potential.

14. Use lower protein feeds. In most cases feed companies Penaeus vannamei are being fed protein levels that are much higher than the shrimp need.

15. There is good field data that suggests that the impact of EMS can be lessened or even largely negated by the use of small ponds, co-cultivation with Tilapia, modest water exchange rates, better feed management and effective management to prevent the accumulation of organic material.

Clearly it is not possible to detail all of the steps that need to be taken in a short article. While books have been written about this subject following the above guidelines and moving towards a science based production paradigm where proactive disease management is a significant feature can positively impact the bottom line. Without this there is little hope that regardless of the certification schemes that the farms are aligned with that they will truly be sustainable.