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Commentary

Commentary on Microorganisms in Aquaculture

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DESCRIPTION

Microorganisms are important in aquaculture because they occur naturally and may be added intentionally to perform various roles. Furthermore, certain bacteria may protect fish and larvae against illness. As a result, monitoring and altering microbial populations in aquaculture environments has enormous, not only for measuring and improving water quality, but also for preventing the spread of microbial diseases. The use of microbial communities to monitor water quality and efficiently carry out ecosystem functions inside aquaculture systems might be just a few years away. Microbiomes should be completely studied for a proper understanding of both beneficial and detrimental aquaculture systems. But proper management and development of these microbiomes are necessary.

Similarly, it may reduce the demand for antibiotics in aquaculture by regulating the microbiome, by utilizing probiotic bacteria. Recent research has shown that probiotic bacteria can control fish pathogenic bacteria in the live feed and that probiotic bacteria can considerably reduce mortality in infected fish larvae. However, efficient aquaculture micro biota management is now limited by a lack of understanding of important microbial interactions and the general ecology of these systems. Microbial communities in natural aquatic habitats adapt quickly to changes in their surroundings. These changes might be modest, manifesting as the activation or inactivation of specific metabolic pathways, or they can induce changes in the general composition and functionality of the microbial population. Because of the fast development of High-Throughput Sequencing (HTS) technology, it is now possible to track changes in microbial water communities using an all-encompassing systems biology approach. It is possible to investigate the combined genomic and transcriptomic composition of a single water sample.

Although not yet standardized, efforts to include such HTS technology in environmental monitoring programs for natural marine systems are ongoing, and such techniques have significant potential for aquaculture systems as well. Besides the well-known technical challenges associated with the application of HTS technology to natural samples, such as extraction of representative environmental DNA, PCR amplification bias in targeted amplicon sequencing approaches, rapid RNA degeneration, etc., the application of HTS as a tool to monitor the overall state of aquaculture systems is currently hampered by our level of understanding of the system's microbial ecology. As a result, the first need for using HTS technology as a surveillance tool is to characterize both the healthy and diseased aquaculture microbiome. Studies on the microbial community composition in recirculating aquaculture systems and the microbiome of cultured fish have recently begun, but the detailed characterization of the aquaculture environment in terms of its residing microbiota and its functions is still in its early stages.

Another challenge is that these aquaculture microbiomes are likely to be system-specific, requiring different practices to be developed depending on the system at hand. The growth of fish pathogenic bacteria and associated disease outbreaks is a serious limitation in fish aquaculture. Outbreaks may have devastating economic effects for individual fish farmers, and in rare situations, the spread of infectious illnesses can restrict whole subsectors. Bacterial fish pathogens are often regarded as the most dangerous infectious germs in aquaculture, and the industry goes to considerable measures to decrease the number of pathogenic bacteria in its facilities. Aside from disinfectants and biocides, antimicrobials can be used to treat diseased fish as a preventative step. Antibiotic resistance is outpacing the discovery and development of new medications, and the rise in the number of bacterial infections that are resistant to currently available antibiotics has highlighted the dangers of widespread antibiotic overuse.

As a result, it is critical that we, to the degree feasible, replace antibiotic usage with long-term preventative measures. The establishment of immunization programs is one example of a successful measure. This technique is a significant part of contemporary finfish aquaculture, and vaccinations against a variety of fish pathogenic bacteria are available for a wide range of farmed fish species. Vaccination programs should be expanded and extended in the next years; however, because fish larvae and bivalve molluscs do not have established adaptive immune systems, vaccination is not suitable in larviculture and bivalve rearing. Manipulation of the bacterial population

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associated with the larvae, the rearing systems, or in the live feed, for example, by the inclusion of probiotics, maybe a viable alternative to the prophylactic use of antibiotics. Another problem is determining how to incorporate probiotics into complicated systems, such as larval rearing facilities, and whether the probiotics would perform efficiently inside such systems. Roseobacters are native to the aquaculture environment and hence should have the ability to persist in the systems. Although steps have been conducted to investigate the efficiency of Roseobacter probiotics in live feed systems in the presence of aquaculture relevant microbial populations, it is uncertain if the probiotics given to live feed will persist and multiply downstream in the system.

CONCLUSION

As the aquaculture industry expands, researchers must develop sophisticated methods for monitoring diverse aquaculture systems and improving their autonomy, therefore reducing the environmental and human health effects of intensive fish breeding. To do this, extensive research should be conducted into the microbial ecology of aquaculture systems, uncover essential processes and critical interactions between relevant species in these settings during the next years.