IMPROVING BIOSECURITY: A SCIENCE-BASED APPROACH TO MANAGE FISH DISEASE RISKS AND INCREASE THE SOCIOECONOMIC CONTRIBUTION OF THE NIGERIAN CATFISH AND TILAPIA INDUSTRIES

Nigeria is currently one of Africa's largest aquaculture producers and catfish and tilapia are the most farmed fish. However, the lack of a clear aquatic animal health strategy has resulted in substantial disease-related production losses. The Improving Biosecurity activity in Nigeria aimed to better understand the disease and health status of catfish aquaculture through deployment of a digital epidemiology survey, collection and laboratory analyses of biological samples, and a series of stakeholder consultations. By identifying key risk factors and farm-level biosecurity gaps, the activity sought to develop recommendations on better management practices for farmers and action points for the national authorities. The activity was implemented by WorldFish in Malaysia together with Mississippi State University in the U.S. and the University of Ibadan in Nigeria.

A farmer feeds the fish in her aquaculture pond. Photo by Arnold Irabor

RESULTS

To better understand existing biosecurity management practices and risk factors that could potentially lead to mortality and production losses in catfish production systems, the research team developed a Fish Epidemiology and Health Economics digital survey tool to collect baseline data from 399 farms in Delta and Ogun States. Fish samples were also collected from farms that were recruited for the epidemiological study. The samples underwent bacterial identification, DNA extraction, and biochemical and antibiotic susceptibility tests. The findings were presented in two master's theses, two scientific publications, and a detailed microbiology report.

BETTER MANAGEMENT PRACTICE GUIDELINES

Epidemiological analyses of the data set from 399 farms helped to identify several risk factors and biosecurity gaps in local production systems. These results were shared with key stakeholders from both states, including farmers, farm cluster leaders, government officers, academic institutions, and resident veterinarians, as part of a workshop held in August 2022 in Oyo, Nigeria. Insights from the workshop and lessons learned from the researchers and farmers throughout the field survey were then used to create a better management practices manual to address the identified risks. The manual provides general guidelines to establish and maintain biosecurity practices for aquaculture farms in the Nigerian context. Workshop participants also brainstormed key components for a National Aquatic Animal Health Strategy, which Nigeria does not currently have, and minimum operational requirements for such a strategy.

Poor communication between fish farmers and resident veterinarians emerged as a key gap in fish health management through this activity. The research team identified and engaged resident aquatic veterinarians in Ogun and Delta States to assist farmers in disease diagnosis and treatment of sick fish as well as maintenance of standard biosecurity on their farms. The team also created e-AquaHealth, a web-based platform to bridge the gap between fish farmers and aquatic veterinary professionals to enhance the delivery of quality services and improve the wellbeing of fish.

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CONCLUSIONS AND RECOMMENDATIONS

The Improving Biosecurity team built a large data set on farming practices and farmer behavior from 399 catfish farmers in Nigeria using their online digital tool. This led to the identification of several risk factors associated with unusual mortality events and farm-level biosecurity gaps. Microbiological findings highlighted the need for a One Health approach in managing bacterial diseases and use of antimicrobial agents. Extensive use and abuse of antimicrobials in the aquaculture industry was established, and antimicrobial resistance genes were identified through next generation DNA sequencing. Potential risk of environmental bacteria (e.g., *Klebsiella*, *Salmonella* and *Pseudomonas* spp.) to human health was also identified.

It is evident that aquatic animal diseases and One Health issues are influenced by various actors and elements involved in aquatic food systems and beyond. Hence, advocating for collective action under a One Health framework is necessary to promote responsible and sustainable aquatic food systems in Nigeria. The following recommendations will contribute to the long-term sustainability of findings and benefits from this activity:

- Publish the epidemiology study report on an open-access platform to motivate and encourage researchers in Africa and Asia to undertake more epidemiological studies, fostering knowledge sharing and advancing the field.
- Promote the epidemiology survey tool to provide valuable insights into farmer behaviors, production practices, outcomes, mortality events, and socioeconomic factors. Analyzing this data can help identify trends, associations, and risk factors, informing the development of interventions in the form of better management practices and farm-level biosecurity plans. (Aquatic Animal Health Package of Practices: Fish epidemiology and health economics— https://hdl.handle.net/20.500.12348/4900)
- Promote better management practice guidelines amongst farm clusters and utilize them to train government extension workers, resident veterinarians, and university students. This will enhance the adoption of sustainable and responsible practices within the aquaculture sector.
- Promote the e-Aquahealth platform by leveraging the skills and resources of the University of Ibadan, resident veterinarians, and the farmer cluster network. The e-Aquahealth platform can offer diagnostic services to farmers in Nigeria, providing timely and accurate disease diagnosis and aiding in effective disease management.
- Promote the use of e-learning modules and standard operating procedures developed by the activity as educational and teaching materials in universities and extension units to enhance knowledge dissemination and capacity building. These resources are available at https://ohrg-unibadan.org/aquahealth/vetsupport/articles.
- Promote the National Aquatic Animal Health Strategy draft document through the National Competent Authority platform to help raise awareness among policymakers and stakeholders and facilitate the operationalization of a national strategy.

By implementing these recommendations, we can foster collaboration, knowledge sharing, and capacity building, leading to improved aquatic animal health, biosecurity governance, and the development of sustainable aquaculture systems in Nigeria.

ABOUT THE FISH INNOVATION LAB

The Fish Innovation Lab supports the United States Agency for International Development's agricultural research and capacity building work under Feed the Future, the U.S. Government's global hunger and food security initiative. Mississippi State University is the program's management entity. The University of Rhode Island, Texas State University, Washington University in St. Louis, and RTI International serve as management partners.

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