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DEVELOPMENT AND INVESTIGATION OF THE DELIVERY MODE OF A MULTIVALENT BACTERIAL FISH VACCINE IN ZAMBIA

Africa has seen a rapid increase in aquaculture production, with a large share occurring in Zambia as the country has intensified its political and economic support to the industry. The intensification has led to increased disease occurrences that have affected productivity in both large- and small-scale establishments. Small-scale establishments are severely hit in some cases as producers lack technical know-how to prevent and respond to disease outbreaks. The aim of the activity was to identify bacteria causing disease in small-scale aquaculture establishments and develop an autogenous vaccine for the farmers. Following vaccine formulation, the activity is also looking at methods of improving vaccine administration.

Collecting sick fish from a cage. Photo by Bernard M. Hang'ombe

BACTERIA IDENTIFICATION AND DISEASE CAUSATION

Bacteria involved in fish mortalities were identified from small-scale farmers who had stocked fish in cages with a capacity of 25,000 fish. The sick fish were sampled, and bacteria was identified using the analytical profile index and genetic sequencing. The identified bacteria genera included *Acinetobacter*, *Pseudomonas*, *Aeromonas, Bacillus, Clostridium*, *Klebsiella, Lactococcus, Micrococcus, Staphylococcus, Streptococcus,* and *Vibrio.* Of these bacteria identified, *Acinetobacter, Aeromonas, Klebsiella*, and *Lactococcus* were documented as pathogenic after testing in fish.

DEVELOPMENT AND TESTING OF THE AUTOGENOUS VACCINE

Of the identified bacteria, *Lactococcus garviae* and *Aeromonas hydrophila* were selected for vaccine formulation following their pathogenic potential. These bacteria were killed and tested for vaccine efficacy using two exposure methods: injection and bath immersion. The killed *Lactococcus garviae* vaccine administered through the injection route provided good protection; no clinical signs were observed in the vaccinated fish as opposed to the control groups. The killed *Aeromonas hydrophila* vaccine provided some protection using the injection exposure route. Protection provided by the immersion route was low for both vaccines, with protection being better for *Lactococcus garviae* compared to *Aeromanas hydrophila*. The *Lactococcus garviae* vaccine was used in field trials at a farm. As observed so far, deaths are not being recorded in the vaccinated cage as compared to the unvaccinated cages.

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LESSONS LEARNED DURING ENGAGEMENTS WITH SMALL-SCALE FARMERS

While collecting fish samples from the cages owned by small-scale farmers, the team observed a lack of knowledge on fish health and biosecurity. There were virtually no signs of disease prevention measures being enforced. The farmers had no knowledge of fish movement restrictions, limiting access to the production site, or sanitation and disinfection procedures.

CONCLUSIONS AND RECOMMENDATIONS

This study revealed the potential use of autogenous vaccination in minimizing losses in aquaculture that may emanate from production diseases in Zambia. In this study, known opportunistic fish pathogens were identified such as *Lactococcus garviae, Aeromonas hydrophila, Klebsiella,* and *Vibrio.* The isolation of which highlights the potential presence of human fecal contamination in water. Holistically, the study demonstrated that vaccination can be an effective part of an aquatic animal health program for the country.

Based on observations and interactions with the farmers, the following recommendations are proposed:

- Continue studies on autogenous vaccine formulation and application in the field for the benefit of farmers.
- Improve biosecurity and aquatic health knowledge and extension by the Ministry of Fisheries and Livestock.
- Move to a more proactive approach of evidence-based strategies for the prevention and control of aquatic diseases in the country and region where there are shared water bodies.
- Build confidence and trust with farmers for successful knowledge uptake and change in farm practices by the various stakeholders involved in the industry.
- Create secured platforms for collection and storage of data through the University of Zambia and Ministry of Fisheries and Livestock that farmers can and are willing to use.
- Create communication channels on social media platforms for farmers to obtain early outbreak reports for sample collection and disease diagnosis by the University of Zambia and Ministry of Fisheries and Livestock.

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.

www.fishinnovationlab.msstate.edu

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