MACHINE LEARNING TOOL PAVING THE WAY TO MODERNIZE AQUACULTURE STATISTICS IN BANGLADESH

By Mohammad Mahfujul Haque and Ben Belton

Accurate, reliable, and timely statistics serve as the basis for sustainable development planning and decision making and help organizations to understand the challenges and opportunities of a changing world.

Lack of rigorous data collection efforts in developing countries such as Bangladesh mean conventional wisdom about aquaculture is often outdated and makes aquaculture production statistics notoriously unreliable. Inadequate information makes it difficult to plan and manage aquaculture development or design investments, policies, and interventions effectively. Moreover, new technologies and practices developed by innovative farmers and supply chain actors often go unrecognized by formal extension agents and are adopted more gradually than they would if promoted actively.

Director General of the Department of Fisheries, Kh. Mahbubul Haque, remarked on the research findings. (Photo by Balaram Mahalder, PhD student at Bangladesh Agricultural University in the Department of Aquaculture)

The Harnessing Machine Learning activity of the USAID-funded Feed the Future Innovation Lab for Fish worked with stakeholders in Bangladesh to develop a rigorous approach to survey design and implementation to ensure high quality data and representativeness beyond what is normally collected for the aquaculture sector. Using machine learning and a large survey with a statistically representative sample of over 1,100 aquaculture value-chain actors, the research team studied the seven major aquaculture districts in the Feed the Future Zone of Influence in Southern Bangladesh: Khulna, Satkhira, Bagerhat, Jashore, Barisal, Bhola, and Gopalganj. A machine learning tool was developed to estimate total aquaculture farm area using images from remote sensing, while the survey collected data on a range of variables related to farm productivity, revenue, inputs, and employment.

A key part of the research was providing the results to policy makers and development partners through outreach workshops. The Department of Fisheries (DoF), in particular, plays an important role in Bangladesh by planning, developing, and monitoring the progress of the fisheries and aquaculture sector and preparing a statistical database every year.

One workshop, held on August 4, 2022, at the DoF headquarters, had a total of 60 participants, 30 of whom were DoF officials. The information presented was welcomed by all levels of the DoF officials, ranging from Director General Kh. Mahbubul Haque to field level officials.

"The Department of Fisheries started a fish production survey with support from FAO," Haque said. "The Space Research and Remote Sensing Organization helped by providing helicopters to identify the water bodies, but that was long ago.

PROJECT TEAM

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"We need to refine the existing aquaculture census technique and adopt new tools to estimate actual aquaculture production. I am hopeful that the presented technique by the Machine Learning team will fill this gap."

Haque encouraged the DoF officials to learn the new census technique to identify all the water bodies. He added that adoption of machine learning techniques would not be difficult since DoF field staff already collect real-time data, which can be integrated with machine learning approaches for ground truthing and developing the official statistical database. Haque noted his eagerness to meet with the research team again to decide pathways for the adoption of the presented technique to develop better aquaculture statistics data in Bangladesh.

Md. Khaled Kanak, deputy director for the aquaculture extension wing of DoF and a senior policy official, noted that the total fish production estimated by the Machine Learning activity was higher than current DoF estimates and that many meeting attendees believe this analysis to be correct. He requested the project team to share machine learning techniques with other DoF officers so that they can also use the approach.

Since the DoF is interested, the team hopes to partner with the department to publish all statistics for the entire Bangladesh aquaculture sector through interactive web-based tools. Shamsul Alam Badal, a hatchery owner, fish farmer, and general secretary of the Bangladesh Tilapia Association who participated in the meeting, noted that this kind of action-based research shared through internet platforms—rather than statistics published only in printed reports—is of great interest for aquaculture value-chain actors like him.

Lutful Hassan, vice-chancellor of Bangladesh Agricultural University (BAU), emphasized the power of the machine learning technique for building the aquaculture statistical database.

"BAU will work closely with the government in the coming days, especially with DoF, for the development of the entire fisheries sector," Hassan said. "There will be participation of relevant stakeholders and researchers from home and abroad with modern technological expertise."

The Harnessing Machine Learning activity's results demonstrate the potential of combining remote sensing with representative surveys to estimate statistics on a wide range of aquaculture performance indicators, which are rarely measured accurately with traditional data collection techniques. The results also demonstrate potential expansion of the Machine Learning approach to estimate aquaculture production and its economic impacts at the national scale for Bangladesh as well as in other countries.

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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.feedthefuture.gov
www.fishinnovationlab.msstate.edu