FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

INCREASING SUSTAINABILITY OF FISHERIES AND AQUACULTURE FOR THE RESILIENCE OF CAMBODIAN COMMUNITIES

Wild fish are a vital resource for human nutrition and commerce in Southeast Asia, but many of these important populations are declining. Government resources are limited and are typically allocated to more valuable fisheries, leaving small-scale rural fisheries unmanaged. Thus, data on these population declines and their potential solutions are largely lacking. With the support of Cambodia's Fisheries Administration, local villages along the Sre Ambel River in southern Cambodia have united to provide community-level governance. This arrangement places management authority in the hands of those who have a vested interest in the resource. The objective of the Feed the Future Innovation Lab for Fish activity on fisheries resilience in Cambodia was to support this endeavor and improve sustainable fisheries management by developing a citizen science program to systematically monitor fish populations, creating an online platform (iFISH) to visualize and interpret data, improving fish protein shelf life by providing education on fish preservation techniques, and conducting nutrient analyses of primary harvested species.

Fishing is a way of life for many Cambodians and management of fisheries requires accurate data, as the fisher shown here learned. Photo by Phun Thorn

CITIZEN SCIENCE PROGRAM

A citizen scientist corps consisting of five villages and 15 fishers was established to collect continuous fisheries data for two years. Citizen scientists were provided training, materials, and a small compensation for their time. Oversight, verification, and photographic documentation ensured the accuracy of the data. For each fishing trip, fishers collected data on effort, location, gear, harvest, and size. During the assessment, 162 species were recorded, represented by 118,528 fish with 48,048 individual-level data entries and photos for species and length verification. The data provided a baseline of the river prior to management, will aid in development of management solutions, and will serve as a benchmark to assess the success of and to refine management actions that are implemented. Thus, continuation of the citizen science program is paramount so that data are continuous and comparable through time.

FISH PLATFORM

The activity developed a web-based analysis platform to facilitate visualization and interpretation of fisheries data. A master file containing citizen science data is uploaded to the platform, which then allows the user to visualize the data and make computations as necessary, such as by species, village, season, or gear type. Outputs include catch rates, length frequencies, maps, and other data for management. For example, iFISH demonstrated that fishing grounds by village do not overlap, which will simplify management and enforcement. Also, only 10 species make up most of the wet season catch, suggesting these species may need to be prioritized. Length frequencies of captured fishes can be compared to maximum lengths to help understand the sustainability of the fisheries. Fish that are harvested at sizes well below maximum length may be subject to overfishing because excessive harvest of fish before they can replace themselves will lead to population declines. Additional evidence on species traits, such as size at maturity, is needed to fully understand these effects. iFISH is open-source software; thus, features like size at maturity can be added as needed.

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FISH PRESERVATION APPROACH

Live fish is the most accepted form for trade at local markets due to the lack of refrigeration. Many fish die before arriving at markets and may go to waste. Preservation of these fish could reduce waste and increase shelf life. We assessed local fish processing and fish products, designed and trained villagers on minimal processing methods, and produced and further tested processed shelf-stable products. Currently, most fishers reported using ice, salt, or no preservation immediately after harvest, and most (88%) fish are sold whole. Fish not sold immediately are salted (36% of respondents), fermented (29%), dried (25%), and smoked (6%). Consumers demonstrated preferences in species and smoking methods but generally found all preservation products acceptable. Training on fish smoking, fileting, and antimicrobial treatments was provided to villagers, and participants indicated a willingness to continue these practices and join a fish processing consortium. The research team identified smoking technology using locally available materials (concrete blocks and hardwood) and vinegar treatment for fish preservation as two promising innovations to improve the quality and food safety of local fish as well as the livelihoods of fishers who sell these value-added products.

NUTRIENT ANALYSES

Fish species located lower on the food chain (i.e., those who eat plants, algae, or small insects) are more abundant and sustainable than higher-level piscivores (fish that eat other fish), but the nutritional differences are unclear. We evaluated 11 commonly harvested fish for proximate composition (protein, fat, water, ash, and carbohydrates) and fatty acid composition. Large-bodied piscivores tended to be slightly higher in protein and lower in fat than small-bodied species, yet differences were insignificant. Conversely, small-bodied species tended to be higher in many important fatty acids, suggesting that the nutritional value of these smaller fishes is at least equivalent to larger piscivores.

CONCLUSIONS AND RECOMMENDATIONS

This activity created an infrastructure for fisheries data collection, interpretation, and evaluation to improve the management of small-scale fisheries and provided outreach on techniques to prolong the shelf life of captured fish. This approach and the iFISH platform are scalable to other artisanal fisheries globally. Based on the results of this Fish Innovation Lab activity, the following recommendations are suggested:

- Continue the citizen science program to support adaptability in management.
- Data on life-history characteristics of target fishes (growth patterns, reproduction, etc.) are required for effective management actions.
- Reduce reliance on non-selective gears and reduce or eliminate the harvest of juvenile fishes.
- Spatial variation suggests that management strategies may need to vary by river reach or village.
- Coordinate a fish processor consortium to continue training in fish preservations and value-added products.
- Harvest fish from lower on the food chain to increase sustainability and provide greater harvest opportunities.
- Target high-value species with better sensory attributes and help fishermen further improve the quality of low-value catches.
- Continue to use digital materials to train fishermen on fish processing and preservation.

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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