Research Stories 2001

Fish is a major source of protein and nutrients for millions of poor people. As world population expands and fish stocks decline, science must be used to explore ways to improve the supply of food to the poor and malnourished. The World Fish Center has focused on looking for the best way of replicating, for fish, the scientific advances in breeding of crops and livestock that have resulted in such enormous increases in their supply. With its mandate to provide better food and livelihoods for the poor, the Center realized that the most appropriate strategy was to apply science in a way that would both involve the target beneficiaries and make the results immediately and freely available to them. It was a new approach, but its success has been remarkable.

Farmers identified the poor growth of fish as a constraint to aquaculture development. Studies confirmed that the stocks of Nile tilapia available in Asia were of poor genetic quality. Consultations with national aquatic research systems, farmers and geneticists indicated the pressing need for genetic enhancement of fish. What the farmers wanted was a faster growing fish and an adequate supply of good quality seed.

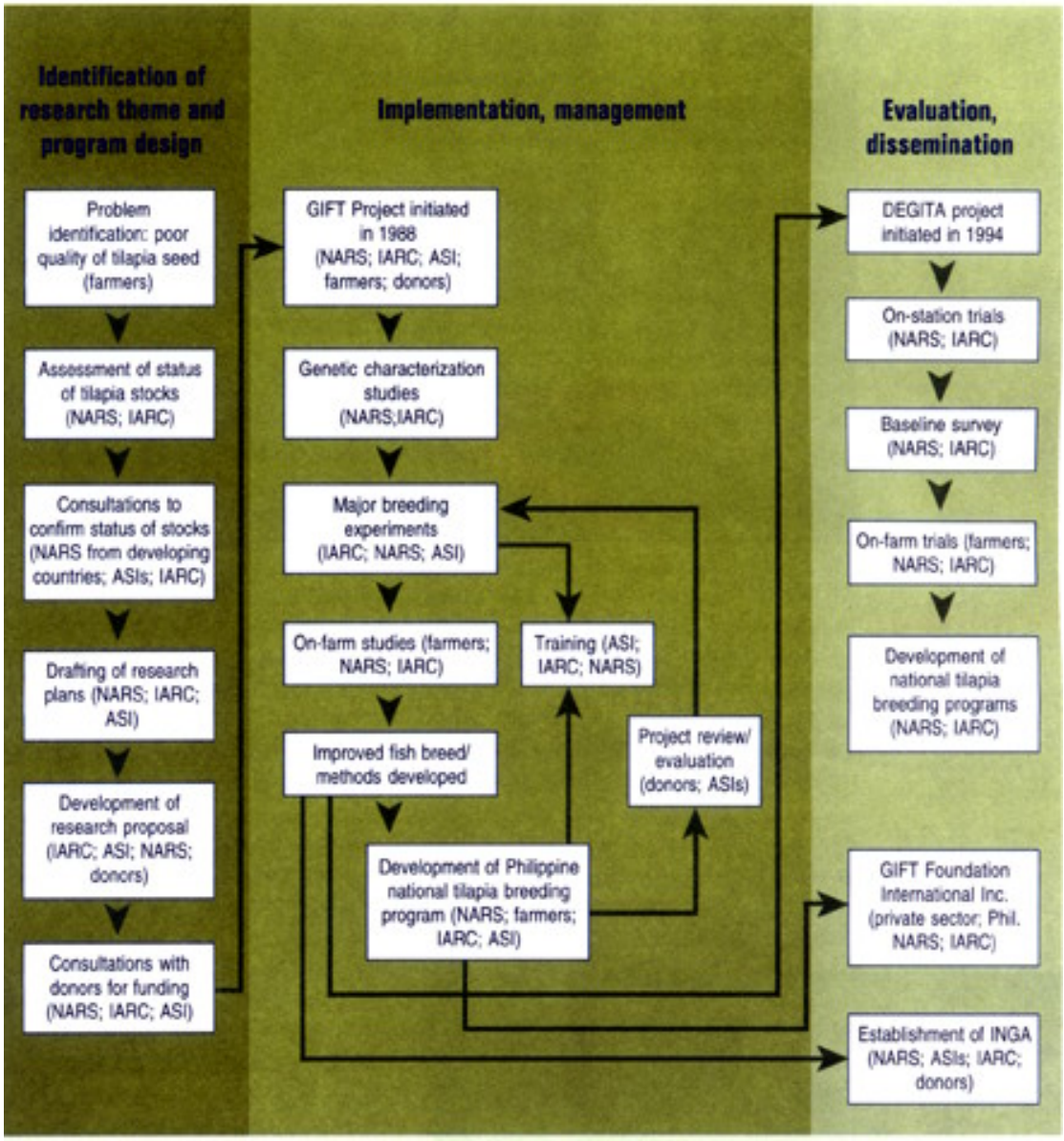
Top: 'ordinary' tilapia
Bottom: GIFT

Based on the studies, advice and a whole range of intellectual inputs, The World Fish Center identified the need for research to focus on the tilapia. The Nile tilapia (*Oreochromis niloticus*) was selected for the first effort to improve the productivity of acquaculture to increase the supply of fish for the poorer sections of society and improve the earnings of fish farmers and related workers. It is a species of great importance to developing countries because of its many desirable traits and suitability for culture in low/high input farms.

A project for the **genetic improvement of farmed tilapia (GIFT)** was undertaken in the Philippines (1988-1997) to develop methods for producing improved fish breeds using Nile tilapia as a model species. The project used a very broad based approach in that it was conducted in partnership with the beneficiaries of the research, on the one hand, advanced research institution with knowledge and experience in genetic enhancement research, on the other, and with the full involvement of organizations engaged in aquatic research in the countries concerned. The project was supported and funded by the Asian Development Bank (ADB) and the United Nations Development Fund (UNDP).

Figure 1 illustrates how the different partnerships evolved for this project and its follow up activities. The Philippine NARS provided: direct links with farmers and extension workers (BFAR); facilities, manpower and training inputs (FAC/CLSU); and expertise in documentation and genetic characterization of fish (UPMSI). They took the lead role in on-station and on-farm testing of the improved strain and in developing and implementing national breeding programs.

FIG. 1. DEVELOPMENT OF PARTNERSHIPS FOR GENETICS RESEARCH AND ENHANCEMENT



ASIs	Advanced Scientific Institutions
DEGITA	Dissemination of Genetically Improved Tilapia in Asia
GIFT	Genetic Improvement of Farmed Tilapia
IARC	International Aquatic research Center
INGA	International Network on Genetics in Aquaculture
NARS	National Aquatic Research Systems

AKVAFORSK provided the expertise in quantitative genetics, contributed substantially to formulating the design of the breeding experiments and later assisted in training NARS in different countries to establish their own breeding programs. In addition, the project established links with national institutions in Egypt, Ghana, Kenya and Senegal, the University of Hamburg (Germany) and the Musee Royale de l'Afrique Centrale (Belgium) for the collection and successful transfer of pure tilapia stocks from Africa to the Philippines.

As the project and its follow on activities developed, the partnerships expanded to include fish farmers, NARS and NGOs in other countries. The World Fish Center (IARC) coordinated the research efforts: providing intellectual inputs in the overall planning and project implementation through its own multidisciplinary research team; ensuring successful implementation of all project-related activities in the participating countries; facilitating exchange of information, methodologies and genetic materials among research partners;


Photo: A. Eknath

Through a process of genetic selection, the GIFT project developed a tilapia strain with 77 per cent faster growth and 66 per cent higher survival rates as compared to the strains being cultivated in the Philippines. The main products of the GIFT project were the improved GIFT strain of tilapia and methods for the genetic improvement of tropical finfish.

organizing training programs, workshops and interaction between NARS in different countries; and preparing and distributing research results/reports.

The success of the experiment demanded that these techniques be used in aquaculture systems as widely as possible, which called for a whole range of activities that included dissemination of the new strain and the evaluation of its performance under different conditions, continuation of genetics research, commercialization of the improved strain and establishment of genetic improvement/breeding programs in many countries. To manage all these activities effectively it was absolutely essential to forge collaborative partnerships with all the stakeholders.

The next step was to see how successful the new strain was going to be in practice, outside the controlled research environment. The Center and its NARS partners in Bangladesh, People's Republic of China, Philippines, Thailand and Vietnam undertook the dissemination and evaluation of genetically improved tilapia (DEGITA project) from 1994 to 1997 in their respective countries. The performance evaluation was done in collaboration with the NARS, the farmers and local NGOs. The study confirmed the potential of the GIFT tilapia strain for increased production, enhanced profitability of fish farming, lower price and increased consumption of fish, resulting in increased welfare for the country as a whole.

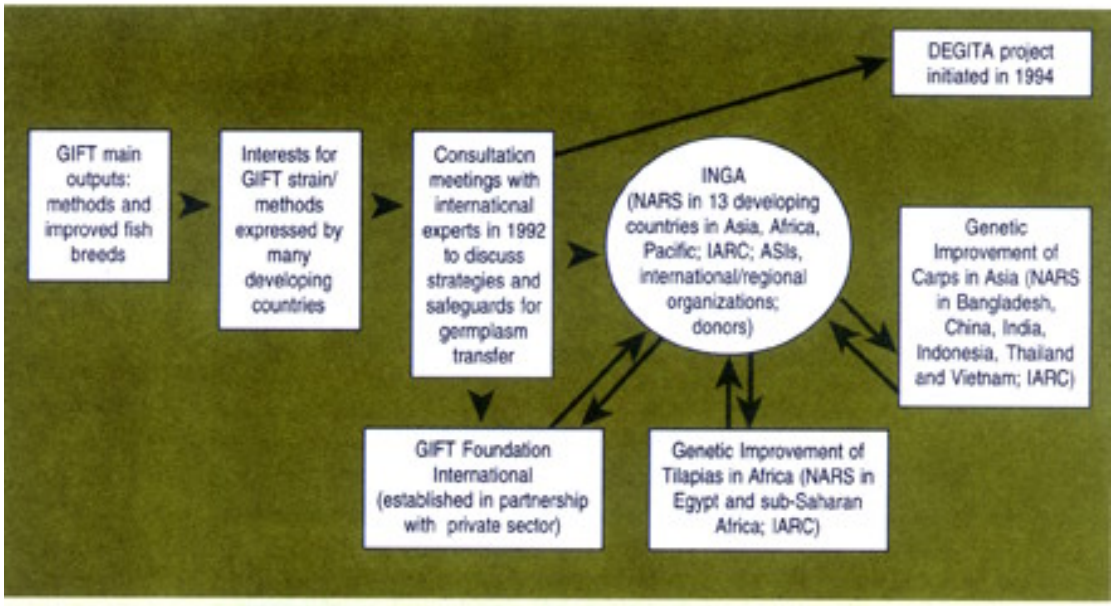
The success of the genetic improvement experiment and the confirmation of its potential in its practical application generated a great deal of interest among NARS in Asia, Pacific and Africa. This interest was formalized through the formation of the International Network on Genetics in Aquaculture (INGA) in 1993 as a global forum for fish breeding and genetics enhancement, with World Fish Center as the network coordinator. With a current membership of 13 countries from Asia, Pacific and Africa, 10 advanced scientific institutions and two regional/international organizations, INGA has been playing an important role in national, regional and international genetics research aimed at improving production from aquaculture operations while conserving aquatic genetic resources and biodiversity. The network facilitates a continuous feedback and flow of information on the performance of the improved germplasm in different environments and the effectiveness/usefulness of GIFT protocols and methods. It has proved to be an effective mechanism for monitoring and reviewing the progress of the fish breeding programs in the various countries and in the transfer and utilization of fish germplasm. It has, thereby, become a broad based and expanding, multi-country system of genetic research and its practical application in aquaculture. AKVAFORSK is providing invaluable assistance to these programs and to the training of their scientists in quantitative genetics and applied breeding.

The GIFT Foundation International Inc., an independent, non-stock, non-profit organization, was established in 1997 in the Philippines to continue the research on selective breeding and to commercialize the improved strains in partnership with the private sector. It has become a self-sustaining entity and an established and reliable source of supply of GIFT tilapia fingerlings to fish farmers.

Figure 2 illustrates how this broad-based and inclusive collaboration has paved the way for disseminating the results of aquatic research to the scientists, researchers, extension workers, and down to the individual farmers in so many countries in Asia and Africa. The overwhelming success of the genetic research and breeding work of the tilapia through this

collaborative approach has blossomed into several regional projects for the improvement of carp species in Bangladesh, China, India, Indonesia, Thailand and Vietnam. A step towards globalization has been taken with the commencement of work on the genetic improvement of tilapia in Cote d'Ivoire, Egypt, Ghana and Malawi. To protect the integrity of the genetic stocks in Africa, it has been judged inadvisable to transfer any new strains developed in Asia. However, the methods, protocols and experience of the GIFT project in Asia will be applied to the local tilapia strains in these countries to develop more productive strains for aquaculture.

FIG. 2. DEVELOPMENT OF REGIONAL/GLOBAL PROGRAMS FOR BREEDING FISH THROUGH A COLLABORATIVE APPROACH



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