UNITED NATIONS

DP

Governing Council of the United Nations Development Programme

Distr.
GENERAL

DP/PROJECTS/REC/47
17 March 1992

ORIGINAL: ENGLISH

Thirty-ninth session
4-29 May 1992, Geneva
Item 6 of the provisional agenda

PROGRAMME PLANNING

Country and intercountry programmes and projects

# ASSISTANCE FOR A GLOBAL PROJECT

## Genetic improvement of farmed tilapia - GLO 90/016

Recommendation of the Administrator

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| Estimated UNDP contribution | $4,822,690 |
| Duration | Five years |
| Executing agency | OPS |

## I. BACKGROUND

1. The problem of protein malnutrition among disadvantaged populations of the developing world is increasing, especially owing to increased scarcity and high cost of animal protein sources. Fish already provides the primary source of animal protein for over one billion people in many developing countries and contributes substantially to national economies. Increased production of fish will be a major source of protein to supply the increasing world population.

2. The demand for fish has grown substantially over the past few decades and the fisheries sector is under heavy pressure. While fish supply has been mainly based on harvesting wild populations, prospects for further sustainable increased catches from capture fisheries are very limited. The Food and Agriculture Organization of the United Nations (FAO) projects an annual increase of only 0.3 per cent. Moreover, many traditional fishing grounds

are heavily exploited and some wild stocks are in danger of extinction. Consequently, the major source of increased fish supply can only come from aquaculture.

3. Aquaculture will have a major role in producing a growing proportion of the world's fish supply. While at present 13.5 per cent of fish supply in developing countries comes from aquaculture, the demand for fish from aquaculture systems is expected to increase rapidly. For aquaculture to respond to this demand, concerted research efforts are urgently needed to improve the efficiency of present fish farming practices, especially for tropical species.

4. Genetic research and the application of breeding programmes have been major contributors to the significant production improvements in agriculture over the past 40 years. For example, the time to produce a 1.7 kg broiler chicken has been reduced from 14 weeks to 7 weeks and the amount of feed reduced to one half. In the case of aquaculture, genetic selection programmes can also make major contributions to increasing productivity and profitability. After 15 years of accumulated selection and improved feeding and management, productivity in the Norwegian salmon aquaculture industry has increased by 60-70 per cent.

5. Tropical aquaculture species, such as carps and tilapias, which form the mainstay of small-scale enterprises for many resource-poor farmers in the developing world, possess the ability to convert natural feed sources into high quality protein. For tilapias, conservative estimates of the levels of production gains that can be readily achieved through genetic selection are of the order of 8-16 per cent per year.

6. Unfortunately, efficient breeding and genetic selection programmes are rarely practised for important tropical fish species even though the tradition of fish farming dates back thousands of years. There are several reasons for this. Aquaculture research in general and genetic improvement research in particular, have been hampered by short-term, scattered and disjointed funding. Long-term strategic research efforts have been neglected. Research methodologies and rigorous protocols are therefore poorly developed. Based on its work during the previous decade, the International Centre for Living Aquatic Resources Management's (ICLARM) aquaculture programme has identified key problem areas requiring long-term investigations that include breeding, genetics and integrated agriculture-aquaculture food production systems.

7. ICLARM has given a high priority to achieving increased food production and income by and for low-income small-scale producers. The first priority in this research is tilapia, which forms the mainstay of small-scale aquaculture for many resource-poor farmers. The focus is on the Nile tilapia (Oreochromis niloticus) which has wide appeal throughout the tropics. The experiences gained with Nile tilapia will help to indicate approaches that can be adapted and applied to other finfish species, notably carps and other indigenous species, in national breeding programmes. Potential collaborating countries include China, India, Thailand, Ghana and Malawi. ICLARM already has a major fisheries project operating in Malawi.

8. Tilapias possess an impressive range of attributes for aquaculture: excellent growth rates on low protein diets (natural or artificial); tolerance of wide ranges of environmental conditions; freedom from serious diseases and parasitic infestations; ease of handling and breeding in captivity and wide acceptability as a foodfish. Tilapias are therefore widely recognized as a prime domesticated species for farming in a wide range of aquaculture systems. For this reason, tilapia has been called the "aquatic chicken". The origin of tilapias is Africa but a few species have been introduced into most tropical and subtropical Asian countries. Annual production exceeds 50,000 metric tons in several Asian countries. In Asia, tilapia production contributes about 10 per cent of the total aquaculture of finfish. There is significant tilapia culture in Bangladesh, China, Indonesia, the Philippines, Sri Lanka, Thailand and Viet Nam.

9. ICLARM, an autonomous, non-profit fisheries research and training centre, was established in 1977 and has received support from a number of multilateral, bilateral and private sources. ICLARM has been conditionally invited to join the Consultative Group on International Agricultural Research and has presented its strategic plan to CGIAR Technical Advisory Committee. Fish germplasm enhancement and breeding are seen as major strategic research areas for ICLARM's future programme.

10. A small pioneering collaborative research project on the genetic improvement of tilapias, funded by UNDP (INT/88/019) and the Asian Development Bank, is being executed by ICLARM in cooperation with a research centre and two universities in the Philippines and with the Norwegian Institute of Aquaculture Research. This project has collected, transported and characterized diverse and promising tilapia germplasm from Africa (Egypt, Ghana, Kenya and Senegal) and "genetically narrow" strains of African origin that are currently farmed in the Philippines; established a Tilapia Germplasm Reference Centre; standardized techniques for further research; evaluated the growth performance of African and "Philippine" strains in different farming systems and agro-climatic conditions; trained project personnel and built a base population of the 25 best-performing genotypes. The base population developed in this project is already showing at least 30 per cent (up to 60 per cent) faster growth when compared with the most widely cultured commercial strain in the Philippines. Selection experiments to determine the magnitude of further genetic gains are under way. A conservative projected rate of gain is about 10 per cent per generation. Collaboration has already been initiated with other donors in this field including the International Development Research Centre, Overseas Development Administration (United Kingdom), Norwegian Agency for Development Corporation and the Commission of the European Communities as well as with the Network of Aquaculture Centres in Asia and the Food and Agriculture Organization of the United Nations.

## II. THE PROJECT

11. The project will focus on four key areas: (a) the selection and dissemination of improved breeds; (b) the investigation of genetic traits leading to efficient breeding and selection programmes; (c) the documentation and collection of promising strains, and (d) strengthening the capacity of national institutions to carry out selection work and develop breeding programmes.

12. The selection of improved breeds will be carried out over about six generations. In each cycle, about 200 families will be produced and each individual will be tagged and distributed to different test environments for grow-out, evaluation and selection. Rigorous standards will be applied at all stages. Detailed guidelines and protocols for the dissemination of improved breeds will be developed with international experts in order to ensure that there is no adverse environmental impact. A self-sustaining breeding programme with private sector and government hatchery involvement will be established for the Philippines and guidelines will be prepared for similar work in other countries. This programme of work is unique in tropical developing countries and will produce, in addition to improved germplasm for Nile tilapia and guidelines for breeding programs, protocols for fish quarantine, germplasm cryopreservation, farmer-research interactions (user-perspective monitoring), and assessment of possible social and environmental impacts of improved breeds.

13. The investigation of the genetics of economically important traits and their relationship will lead to more efficient breeding and selection programmes. These investigations will involve field studies aimed at developing a well-defined breeding protocol on traits important to farmers and consumers. Other research related to the measurement of genetic traits and their use in selection will also be carried out.

14. The project will document and collect germplasm for strategic research. It will also evaluate new germplasm for aquaculture purposes and help in the development of protocols for the conservation and utilization of genetic resources.

15. A key element is the project's work in strengthening the capacity of national institutions to carry out selection work and develop national breeding programmes. This will be done through regular training workshops, specialized training for cooperating scientists from the Philippines and other countries, post-graduate training for graduate students, interregional workshops and an international conference.

16. The project is ultimately aimed at benefiting resource-poor fish farmers in developing countries, who will achieve a more stable increase in productivity. This increase in production of relatively cheaper fish protein will provide a dependable source of affordable animal protein for rural and urban consumers. Profitability will be an incentive for many families to start small-scale aquaculture enterprises. Women are also actively involved

in aquaculture enterprises, particularly at the family and community levels. In Bangladesh, 40 per cent of new entrants to tilapia and puntius (silver barb) culture are women. Their role in production and distribution activities is well recognized. The immediate beneficiaries will be the scientists of the national, regional and international institutions involved in aquaculture genetics research. The close involvement of scientists from the Philippines and other countries and regional organizations will be ensured through various means, including cooperative research networks.

17. UNDP and the World Bank have joined with the Commission of the European Communities and FAO to launch a study of international fisheries research and develop a related strategy and action plan for donor coordination. The proposed project covers one of the priority fields identified for strategic research and incorporates cooperative modalities which are fully in line with the strategy and action plan. The project also addresses issues identified in UNDP's fifth cycle global and interregional programme. The project will be executed by the Office of Public Services project.

18. The proposed total UNDP contribution is $4,822,690. Out of this total contribution, 36 per cent is for ICLARM, 32 per cent for the three collaborating organizations and 32 per cent for outreach to other organizations.

## III. RECOMMENDATION OF THE ADMINISTRATOR

19. The Administrator recommends that the Governing Council approve this project.

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