

Second Year Annual Report

Time period
Jun 26 2012 – Jun 30 2013

Title of project:

Establishment of a satellite nucleus of the GIFT strain at Rajiv Gandhi Center for aquaculture (RGCA), India

Project Number: N1152AQAQ

NAME OF ORGANIZATION: Rajiv Gandhi Center for Aquaculture (RGCA), India
Project: (RGC)-AQ3815RGC

Principal Investigators:

Curtis Lind [Quantitative Genetics] - WorldFish
Wagdy Mekkawy [Quantitative Genetics] - WorldFish
Raul Ponzoni [Quantitative Genetics] - WorldFish

Summary

The RGCA has expressed interest in running a formal breeding program (fully pedigreed population) that is similar to what WorldFish has been conducting for the GIFT strain in Malaysia. After discussions within the Fish Breeding and Genetics Group, the decision was made to develop a joint proposal between WorldFish and RGCA. The project includes the establishment of a satellite nucleus for the GIFT strain in India, the design and conduct of the genetic improvement program for GIFT fish, the development of dissemination strategies, and the enhancement of local capacity in the areas of selective breeding and genetics.

During the reporting period (June 2012 – June 2013), progress of the breeding program and other project activities was smooth. Progeny from the first generation of GIFT produced since transfer from Malaysia were successfully reared to tagging size and evaluated for grow-out performance in communal ponds (60 families). Selection decisions and subsequent production of the second generation was achieved between March and June 2013. The progeny are currently under communal rearing conditions in ponds and will be harvested in November, 2013 (planned). A training course on quantitative genetics and statistical analysis is planned and will take place at WorldFish, Malaysia, for four RGCA staff in September, 2013.

A. Progress of Research

1. **Purpose** – To develop a logical breeding structure for the tilapia industry in India in order to enhance the efficiency of the aquaculture production system.

2. Objectives

- Establish a satellite nucleus of the GIFT strain at RGCA
- Improve the genetic performance of the established nucleus through the application of a selection program based on a fully pedigreed population
- Disseminate the improved strain to farmers and producers throughout the country
- Enhance local personnel capacity in selective breeding, genetic improvement and statistical analysis

3. Implemented work program/workplan:

The work carried out so far covers the project activities planned for the first and second year, up to Q2 2013..

Table 1: Proposed work plan

Activities	2011				2012				2013				2014			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Transfer GIFT to India		X	X													
Rearing to harvest			X	X												
Production of 1 st generation					X	X										
Culture and data collection						X	X	X								
Selection of brood stock								X								
Production of 2 nd generation									X	X						
Culture and data collection										X	X	X				
Statistical analysis												X				
Production of 3 rd generation													X	X		
Culture and data collection														X	X	X
Statistical analysis																X
Meeting and group discussion			X		X		X		X		X		X		X	
Production of 4 th generation																X
Estimation of genetic parameters & responses														X	X	X
Training courses in genetics						X									X	
Meetings, visits			X				X				X				X	
Progress report & seminar				X				X				X				X
Final report & workshop																X

Quarter 1: Jan-Mar, Quarter 2: April-June, Quarter 3: July-Sept, Quarter 4: Oct-Dec

A. Major Achievements during the reporting period

After visiting the RGCA research station in June 2011, recommendations were made for the preparation of hatchery, nursery and grow out facilities. Sixty families from the latest generation of GIFT (generation 10) were transferred successfully from Jitra, Malaysia, to the RGCA research station at Vijayawada, India on the 25th of August 2011. After harvest and data collection, the data were processed and a mating list was prepared. For the long term sustainability of the population it is very important that as many families as possible sent to RGCA are represented in the next generation. This may not be possible due to a number of reasons, including very small number of fish in some families and unsuccessful spawning. In the preparation of the mating list every effort was made to maximize the family representations, as well as to minimize inbreeding in the offspring of the first mating. Subsequent spawning and mating activities were organized with the help and supervision of staff from the Fish Breeding and Genetics Group to produce the first generation of GIFT in India. The set-up of mating hapas at the RGCA research facility at Vijayawada can be seen in Figure 1. After the first spawning, 59 of the independent families sent to RGCA were represented in the new generation (G1). This is a very good outcome given that Indian team was involved in the spawning of tilapia for the first time. This first generation of GIFT produced in India after transfer from Malaysia was successfully reared to tagging size and subsequent evaluations for growth performance in communal ponds was conducted from Q1 to Q2 2012. Selection of brood stock to be used for producing the second generation (G2) occurred under the guidance and supervision of WorldFish staff in Q2 2012. Currently, 50 families from G2 are being tagged in preparation for rearing in communally reared in ponds as part of the evaluation process. Selection decisions on candidate brood stock to produce G3 are expected to be made in Q4 2013. A summary of major field activities is presented in Table 2, and achieved activities are presented in Table 3.

Table 2: Summary of field activities throughout the project

Generation	Spawning, egg collection	Tagging, stocking	Harvest	Number of families tagged	Number of tagged individuals
Base (shipped from MY)	6 Dec 2010 – 22 Apr 2011*	1 st and 2 nd week Jan 2012	24 Mar 2012 – 27 Mar 2012	59	1118
G1	18 Jun 2012 – 29 Aug 2012	13 Oct 2012 – 20 Oct 2012	18 Jan 2013 – 21 Jan 2013	60	4011
G2	3 Mar 2013 – 18 Jun 2013	Planned Aug 2013	Planned Nov 2013	50	Approx. 4000

* spawning done in Jitra, Malaysia



*Set up of mating hapas at RCGA research station at Vijayawada (May, 2012). An individual hapa was set up for each of the 150 mating pairs selected for producing the first generation of GIFT.
Photo: Curtis Lind.*

Table 3. List of achievements

No.	Activity	Target Date	Completion Date
1	Upgrading and preparation of hatchery, nursery and grow out facilities	Q1 2011	25/06/2011*
2	Transfer of fish to India (sixty families;1800 fish)	Q3 2011	25/08/2011
3	Rearing to harvest	Q4 2011	17/03/2012*
4	Processing of data, preparation of mating list and implementation of spawning and mating	Q2 2011	25/06/2012
5	Conduct of the mating cycle among selected G0 individuals (Base), resulting in G1	Q2 2012	29/08/2012
6	Grow out and genetic evaluation of G1 individuals	Q4 2012	21/01/2013
7	Conduct of the mating cycle among selected G1 individuals, resulting in G2	Q2 2013	18/06/2013
8	Grow out and genetic evaluation of G2 individuals	Q4 2013	On track Q4 2013
9	Conduct of a training course on quantitative genetics applied to the genetic improvement of tilapia	Q2 2012	Planned Q3 2013

*Project started later than scheduled, which is why these targets were not met

B. Outputs

The overall outputs funded by this project will be:

- Production of a high yielding tilapia strain adapted to a wide range of farming environments.
- Dissemination of the improved genes to a large number of fish farmers and producers sharing a common environment and interest.
- Development of a standard selective breeding protocol for relevant aquaculture species that are commonly cultured in India.
- Training the project staff in the areas of advanced quantitative genetics and statistics as well as newly developed techniques of tilapia farming.
- Helping hatcheries, producers and farmers to implement on-farm selective breeding programs.

As the project is in the implementation process, these outputs are yet to be fully achieved.

Products, people trained and technology transferred: To date, no formal training has been implemented. Hands-on guidance and training was provided by WorldFish when two staff (Hoong Yip Yee and Curtis Lind) visited RGCA to be present for the first spawning of GIFT after being transferred from Malaysia, in Q1 2012. This spawning was successful, which could be considered positive signs of an effective technology transfer of GIFT and GIFT technology from Malaysia to India. Mr Yee visited the station at Vijayawada again in February 2013 to advise and provide guidance on the preparations for the second spawning, to produce Generation 2 of the breeding program at RGCA. One training program was scheduled for Q2 2012; however, after discussion with RGCA staff it was decided that such a course would be more effective once data from the first generation produced at RGCA was available and could be utilised as example material during the course. It was decided that this training will take place at WorldFish HQ, Penang from 16-20 September, 2013. Four RGCA staff will attend the course, which will focus primarily on quantitative genetics and statistical analysis and will be delivered by Curtis Lind and Wagdy Mekkawy.

Reports and Publications: No scientific publications have been prepared yet as data generation and collection are in the initial phases. A summary of the full project and its importance to the future of the tilapia production in India has been published in the *Aquaria Aqua India Souvenir* magazine:

Nguyen, N.H., Ponzoni, R.W., Vijayakumar, S. and Raj, T.S. 2011. Establishment of a satellite nucleus of the GIFT strain at Rajiv Gandhi Center for Aquaculture (RGCA) to support tilapia production in India. *Aqua Aquaria India Souvenir* pp.37-47. Available online: http://www.worldfishcenter.org/resource_centre/WF_2833.pdf

Meetings and visits: So far three project meetings have occurred. A visit to RCGA (June 2011) by Alex Safari was done to inspect facilities and provide input towards initial implementation of the project and plans for transferring GIFT to RGCA. A second visit, in May 2012, was carried out so that experienced personnel (Hoong Yip Yee and Curtis Lind) could be present to supervise the first spawning of GIFT after being transferred

from Malaysia. Although the latter visit was not planned in the initial project proposal, a request from RGCA was made to WorldFish indicating that such a visit would be highly beneficial to the project and was thus carried out. This visit was supported by RGCA following a special request for an additional \$5000 to cover additional travel expenses that were unbudgeted for in the original project. Further details of the justification for the second visit are outlined in Annex 1. Two separate visits to Vijayawada were made by WorldFish staff in Q1 2013. Curtis Lind visited Vijayawada to discuss the progress of the project with the RGCA scientists and field staff, and combined the trip with an invitation to give a presentation at the technical session of the MPEDA-RGCA hosted AquaAquaria India Conference. The talk was titled “*Considerations about dissemination of improved fish strains for aquaculture.*”, and can be viewed at:

<http://www.slideshare.net/worldfishcenter/considerations-about-dissemination-of-improved-fish-strains-for-aquaculture>. Hoong Yip Yee also returned to Vijayawada to

oversee and provide guidance for the second mating at the station, which successfully produced Generation 2 of the breeding program in India. Further details of WorldFish staff travel during the project are in Table 4.

Table 4: Summary of WorldFish staff travel activities throughout the project

Date	Person	Place	Purpose
June 2011	Alex Safari	Vijayawada, IN	Facility inspection; project planning meeting
26 May – 9 June, 2012	Curtis Lind Hoong Yip Yee	Vijayawada, IN	Supervision and guidance during first spawning; project meeting
6 Feb – 15 Feb, 2013	Curtis Lind	Vijayawada, IN	Invited speaker at RGCA AquaAquaria India, 2013 conference; project meeting
21 Feb – 1 Mar, 2013	Hoong Yip Yee	Vijayawada, IN	Supervision and guidance during second spawning



Dr Anup Mandal (left) and RGCA Tilapia Project staff with Dr Curtis Lind (center) during the Aqua Aquaria India conference, February 2013.

C. Implications of Research Outputs and Achievements

To address the issue of lack of high quality brood stock of tilapia for poor farmers in India, RGCA decided to establish a satellite nucleus of the GIFT strain with the help from the WorldFish Fish Breeding and Genetic Group. Although the ultimate target groups of this project are fish farmers and small households, a wider range of beneficiaries are expected to benefit, including consumers more generally, commercial producers and scientists. The partner institutions involved will gain experience and knowledge in the development of genetic improvement programs for economically important traits and other aspects of quantitative genetics. Aquaculturists can adopt the technology for the general enhancement of fish production. The establishment of satellite hatcheries can increase availability and decrease the costs of seed stock. In this way the superior genetics at the nucleus level can be disseminated directly to fish farmers or indirectly through public and private hatcheries. Consequently, the project is expected to have positive social and economic impacts on the community, improving the living standard of poor people and contributing to gender equality via the creation of employment opportunities for women (e.g. forward and backward linkages in seed, feed and post-harvest) in rural areas of India where a large proportion of women are involved.

D. Problems

So far no major problems have been encountered. The program has been implemented successfully under the continuous guidance and supervision of the WorldFish Fish Breeding and Genetics Group, the dedicated staff of the RGCA research station and the

availability of excellent facilities. One of the members of Fish Breeding and Genetics Group was not able to obtain Indian visa to travel and participate in the conduct of mating activities in May 2012. We raised the matter with the RGCA coordinator in charge of the project and discussed the potential benefits of obtaining longer-term, multiple entry visas so that such an occurrence can be avoided in the future. The feasibility of this option is being investigated.

E. Linkages with other research

Currently the Fish Breeding and Genetics Group is planning research in the area of disease resistance, saline tolerance and feed efficiency, in order to include these traits in the future breeding objectives of GIFT. The establishment of another GIFT population in India opens up the opportunity of linkage and joint research for further improvement in productivity by focusing on the genetic improvement of these economically important traits and other traits which are important under the prevailing production systems in India.

In an unanticipated and unfortunate event, like flooding or high mortality due to diseases, the established GIFT nucleus at RGCA can be used to regenerate GIFT populations in Malaysia and vice versa. Furthermore, it will be interesting to compare the performance of the GIFT strain in two different locations.

G. Collaborators

The WorldFish Center
Rajiv Gandhi Center for Aquaculture (RGCA), India

H. Future Research Plans

The main aim of this project was to establish a satellite nucleus of the GIFT strain at RGCA. It will take at least 3 years to assess the outcome of the selection results and train RGCA staff in the area of selective breeding and quantitative genetics. The establishment of the GIFT population provides further opportunity to do research in the following areas:

- Disease diagnosis and inclusion of disease resistance in the breeding objectives
- Identification of alternative plant based feed.
- Inclusion of feed efficiency in the breeding objectives.

I. Budget

The detailed budgetary expenditures have been provided by Mr. Tan Ban Swee, of the WorldFish office in Penang.



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24th April, 2012

Dear Mr Thampi

RE: Request for additional travel funds for project to establish GIFT satellite breeding nucleus at RGCA

This note outlines our justifications for requesting additional funds from the Rajiv Gandhi Centre for Aquaculture (RGCA) to support the recently initiated project to establish a satellite breeding nucleus for a genetically improved strain of tilapia (GIFT) at the RGCA (Project number: AQ3815RGC).

We kindly request an additional \$US 5000 (five thousand US dollars) be provided to support travel expenses of an experienced team (3 persons) to make a field visit to RGCA to assist and advise staff in a critical stage of the breeding nucleus establishment. This request is an unanticipated addition to the currently allocated budget of this project; however, we believe that the activities facilitated by the additional support would provide important long-term benefit to the breeding program and to RCGA technical staff. Justification for this request is as follows:

1. The current budget provides for one visit to RGCA by a single member of the WorldFish genetics team per year (\$3000/year). Upon receiving the shipment of GIFT families from WorldFish in March 2012, the RGCA project coordinator requested for a team of WorldFish staff to visit and provide support and expertise to RGCA in areas of selective breeding, tilapia husbandry and reproduction during the first instance of brood stock selection and spawning. Although a team visit was not in the original budget, we believe this request is highly astute, as a successful and well organised mating in the base population will provide a strong foundation for a newly established breeding nucleus and place the RCGA tilapia genetic improvement program on the correct trajectory for long-term success. Such a visit by WorldFish staff will help achieve this.
2. Given that it will be the first time that the majority of RGCA staff will take part in a major structured tilapia breeding event, they will benefit from the presence of a team with diverse expertise and experience and will gain confidence to run such activities independently in the coming years. As a team, we are able to provide expertise and assistance in many practical and theoretical areas relevant to the implementation of tilapia genetic improvement programs. A field visit by three members of our team is likely to be of particular benefit, especially during the critical first spawning event as we can clearly demonstrate and describe what is required. Furthermore, one of our technical staff recently took part in an international tilapia husbandry course in Thailand, and we believe it

would be highly beneficial that he is able to share the most recent advancements and techniques in tilapia aquaculture with the RGCA staff.

3. Since the initial proposal (and budget) was written, it is evident that frequent and open interaction between WorldFish and RGCA staff will substantially improve the likelihood of a smooth and successful technology transfer of GIFT to India. Opportunities for WorldFish and RGCA staff to familiarise each other and communicate face-to-face, such as what will be facilitated through this additional request for support, provides a fertile ground for strengthening our collaboration and the continued success of a tilapia genetic improvement program in India.

We trust that you will agree that our justifications for this request are highly relevant. We are confident that, if approved, the additional support provided by your organisation will help contribute towards us achieving a similar impact of GIFT tilapia in India as has been done in other regions of Asia.

We look forward to receiving your response.

Sincerely,

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cc: Dr Raul Ponzoni [Principal Research Scientist]
Dr Curtis Lind [Scientist]
Mr Ban Swee Tan [Business manager]
Mr Yee Hoong Yip [Technician]