

DEVELOPMENT OF SUSTAINABLE AQUACULTURE PROJECT

**A project implemented by
ICLARM-The World Fish Center**

**Funded by the
U.S. Agency for International Development (USAID)
(Cooperative Agreement 388-A-00-00-00068-00)**

PROGRESS REPORT (1 October 2001 - 31 December 2001)


Prepared by

**Johannes Janssen
Project Leader**

**Aminul Islam
Integrated Aquaculture Consultant**

**Ferdous Alam
NGO Coordinator/Researcher**

**Hasan Chowdhury
Research Associate**



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INTRODUCTION

The Development of Sustainable Aquaculture Project (DSAP) was authorized by USAID under the Cooperative Agreement # 388-A-00-00-00068-00 on 28 June 2000. This report covers activities for the three months of the project, 1 October 2001 through 31 December 2001. Financial reporting for the Project is handled separately from ICLARM headquarters in Penang, Malaysia.

The main thrust of the DSAP is to sponsor on-farm aquaculture production demonstrations implemented through co-operating NGO partners. These demonstrations are expected to show farmers and their neighbors the profitability of managed aquaculture systems as small business operations. Both small ponds and integrated rice and fish systems, based on research proven production results, are the target of these demonstrations. The Project also has a research component directed to understanding and exploring additional production options, improving the technology transfer process and monitoring the impact of the adopted aquaculture practices.

Our activities are generally on schedule as given in the work plan for 2001. We have completed an extensive evaluation of the 2001 program for the implementation of aquaculture demonstrations by organizing an individual evaluation meeting with all partners NGO at their headquarters. Of note is the transition to a new Project Leader, Drs. Johannes Janssen who assumed full responsibilities from Dr. John Grover as of 1 October 2001.

Details about the support for on-farm demonstrations, research, training and administrative actions are given in the respective sections of this report.

DEMONSTRATIONS AND NGO ACTIVITIES

As per need of the project, the tenure of the production cycle for 2001 was extended for one month up to December 31, 2001 making the total time for the 2001 implementation 13 months. The NGOs' budgets for 2001 have been revised accordingly. As of the end of the reporting period a total of 16 (sixteen) NGOs took active part in the implementation of DSAP activities. BRAC discontinued the use of DSAP funds from August 2001 as reported in the previous progress report. While monitoring implementation of DSAP activities, the performance of the field staff of the TMSS was not found satisfactory. In mutual agreement, ongoing activities of TMSS under the DSAP were frozen and DSAP financial support was discontinued allowing TMSS to restructure their staff. TMSS used part of the DSAP budgeted money but retained the balance for implementing DSAP activities in 2002. BRAC used some part of the DSAP budget and returned the balance to ICLARM. Both BRAC and TMSS reported that they continued demonstrations until fish harvest, which was supported by their core staff.

Altogether the partner NGOs demonstrated a total of 16 different technologies in 2001. The working areas included 68 Thanas of 27 districts. A total of 6608 demonstration farmers in 464 groups were made. The average number of demonstration farmers per group was 14 ranging from 2 to 34. The low number of members of some demonstration group is due to the 2001 strategy that focused on organizing the demo-farmers technology wise. One Field Assistant was on average responsible for 7 groups (lowest 4, highest 12). The average size of the demonstration pond/plot was 28.92 decimals. Some 774 hectares (1912 acres) of water areas were covered in the demonstration. The details of the 2001 demonstrations are provided

in DSAP working paper No 5 "Development of Sustainable Aquaculture Project", and the ICLARM-NGO Directory 2001.

The activities of the partner NGOs were closely monitored by the Research Assistants supported by the project's Research Associates and Field Coordinator during the entire reporting period. Occasional sampling of fish was conducted in some farms to monitor fish growth. Subsequently it was decided to discontinue this time consuming activity since this and monitoring of fish health could/should be done by daily observation during feeding. Although the Research Assistants discontinued the monitoring of sampling, some demonstration farmers however, who had expressed their desire to continue the same, were supported by NGO staff and Research Assistants of ICLARM.

All the 16 Partner NGOs have successfully completed the 2nd follow-up training and thereby completed training of nearly 6,000 demonstration farmers during the period of October-December 2001. This 2nd refresher training for farmers was concentrated on post-stocking management, disease prevention and harvesting of fishes. The trainer teams composed of NGO trainers (Project Coordinators and Field Assistants) conducted the training with necessary assistance of ICLARM's Research Assistants.

Significant efforts were made by ICLARM to assist the farmers and the Field Assistants to correctly fill up the pond books. The necessity of a pond book for each demonstration pond/plot and the probable use of data contained therein was mentioned in the second and third follow up training courses. In order to make meaningful use of the information in the pond books, all Research Assistants of the DSAP team were sent to the field to monitor the status of pond book. They also assisted the NGO staff to correctly fill up the same so that meaningful use of data of the pond book can be made.

To make the aquaculture support program of the contracted NGOs sustainable, the Project has introduced the principal of paid extension. Verbal or written contracts have been made with the cooperating farmers to share a small part of the benefit from the aquaculture demonstration with the NGOs as payment for the provision of services that allowed the farmer to increase his aquaculture production and profit significantly by adopting the improved technologies. The general agreement was to pay more or less 10 Taka per decimal as service charges after harvesting and some NGOs have already started to collect some of the service charges. The situation of the service charges for the 2001 demonstrations will be given in the next progress report (first quarter 2002) when all the harvests are completed.

The NGOs were committed to organize at least two rallies and/or farmers' days per field assistant. After the withdrawal of BRAC and TMSS from the 2002 program as well as after the reduction of ARSHI's staff (cf. previous progress report), at least 116 rallies were scheduled. The contracted partner NGOs organized and held during the reporting period 55 rallies reaching over 7,000 participants. On average 130 participants per rally attended these public aquaculture promotion meetings. Research Assistants and other DSAP staff supported the organization of these rallies and farmers' days and attended almost all of them. The remaining rallies and farmers' days are scheduled for the first quarter of 2002.

One important objective of the aquaculture demonstrations is the adoption of these improved aquaculture technologies by fellow farmers. The continued publicity by the cooperator farmer as well as the rallies/farmers' day are the main tools to achieve this goal. A specific survey has been developed to assess the degree of spread-over effect of the 2001 demonstrations. This survey has been scheduled for April-May 2002 and will be conducted at

the same time as the checking of the selection of new cooperator farmers of the 2002 program.

All problems related to implementation of DSAP activities during the period were addressed by the DSAP staff and possible solutions and assistance were provided. The Project Leader and the Field Coordinator physically visited all NGOs in order to gain a clear understanding of the office accommodation, staff strength, and participation in different programs as well as their attitude regarding the partnership arrangement. Discussions with most executive directors (ED) were made to know recommendations for improving our collaboration and share with them our strategy for the future. Most executive directors came up with constructive proposals and responded very positively to the probable strategic reorientation to be made for the following year's program.

The DSAP staff arranged four visits of USAID and other personnel to practically show to them the demonstration plot/ponds of the farmers.

RESEARCH

Impact assessments of adopted aquaculture practices

The use of the data of the pond book for 2000 was considered essential and some 800 such pond books out of 6248 received have been randomly selected to determine the technology profiles and partial economics of the fish culture operation as part of their overall farm household. Activities related to this such as scrutiny of the contents of the selected pond books and entry of the same is in progress. The report will be available in July 2002.

Collection of the 2001 pond books for analysis is scheduled for 2nd quarter 2002. After checking the data, a random sample will be analyzed and the results will be reported by the end of the 3rd quarter 2002.

A detailed questionnaire was prepared and pre-tested to study the impact of the 2001 aquaculture demonstrations on the livelihood of the farmers. Some 475 farmers were randomly selected for the study. All Research Assistants were sent to the field to collect relevant data for the impact analysis. The effort started in the month of September 2001 and will continue till March 2002. Multiple visits are being made to collect the data. Selected sample farmers were monitored to complete the collection of desirable information. In the mean time, some 80% of the data collection have been completed. The collected data are being entered in the computer and analysis of the same will be started after completing the entry of the rest of the data.

Collaborative Research with BFRI

Continuing efforts for approval of the TAPP for collaborative research work with BFRI has been successful and the TAPP has been approved at the end of December 2001. Awaiting the finalization of the long administrative procedures and the release of the signed approved TAPP, a work session with BFRI should be organized beginning next year to prepare the 2002 work plan for DSAP support of collaborative research with BFRI.

Research Grants to Universities

The DSAP continued to support five small research projects, three of which have been ongoing since April 2001, one since July 2001 and one since August 2001. Implementation of another small research project has been started 29 November 2001. In total, six small research projects are now in force with different sector specialists at the Bangladesh Agricultural University (BAU), Mymensingh. They are as follows:

1. **Improved handling and preservation of golda (*Macrobrachium rosenbergii*) for producing safe and wholesome products.** Prof. Dr. Md. Kamal and Prof. Dr. Md. Nazrul Islam, Dept. of Fisheries Technology, BAU; contracted to implement the project during 1 April 2001 to 30 March 2002, approved budget Tk. 250,000.
2. **Cost-profit analysis and market testing of value-added products from silver carp (fish mince block, fish burger, fish stick and fish sausage).** Prof. Dr. A.K.M. Nowsad Alam, Dept. of Fisheries Technology, BAU; contracted to implement the project during 1 April 2001 to 30 March 2002, approved budget Tk. 250,000.
3. **Development of an appropriate technology on *Azolla* based rice-fish farming.** Prof. Dr. Musharraf Hossain Mian, Dept. of Soil Science, BAU; contracted to implement the project during 1 April 2001 to 30 March 2002, approved budget Tk. 254,800.
4. **Ecology of euglenophytes in aquaculture ponds and their role in fish production.** Dr. Ms. Saleha Khan, Dept. of Fisheries Management, BAU; contracted to implement the project during 1 July 2001 to 30 May 2002, approved budget Tk. 237,315.
5. **Economic analysis of the sustainability of supplementary feed based aquaculture.** Prof. Dr. Md. Ferdous Alam, Dept. of Agricultural Finance, BAU; currently Field Coordinator/Researcher, ICLARM, Dhaka; contracted to implement the project on 1 August 2001 at a budget of Tk. 225,000.
6. **Study of inbreeding problems of Thai pangas (*Pangasius sutchi*) in Bangladesh using allozyme electrophoresis.** Dr. Md. Mukhlesur Rahman Khan, Dept. of Fisheries Biology and Genetics, BAU; contracted to implement the project during 1 December 2001 to 30 November 2002, approved budget Tk. 250,000.

Details of these studies and the graduate research assistants assigned to these small grant projects are given in attachment 2.

TRAINING

The 2nd follow-up training for field staff of DSAP-partner NGOs recruited in 2001 was conducted from 13-30 October 2001 at GTI, BAU Mymensingh. 63 Field Assistants participated in 3 training workshops each of 2.5 days. One special follow-up training workshop was organized for the 13 NGO Project Coordinators during the same period. A participatory training needs to assessment was carried out at the beginning of the training sessions and the results of this assessment have been integrated in the course content. During these refresher-training courses, the guidelines for the implementation of the 2001 demonstrations were analyzed by the trainees using different participatory tools. After a series of brain storming sessions in work groups, prioritization of constraints and possible solutions, panel discussions/analyses, the participants came up with constructive

recommendations for the implementation of aquaculture demonstrations through the NGO community.

MACH Project, ICLARM, Farmer-to-Farmer Program (FTP) and CARITAS Bangladesh jointly organized a workshop on "Status of Tilapia Production Strategies for Bangladesh" on 9th December 2001 at the BRAC Center, Dhaka. The guest speaker Dr. James Rakocy, a scientist from the University of the U.S. Virgin Islands presented an oral presentation on the potentials and constraints of tilapia farming and different culture practice models of tilapia around the world. About 60 participants from different leading private commercial farms, DoF, BFRI, BAU, BRAC, CARITAS, CARE and other donor funded project specialists took part in the workshop. Discussions were concentrated on the emerging commercial monosex tilapia culture in fresh water ponds, in particular (i) the dependency on imported seed (from Thailand and Taiwan) and (ii) the fear for the reduced market price in near future as a result of increasing supply.

BAU and the Directorate of Youth Development (DYD) organized a week-long training program from 21-27 October 2001 at YTC, Mymensingh for the Senior Instructors of Youth Development Centers. Prof. Aminul Islam and Hasan A. Chowdhury from ICLARM participated for 3 days as facilitators/resource persons on two main topics, namely principles of aquaculture and modern approaches of rice-fish farming, respectively.

Numerous visitors from different NGOs and Private Institutions visited the ICLARM Office during last quarter 2001 and senior staff of the DSAP team including the Project Leader had discussions on project delivery and design of the 2002 workplan.

ADMINISTRATION

A list of the Project personnel as of 31 December 2001 is attached (cf. attachment 4). Johannes Janssen joined the DSAP as the incoming Project Leader on 1 September and took over the responsibility of the Project on 1 October 2001. Outgoing Project Leader Prof. John Grover left Dhaka in 11 October 2001. Mr. Md. Nazrul Islam joined ICLARM as driver on 1 November 2001. ICLARM purchased a reconditioned 15-passenger van that will be available to support our training efforts. The Project will be charged monthly 0.33 US\$ per mile for the use of this microbus. A monthly DSAP staff meeting has been introduced to improve the implementation of the planned project activities. The first staff meeting which involved the regrouping of all technical staff and representatives of the different categories of support staff was held on 11 November 2001.

The usual assortment of meetings, visitors and field visits were attended to during the report period. The most important were:

1. Drs. Johannes Janssen and Dr. Ferdous Alam attended the national workshop on review of proposed research projects (2000-2001) of BFRI on 16 October 2001 at Mymensingh;
2. A field visit was organized for USAID and US Embassy staff to visit project activities in Kapasia and Sreepur (Gazipur district) on 1 November 2001;
3. Dr. Mark Prein, Program Leader, Freshwater Resources Research Program, ICLARM headquarters, Penang/Malaysia, visited Dhaka for a back stopping mission from 19-22 November 2001;
4. Professor Islam gave special service to BAU Faculty of Fisheries in conducting examinations spanning 3 days in November.

ATTACHMENTS

Attachment 1 NGO Cooperators, status of on-farm demos as of 31 December 2001.

Attachment 2 Research assistance supported under small research grants.

Attachment 3 USAID-funded staff list as of 31 December 2001.

Attachment 4 Geographical distribution of year 2001 demonstration effort.

Attachment 1 NGO Cooperators, status of on-farm demos as of 31 December 2001.

NGO	No of planned ponds/plots		Total budget		1st installment	2nd installment			last	remaining
	initial	revised	initial	revised	(50%) to CPMC	to CPMC	to UPMC	total	installment	budget
ADI	500	500	1,500,000	1,531,875	750,000	60,000	552,845	612,845		169,030
ARSHI	500	292	1,500,000	1,016,398	750,000		60,000	60,000	130,975	75,423
BAIC	500	500	1,500,000	1,520,541	750,000	54,619	512,203	566,822		203,719
BS	500	503	1,500,000	1,531,875	750,000	29,830	462,143	491,973	108,027	181,875
BRAC	500	311	1,500,000	194,106	194,106					0
CARP	300	300	900,000	923,337	450,000		360,000	360,000		113,337
CIRUP	300	300	900,000	889,600	450,000					439,600
CARITAS	600	600	2,207,329	2,207,329	750,000			1,236,596		220,733
CRED	500	500	1,500,000	1,531,875	750,000	120,000	480,000	600,000		181,875
DSS	200	201	600,000	608,750	300,000					308,750
ORD+FHD	500	497	1,500,000	1,508,958	751,000	50,493	549,507	600,000		157,958
JC	500	500	1,500,000	1,500,000	750,000	50,416	549,584	600,000		150,000
PRANTEC	300	304	900,000	923,125	450,000		303,801	303,801	33,500	135,824
RRC	300	300	900,000	923,125	450,000	28,075	331,925	360,000		113,125
RASDO	300	300	900,000	923,125	450,000					473,125
SPP	200	200	600,000	608,750	300,000		251,586	251,586		57,164
TMSS	500	500	1,500,000	311,419	750,000					-438,581
Total (Taka)	7,000	6,608	21,407,329	18,654,188	9,795,106	393,433	4,413,594	6,043,623	272,502	2,542,957
Total (US\$)			378,891	330,163	173,365	6,963	78,117	106,967	4,823	45,008

¹ CPMC = Central Project Management Committee, Accounts on this level are managed by Executive Director and Project Coordinator

² UPMC = Unit Project Management Committee, Accounts on this level are managed by Project Coordinator and Field Assistant

Attachment 2 Research assistance supported under small research grants

- 1. Improved handling and preservation of golda (*Macrobrachium rosenbergii*) for producing safe and wholesome products.** Prof. Dr. Md. Kamal and Prof. Dr. Md. Nazrul Islam.

A progress report covering the period from October 2001 to December 2001 was received. The post harvest quality loss from farm to depot is determined to be 2-14% in Paikgacha, Fakirhat and Rampal region. Whole golda put into ice immediately at harvest were in acceptable condition for seven days, delay in icing by 1 hour in tropical weather reduced the shelf life considerably. Delay in icing by 4, 8 and 12 hours was found to shorten the shelf life to only 3, 2 and 1 days, respectively. Changes in myofibrillar ATP-ase activities declined considerably in all samples at high ambient temperature in 4, 8 and 12 hours prior to icing whereas, little or no change was noticed in samples stored in ice immediately after catch. Delayed icing increased the bacterial load (APC) as well as generic distribution of the bacteria considerably (i.e. *Vibrio* and *Enterobacteriaceae*), which were not detected in the initial samples but were detected in some samples during subsequent storage.

- 2. Cost-profit analysis and market testing of value-added products from silver carp.** Prof. Dr. A.K.M. Nowsad Alam.

A progress report covering the period from October 2001 to December 2001 was received and the release of the second installment (40%) was approved in October 2001. It is reported that a considerable value addition could be done through developing some value-added products from the cheapest fish, the silver carp. From a 1-kg silver carp (price Tk. 25), 600 g of whole mince was recovered which on addition of cryoprotectants (9%) after washing produced 400 g of surimi (78% moisture level). The production cost was Tk. 35 (including price of raw material, ingredients and wage) i.e. Tk. 85/kg of surimi which is equivalent to US\$ 1.42 that may be sold at around US\$ 2.5 in the international market. From 600 g unwashed mince of a 1-kg silver carp, a total of 900 g sausage dough was produced from where 15 pieces of fish sausage, 30 pieces of fish ball, 25 pieces of fish stick and 12 pieces of burger patties were prepared. The production cost was Tk. 65-70 (including price of raw material, ingredients and wage) which could be sold at Tk. 425 in the rural markets in Bangladesh, higher price may be obtained in the urban markets. Estimation of the above prices were reported to be based on the opinions expressed by the rural consumers in the questionnaire ("What price you consider to be reasonable and you could afford for the product?") provided to them during market tests. Consumers living in villages adjacent to the BAU campus as well as in the coastal areas were reported to prefer fish ball, fish sausage and fish sticks of silver carp than those of marine fish. Two training programs on manufacture of value-added products from silver carp were conducted in Mymensingh where the participants were low-income rural people and wives of fishermen. Two more training programs and follow up are targeted to be completed within the tenure of the research grant.

- 3. Development of an appropriate technology on *Azolla* based rice-fish farming.** Prof. Dr. Musharraf Hossain Mian.

A progress report covering the period from 1 July 2001 to 30 September 2001 was received and the release of the second installment (30%) was approved on 3 December 2001. Two experiments were conducted in 15 model rice-fish plots constructed

for the purpose in the field laboratory of the Soil Science Dept. The first experiment was conducted for 120 days to study the efficiency of fertilizer based, *Azolla* based and supplementary feed based rice-fish farming systems. Fish yield of 2083kg/ha was obtained from 100% *Azolla* based-rice fish plots while that of control plots (no *Azolla*) was 1083/ha. On the other hand the maximum rice grain yield (8670 kg/ha) was obtained from plots having 100% urea + rice + fish. The next highest rice grain yield (7770 kg/ha) was in plots having 50% *Azolla* + rice + fish. The second experiment was conducted for 90 days to study feeding efficiency of different fish species on fresh *Azolla* biomass and their relative growth performance. Grass carp fry (30-day old) having an average weight of 0.7 g grew to an average weight of 12 g in 90 days and the *Azolla* consumption was 0.747 kg/1000 fry on the 1st day while 7.5 kg/1000 fingerlings on the 90th day. Silver barb fry (30-day old) having an average weight of 1.0 g grew to an average weight of 7.6 g in 90 days and the feeding efficiency was 0.750 kg/1000 fry on the 1st day while 9 kg/1000 fingerlings on the 90th day. GIFT tilapia fry (30-day old) having an average weight of 1.0 g grew to an average weight of 9.2 g in 90 days and the feeding efficiency was 0.573 kg/1000 fry on the 1st day while 6.2 kg/1000 fingerlings on the 90th day.

4. Ecology of euglenophytes in aquaculture ponds and their role in fish production. Dr. Ms. Saleha Khan.

A progress report covering the period from October 2001 to December 2001 was received and the release of the second installment (40%) was approved in October 2001. Two experiments were conducted towards achieving the targeted objectives; one experiment was conducted in 12 experimental ponds of the Faculty of Fisheries in the BAU campus and the other one in rural fishponds in three geographical areas (Madhupur, Fulpur and Sutiakhali) in the greater Mymensingh district. It is reported that euglenophyte blooms have some relationship with higher temperature but lower values of pH, NO₃-N and PO₄-P in the water. Euglenophyte blooms are found to affect adversely the production of phytoplankton through utilization of pond nutrients (out competition). Affected ponds in BAU campus were dried out and when refilled with water, initially no bloom occurred but blooms reappeared after fertilizer application. Direct toxicity to fish was not detected in ponds with a euglenophyte bloom. However, it is known that over blooming may cause mass mortality of fish through gill clogging leading to mass mortality and subsequent bacterial decomposition of the blooming organisms. Euglenophyte blooms are reported to reduce considerably the plankton density resulting in the reduction of fish production. However, Rajpunti (40-45 % of the gut contents), silver carp (40-45 % of the gut contents) and rohu (40-45 % of the gut contents) were found to consume euglenophytes. The most affected species is catla, where no euglenophyte was detected in their gut contents as a result of which their growth performance was very poor in ponds with euglenophyte blooms.

5. Economic analysis of the sustainability of supplementary feed based aquaculture. Prof. Dr. Md. Ferdous Alam.

Tk. 43,865 was released as of 31 December 2001. Collection of both the primary and secondary data from different types of farmers are in progress by administering pre-tested questionnaires.

6. **Study of inbreeding problems of Thai pangas (*Pangasius sutchi*) in Bangladesh using allozyme electrophoresis.** Dr. Md. Mukhlesur Rahman Khan.

As per agreement Tk. 100,000 (40%) was approved as first installment on 10 December 2001. Rearing of brood fish and fingerlings from four selected hatcheries is in progress. This activity is conducted mainly by two graduate research assistants are doing the work, which should lead to the preparation of their M.S. thesis.

Furnished below is a list of graduate research assistants receiving support from small grants from our USAID project funds:

Name of project: Improved handling and preservation of golda (*Macrobrachium rosenbergii*) for producing safe and wholesome products.

1. **Name of student:** Mr. Md. Kamruzzaman

Title of thesis: Post-mortem changes in Golda during ice-storage (completed).

2. **Name of student:** Mr. Chowdhury Tanvir Ahsan

Title of thesis: Post-mortem changes of Small Indigenous Fish Species (SIS) under various storage conditions (manuscript drafting).

3. **Name of student:** Mr. Dilip Kumar Chowdhury

Title of thesis: Prevalence of bacteria of public health significance in cultured freshwater prawn *M. rosenbergii* from some selected farms (on-going).

Publication: Rahman, M., L. Yasmin, M. Kamal, M. N. Islam and Y. Ochii (2001). Quality changes freshwater prawn *Macrobrachium rosenbergii* during ice storage. Bull. Fac. Edu. Ibaraki Univ. (Nat. Sci.) 50 (2001): 39-49.

Rahman, M., L. Yasmin, M. Kamal, M. Kamruzzaman, M.N. Islam and Y. Ochii (2001). Effect of delayed icing on the quality changes in freshwater prawn *Macrobrachium rosenbergii* during subsequent storage. Bull. Fac. Edu. Ibaraki Univ. (Nat. Sci.) 50 (2001): 52-57.

Name of project: Cost-profit analysis and market testing of value-added products from silver carp (fish mince block, fish burger, fish stick and fish sausage) and involvement of rural low-income people in the production and marketing of value-added products.

4. **Name of student:** Mr. Md. Kamruzzaman

Title of thesis: Cost-profit analysis of value-added products from silver carp and a pilot market testing of product acceptability by the rural and coastal people (on going).

5. **Name of student:** Mr. Abu Bashar Muhammad Shahidul Hoque

Title of thesis: Development of least-cost and easy formulation process of value-added fish ball, fish stick and fish burger from silver carp in farmer's kitchen (on going).

Publication: Newsad Alam, A. K. M., M. Kamruzzaman and M. S. Hoque. 2002. Cost-profit analysis of the formulation of value-added products from silver carp (*Hypophthalmichthys molitrix*) in farmer's kitchen. Asian Fisheries Science. (MS).

Newsad, A.K.M. A., M.S. Hoque and M. Kamruzzaman. 2002. Consumer's acceptance and pilot market-testing of fish ball and fish burger prepared from silver carp (*Hypophthalmichthys molitrix*). Asian Fisheries Science. (MS).

Name of project: Development of an appropriate technology on *Azolla* based rice-fish farming.

6. Name of student: Mr. Md. Khairul Islam

Title of thesis: A study on introducing *Azolla* as bio-fertilizer for simultaneous cultivation of rice and fish (on-going).

Name of project: Ecology of euglenophytes in aquaculture ponds and their role in fish production.

7. Name of student: Mr. B.M. Zahidul Islam

Title of thesis: Ecology of Euglenophytes in fertilized fish ponds at BAU campus (on-going).

8. Name of student: Mr. Md. Mahabubur Rahman

Title of thesis: Dynamics of Euglenophytes in rural fishponds managed differently in three different geographical areas (on going).

Name of project: Economic analysis of the sustainability of supplementary feed based aquaculture.

9. Name of student: Mr. Md Obaidur Rahman

Title of thesis: Economic analysis of the sustainability of supplementary feed-based aquaculture (on-going).

Name of project: Study of inbreeding problems of Thai pangas (*Pangasius sutchi*) in Bangladesh using allozyme electrophoresis.

10. Name of student: Mr. Suman Barua

Title of thesis: Study on genetic variation of Thai pangas (*Pangasius sutchi*) brood and F₁ generation of four hatchery populations using allozyme electrophoresis.

11. Name of student: Mr. Muhammad Shafiqul Alam

Title of thesis: Comparative study of morphological differences of four hatchery populations of Thai pangas (*Pangasius sutchi*) brood and F₁ generation.

Attachment 3 USAID-funded staff list as of 31 December 2001.

No	Name of Staff	Position	Date Employed
1	Drs. Johannes Janssen	Senior Aquaculture Scientist & Project Leader	01 September 01
2	Prof. Aminul Islam	Integrated Aquaculture Consultant	01 March 99
3	Prof. Md. Ferdous Alam	NGO Coordinator/Researcher	01 July 01
4	Hasan Ahmed Chowdhury	Research Associate	15 December 99
5	Dr. Khondker Murshed-e-Jahan	Research Associate/Fellow	24 January 01
6	Kh. M Shameem Kamal	Research Assistant	01 July 99
7	Manuara Azim	Research Assistant	01 July 99
8	Mohammad Abdul Latif Siddique	Research Assistant	11 March 01
9	Md. Jahirul Hoque	Research Assistant	11 March 01
10	Mohammed Mokhlesur Rahman	Research Assistant	11 March 01
11	Bijan Mazumder	Research Assistant	11 March 01
12	Md. Mamunor Rashid	Research Assistant	20 June 01
13	Md. Abul Kashem	Research Assistant	20 June 01
14	Bijoy Bhushan Debnath	Administrative Officer	01 May 90
15	Khan Golam Rasul	Accounts Officer	01 June 96
16	Md. Billal Hossain	Data Entry Operator	01 August 99
17	Md. Abdur Razzak	Driver	01 May 89
18	Md. Dulal	Driver	01 May 99
19	Md. Nazrul Islam	Driver	01 November 01
20	Tapan Chandra Sarker	Messenger	01 July 93
21	Md. Idris Ali	Messenger	01 June 98
22	Md. Abdul Wahab	Messenger	01 September 98
23	Md. Mahade Hasan Babul	Messenger	01 July 01

Attachment 4 Geographical distribution of year 2001 demonstration effort (NGO-wise)

