

SUNDURBANS AQUACULTURE PRACTICES
 Ray DeWandel, AwF Volunteer
 October 5-20, 2010

Joygopalpur Gram Vikash Kendra

at a glance

June 2009

	State	District	Block	GP	Beneficiaries
INCOME GENERATION					
ANIMAL HUSBANDRY (chicken, duck, goat, sheep, pig)	2	3	5	15	3200
AQUACULTURE (fish, prawn)	2	2	2	4	92
AGRICULTURE (cereal, oilseed, pulses)	2	2	2	4	500
FISHERY	1	5	6	9	1200
HOME INDUSTRY (saree, weaving, knitting...)					
EDUCATION					
NON-FORMAL EDUCATION CENTRES	1	1	2	4	400
NURSERY SCHOOL	2	2	2	2	215
COMPUTER SCIENCE CLASS	1	1	1	4	100
ENGLISH CLASS	1	1	1	1	15
COACHING CENTRE	1	1	1	2	125
TEACHER TRAINING	1	1	1	1	40
SAVITRI EDUCATION PROGRAM	1	1	1	1	622
RURAL LIBRARY	1	1	1	1	Org. Level
DISTRIBUTION OF UNIFORMS AND TEXTBOOKS	1	1	1	8	2000
ENVIRONMENT					
TREE PLANTATION	2	3	5	15	5000
SCHOOL GARDENING	2	1	1	4	5
RAIN WATER HARVESTING	1	1	1	1	2000
WATER LITERACY PROGRAM	2	2	7	21	12000
NATURE PROTECTION					
HEALTH					
WOMEN AND CHILD HEALTH CARE	1	1	1	6	10000
HEALTH CARE CENTER	1	1	1	19	20000
LATRINE PRODUCTION / SANITATION	1	2	8	25	4000
SAFE DRINKING WATER (free of arsenic and bacteria)	1	2	7	25	2000
WASHING PLANTS	2	2	2	2	Org. Level
HYGIENE AWARENESS	1	2	8	25	20000
SOCIAL					
WOMEN SELF-HELP GROUP	2	5	9	39	12000
VILLAGE COMMITTEES	2	5	9	39	15
LOCAL JUSTICE AND SECURITY	2	5	9	39	12000
WEDDING CREDIT	2	5	9	39	5
ENTERTAINMENT AND CULTURE					
VILLAGE SPORT PROGRAM	2	5	9	35	12000
MUSICAL SCHOOL	1	1	1	1	85
PROTECTION OF LOCAL CULTURE PROGRAM	1	1	1	1	3
CHILDREN PARK	1	1	1	1	Org. Level
SUNDARBAN BIO-DIVERSITY MUSEUM	1	1	1	1	Org. Level
OTHER ACTIVITIES					
STREET THEATRE	1	1	5	15	10000 (Appr.)
WORKSHOPS	2	5	9	39	1500
TRAININGS	2	5	9	39	14000
SEMINAR	2	5	9	39	20000 (Appr.)
NETWORK					
VILLAGE COMMITTEES	2	5	9	39	
CRG	2	5	9	39	
UNIVERSITIES (local) (1)	1	1	1	1	1
UNIVERSITIES (International) (2)	2	1	9	39	
GOVERNMENT (3)	2	5	9	39	
NGOs (National & International) (4)	2	5	9	39	
SCHOOLS (primary and secondary)	1	2	7	21	

(1) Jadavpur University
 (2) Royal Veterinary and Agriculture University, Danish Technical University (DTU), Aarhus University, Bangladesh Agriculture University
 (3) DANIDA, Sunderban Development Board, Government of West Bengal, DST Government of India
 (4) Danish NGO Council, IGF, UBU, SUG, CINI, Poultry network, PBMSK, SCF, KMTS, AWF, Tollo Foundation, SSMUS, SMMS, KTT, BJKS, MW, PVNA

OVERVIEW

The Joygopalpur Gram Vikash Kendra (JGVK) organization is a multifaceted community development program established to help the local people meet basic human needs and to advance technology and education. Secretary Biswajit Mahakur is the lead administrator. Programs include but are not limited to education, income generation, health, sanitation and hygiene, preservation of the environment and cultural activities.

The organization is supported by over two dozen partners including the Tollo Foundation and Aquaculture without Frontiers (AWF.) Also noteworthy is the Danish NGO India Group Funen (IGF), Secretary Ganesh Sengupta. IGF provides administrative assistance, regular Danish student volunteers who live on site and financial aid.

The various projects are integrated to improve the standard of living in a broad community. Joygopalpur is located in Western Bengal, India, on an island in a broad delta area of a major river system. Because it is close to the Bay of Bengal and is at low elevation and very flat the river is brackish and subject to tidal fluctuations. The ground water table is very deep and freshwater wells are in the range of 200 meters in depth.

Additionally, the distribution of rainwater is highly variable with most coming in the rainy season around May through September. This combination of factors requires the people to store water in canals and ponds for use throughout the year. The people are very poor and there are no large reservoirs for water storage.

Typically, a small pond is excavated by hand and the earth used to build a mud house. The soil has extremely high clay content as evidenced by numerous clay brick and statue making industries throughout West Bengal. Most houses have a thatched roof. Therefore the majority of households have one or more small ponds 0.05 hectare in size although some are almost 0.2 hectares. Each community is surrounded by vast tracts of rice field which form the watershed area in the rainy season and overflow into narrow closed ponds called "canals."

A canal can be one kilometer in length and a hundred meters wide although most are much smaller. The larger canals have common owners of up to eight or more different families. The canals store water year round and when levels are high enough, water can be diverted from them to ponds either by gravity or pumping. Apparently, the rice fields have highest priority for rainwater resources.

Most farmers are diversified raising Indian carps in the pond, growing vegetables and small areas of tree crops such as guava and banana, and livestock. The livestock is predominantly cattle and goats secured by rope to a stake and fed cut grasses. Chickens, lambs and ducks are also raised by some.

The central hatchery in Joygopalpur hatches four to five different species of Indian carp and distributes fry to nursery farmers and fingerlings to the majority of households in the community. Notable, though, are other sources of seedstock. Other species of Chinese carp, saline tolerant river fish, prawns and occasionally Tilapia are supplied by private distributors and found sporadically throughout the community, particularly in the larger canals and in households with multiple ponds.



Shrimp trap in rice paddy



Chicken coop over fish pond

HATCHERY

Five species of Indian carp are used in culture. A central hatchery at Joygopalpur secures and maintains broodstock. Additional brooders are selected from private production farmers as required. The hatchery consists of a two story building with storage, office, dormitory and culture tanks. There are four circular concrete tanks approximately 3 meters in diameter and over one meter deep. One tank is used to hold broodstock and three are specially built to hatch eggs: central drain with fine screen one meter in diameter. A series of fifty half inch copper pipes enter the tank through the tank floor and angle ninety degrees to create circular flow.

There are two deep wells 700 feet in depth which supply freshwater. Due to aquifer pressure the water level in the wells is around ten meters without pumping drawdown. Water is also recirculated via a pump which receives overflow water and sends it to a concrete reservoir tank on the roof.

The Indian carps spawn naturally in the rainy season which runs approximately from May to September. Brooders are conditioned March and April with homemade diets mixed by hand of rice or tea seed cake, rice dust and occasionally cooked rice. There are small cultures of various cultured algae added as vitamin supplement into the mix. This diet is relatively expensive at perhaps USD \$0.40 per kg. The broodfish are maintained at low density perhaps 1000 kg/ hectare.

For spawning the gravid brooders are transferred to the hatchery holding tank and acclimated to the environment. A minimum of six people then catch the gravid breeders with a short seine and they are injected with LHRH and returned to the holding tank. Usually, three to five species are spawned simultaneously and the same tank.

The eggs are released within hours, allowed to water harden and then the broodfish are seined out of the holding/ spawning tank and transferred to hatching tanks at a rate of not more than 3-5 kg eggs per tank and water is circulated. After 72 hours the “juveniles” are transferred either to a nursery pond on site or to other private nursery farmers.

NURSERY

Nursery ponds are prepared by removing all aquatic macrophytes (weeds) and conditioning the bottom soil starting in January. A local fertilizer mix is prepared using urea, phosphate and cow dung and allowed to incubate in a vessel for seven days before application. The pond is typically filled with well water to a level of one meter, fertilized and allowed to incubate about one week before juveniles are stocked. Additional water inputs from rain are significant.

Typically, nursery ponds are invaded with back-swimming insects which are air breathers so are controlled with minimal applications of diesel fuel. Seventy two hour post-hatch juveniles are counted in bowls of twenty or thirty thousand by water displacement. After stocking they are fed a mixture of dry powdered feed every other day. They are raised for approximately 21-28 days and "fingerlings" are sold to other farmers at one gram average weight, one point five inches total length. The fingerlings are enumerated by average weight and total weight calculation. Then another cycle is initiated, two nursery cycles per season per pond for private farmers, sometimes three cycles at the central hatchery.

One private farmer reported expenses of 3000 rupies and sales of 12,000 rupies. Expenses included pumping well water, feed and fertilizer. No labor inputs were enumerated.

GROW OUT OF FOOD FISH

In general, village ponds are small often 15 by 15 meters and stocked with one or two Indian carp fingerlings per square meter in June. The ponds are fertilized with a standard mixture of cow dung and NPK or phosphate fertilizer mixed and allowed to incubate for seven days. The ponds are fertilized at two week intervals throughout the crop, which is generally partially harvested for domestic consumption at low rates from December to March when the pond is pumped dry.

The final harvest is often done with seine and some fish are sold in regional markets. The farmers are poor and rely on their pond for protein, often the only source for much of the year. A typical household will have one pond, a few livestock and a hectare of rice. Additional fruits and vegetables are grown around the ponds.

Production is relatively low estimated at 300 kg per hectare per crop, one crop per year. Some of the more motivated households feed the fish regularly and harvest more and higher quality fish. The bigger canals are never totally drained and so buy larger fingerlings and prawn for stocking. These are often jointly owned and produce up to 20 tonnes of fish for market annually.

POTENTIAL FOR IMPROVEMENT

Of course, both the fisheries officers and the farmers believe that they are doing all the correct procedures for maximum production. And increasing production requires more inputs and more work. Leaders of the community realize that if fish production in existing ponds could be doubled from 300 to 600 kg per hectare then the benefits would be enormous.

There are many ways to increase aquaculture production. One quick method discussed was to stock freshwater prawns into the rice fields, which constitute 80 percent or more of existing arable land, that is, land available for

farming. I suggested that someone could be recruited to buy a tiger shrimp hatchery nearby the village that had recently been closed. Leaders explained that they had already made preliminary plans to add on a prawn hatchery to the existing carp hatchery.

I suggested that since Bangladesh was enjoying such a huge explosion in their rice- prawn production that an expert from there could be recruited to evaluate the potential and develop the project. In brief discussion, Dr. Nandeeshha from Fisheries concurred. We reached consensus that a suitable assignment would require the prawn expert to remain on site for 6-12 months to accomplish anything worthwhile. It is easy to see that potential exists here but that technology transfer must occur over an extended period.

Another key area which needs to be improved is feed formulation and production. Surely in India there are people who have already done this work and are continuing to advance. JGVK needs to network with these people and others who can help. I would suggest that one of the Danish volunteers be assigned to work several hours per week searching the internet for sources of basic practical information that would apply to their situation.

Even some of the basic information from SRAC and links from the ATA website would help. The chat groups for shrimp and Tilapia would also broaden their scope of information. The group has to realize that they need not invent the wheel. Much basic information and methodology is widespread.

As the project evolves and farmers gain more experience then yields will increase. The continuation of a solid extension program which encourages villagers, promotes communication among fish farmers and transfers technology in small doses to the people will push production levels steadily higher.

A more detailed list of recommendations follows below.



Workshops at Joygopalpur

SUNDURBANS AQUACULTURE PROJECT RECOMMENDATIONS
OCTOBER 2010

1. HATCHERY PROBLEMS IDENTIFIED

- a. Introduction of exotic (alien) species could create future problems
LEVEL OF CONCERN IS EXTREME. Recommend draining of all ponds with Tilapia and eating the fish
- b. No genetic development program has been defined
LEVEL OF CONCERN IS HIGH. Recommend working with professionals to establish genetic improvement program which includes monitoring of progress or lack thereof
- c. Broodstock diets could be improved
LEVEL OF CONCERN IS MODERATE Recommend networking with other hatchery managers and academia to develop better low cost high protein diets. Recommend expanding and improving algae production as a supplement. Investigate vitamin and mineral additives
- d. Space for newly hatched fry is limited
LEVEL OF CONCERN IS LOW. Although the nursery area at the central hatchery is limited, expansion or intensification of management would be expensive. Many farmers have been trained in nursery and are proficient. Also extra ponds are already being leased
- e. Broodstock holding pond management parameters not specified
LEVEL OF CONCERN IS VERY LOW. Fisheries staff is experienced enough to manage the pond satisfactorily.
- f. The current number of species is limited
LEVEL OF CONCERN IS VERY LOW. The farmers have enough species for good pond production. Expanding the number of species would detract from current practice and stress the capacity of the hatchery and nursery systems. The exception would be if some new fish species could be spawned out of season.
- g. Hatching and holding tank designs are not optimum
LEVEL OF CONCERN IS NONE. Existing system is working.

2. PRODUCTION PROBLEMS IDENTIFIED

- a. Ponds susceptible to flooding. There is fear of pesticide and salt contamination from neighboring waters.
LEVEL OF CONCERN IS HIGH. Recommend working with the poorest farmers to perhaps **help** them repair eroding levees. Help would be mainly technical but perhaps some labor could be donated to help get started. Also many ponds are poorly designed and constructed. Recommend slope of dikes to be 2:1 to reduce erosion and collapse of levees. Some ponds are pits with no side slope at all.
- b. Production is low compared to neighboring ponds using similar technology. Level of understanding of best management practices for aquaculture is very low.
LEVEL OF CONCERN IS MODERATE. Learning is a process which requires time to develop. The extension program is already sharing

information with farmers, developed standard management practices and written a training manual. There are regular meetings with and amongst farmers. Of course, these extension programs need to be continued.

- c. Feed can be improved
LEVEL OF CONCERN IS MODERATE. Feed formulation needs to be improved. Feeding storage needs to be improved. Feeding practice needs to be improved. Recommend networking with aquaculture professionals from other areas to learn how to improve.
- d. Some ponds are receiving human sewage so there are food safety and hygiene issues
LEVEL OF CONCERN IS MODERATE. The problem has already been identified and is being addressed through education and the proper installation of latrines.
- e. Biosecurity is almost impossible due to local conditions
LEVEL OF CONCERN IS MODERATE. Need to increase awareness of potential of danger of introduction of disease and alien fish species and destruction of native fishes.
- f. Most ponds cannot be gravity fed or gravity drained
LEVEL OF CONCERN IS VERY LOW. This is one constraint that must be recognized by fishery staff. There are alternative pond designs. Recognize the advantages and disadvantages of various designs. Also, use gravity to move water when possible.
- g. Many ponds have excessive weed growth (emergent, submerged, floating) Poor pond mgt practice even when knowledge exists
LEVEL OF CONCERN IS VERY LOW. Poor mgt due to lack of motivation is the farmers' business. Still, extension should reprimand farmers who are lazy.

SUSTAINABLE AQUACULTURE

Is sustainability technically possible given external inputs and use of non-renewable resources and energy.

PROFITABILITY- RETURNS MUST BE GREATER THAN COSTS of resources. There are capital and operating costs. Successful farmers are experts at reducing costs.

COMPLIANCE WITH LAWS AND REGULATIONS

- Ownership
- Effluents
- License and permits

HUMAN RESOURCES- PROTECTING YOUR PEOPLE

Employment- Maintaining ethical treatment of employees. Fair compensation and good working conditions.

- Human safety and sanitation
- Ascetics

Quality of life. Almost all parents want to improve the opportunities for their children. It starts with providing adequate nutrition in the formative years. A certain level of protein intake is necessary for full brain development. Without sufficient protein the brain will not reach its maximum potential.

Secondly, the level of education should be advanced each generation. When parents are more self-sufficient economically it provides more opportunity for educating the children

BEST MGT PRACTISES

- Recycling of nutrients
- Polyculture to utilize all feeding niches
- Recycling of water and use of wastewater
- Multiple use of land resources- planting vegetables on the levees and rice/fish culture
- Limiting escapement of culture spp
- Limiting damage to native fishes
- Controlled use of approved chemicals
- Use of improved genetic strains of fish

PROTECTION OF THE ENVIRONMENT

Soil and groundwater salinization in coastal areas. Soil erosion , drainage of wetland areas, damming of streams, loss of habitat for native fish, birds and animals.

- Release of chemicals or hormones into the environment

Destruction of habitat such as mangroves. Destruction of by-catch when capturing shrimp PL and adults. Pollution of inshore waters from large shrimp operations.

- Negative impacts on native species and loss of biodeiversity
- Release of nutrients into the environment

The unwise use of antibiotics can lead to resistant strains. Also antibiotics interfere with natural processes which detoxify ammonia and other metabolites.

SEAFOOD SAFETY

Food fish must be free of aquaculture chemicals and contaminants. Contaminants include pesticides, antibiotics, aquaculture chemicals and off-flavor compounds. CHLORAMPHENICAL OXYTETRACYCLINE. Most approved chemicals for food fish have a withdrawal period before consumption. Same for primary treated sewage.

Currently there is controversy over treating Tilapia fillets with carbon monoxide. There has also been controversy concerning boosting feeds with chemicals which falsely increase levels of protein. MELAMINE

Statistics

During the week we visited with and trained one hundred twenty farmers at their ponds. There were ninety or so women and thirty males.