Attachment 1.

Design and budget to convert an existing prawn hatchery into a mud crab hatchery.

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Selected prawn hatchery

Mr Kabir organised for me to visit the Anamika Prawn hatchery in Perozpur, Moutola, Kaliyonz, Shatkira. This hatchery has been inoperative for the past 2 years. It is a large facility having most features of a system suitable for mud crab culture already in place. Of the hatcheries visited this one was the largest, with 120 tonnes of larval rearing tanks. It also has a good variety of storage and production tanks to utilise. The facility is well laid out, with most of the tanks situated within one large shed, segmented into different production areas. Most all of the production areas are duplicated. This gives an option or opportunity to operate the hatchery at half capacity (60 tonnes of larval rearing), to demonstrate mud crab hatchery production in Bangladesh. This would also save money in terms of expenditure on new equipment and operating costs.

History of hatchery (modified from the notes of Quazi A.Z.M. Kudrat-E-Kabir)

Anamika Golda hatchery Pvt. Ltd. (Pania, (Pirojpur more), Satkhira)
Name of Owner: Md.Sayeed Mahadi

This is a big prawn hatchery and its production capacity is more or less 20 million per season (i.e. 10 million per cycle). The hatchery is situated by the side of Satkhira – Munshigonj highway, so has good road access. The hatchery was established in 2007. It has a solid physical structure, a source of freshwater, brine is available, it has heavy-duty back-up generator to supply electricity and others significant facilities. In 2008 the hatchery produced a huge number of PLs, but unfortunately failed to market them all as the market was weak resulting from the drought. In 2009 again the hatchery produced PLs, more than 2008, but again the market for them was poor because of the drought and a cyclone named Aila. The owner lost a lot of money and became bankrupt (2008-2009) due to the failure of the business. So, he couldn't operate the hatchery in 2010 as no operating funds.

In 2011 the hatchery owner tried shrimp PL (P. monodon) production in his hatchery for the first time (bringing nauplii from Cox's Bazar). He was able to produce some shrimp PL following the 'organic' method, where no chemicals are used to produce PLs. However PL production was much lower using the organic method and as a result the production cost per PL was very high. So he decided not to continue this organic approach, which was not commercially viable. The hatchery was not in operation in 2012 due to a lack of funds and also in this season (2013) no decision to operate has been made for the same reason. The hatchery owner is hopeful that he will be able to commence prawn seed (PL) production in (2014), after observing the market situation this year.

Hatchery Assets

The hatchery has large amounts of air tubing, air stones, *Artemia* hatching tanks from its previous use as both a prawn and shrimp hatchery. Below is a list of the hatchery's main assets.

Outside hatchery shed (water treatment end of shed):

- Water storage (3 x 90 tonne tanks, 6 x 48 tonnes),
- 2 of 48 tonne tanks set up as sand filters,
- 3 aerators,
- 1 generator set
- Header tanks for freshwater and saltwater
- Access to freshwater from creek next to hatchery
- If required, brine can be carried from 40 km away

Inside hatchery shed

- 20 x 6 tonne larval rearing tanks
- 20 tonne tank general purpose tank in larval rearing area
- 38 x 3 tonne tanks (broodstock) (all 4 ft or 1.2 m depth)
- 30 x 4 tonne tanks (broodstock)
- 2 x 60 tonne water mixing tanks

- Laboratory + store (both air conditioned)
- 70 sq m area (utility for live feed production)

Outside hatchery shed (larval rearing end)

- Algae production tanks
- Shed that had previously been used for *Artemia* production

Work required to modify the Anamika Prawn Hatchery for mud crab larval work

General

To provide high quality water, treated water from the outside holding tanks will need to be treated further within the production shed. A water treatment array of cartridge filters, UV sterilisers and carbon filters will be required to treat water from each of the 2 internal mixing tanks. The 2 sets will be required to treat the water in the 2 x 60 tonne water mixing tanks, ensure there is adequate water for water exchange in the larval rearing tanks and to top up broodstock, spawning and hatching tanks.

Broodstock:

- Covers will need to be constructed (wooden or plastic or shade cloth) to ensure broodstock crabs are kept under low light conditions.
- Aerated sand trays will need to set up in each broodstock tank.
- Small shelters will be required in tanks
- A couple of chest freezers will need to be purchased to store feed for the broodstock crabs.
- Heaters will be required at times to keep water temperature above $28^{o}C$

Larval rearing:

- Concrete larval rearing tanks need to be painted to provide a smooth internal finish. They will be painted black.
- Heaters will be required to keep water temperature stable and above $28^{o}C$

- Micro-screens of various sizes will be required for standpipes in larval rearing tanks

Algae rearing tanks

- These will be converted to nursery tanks
- Tanks will need to have waterproof shelters constructed over them, wood with Alsynite™ or polycarbonate sheet
- Large numbers of balls of flyscreen style mesh will need to be made up to fill much of nursery tanks, providing 3-D shelter for settling crabs

General

- Electrical supply and circuitry in hatchery needs to be upgraded for safety. All outlets and main supply need to have 'cut-out' protection to avoid electrocution. I didn't examine this in detail but the general impression was that some upgrading of mains box and outlets would be required to meet common safety standards.

Crablet production potential for operating 60 tonne mud crab larval rearing facility

Stocking densities used vary between different hatchery operations, however for estimating the potential productive capacity of this venture we will use 75 zoea per litre as the initial stocking density.

Survival rates from initial stocking of mud crab zoea to settled crab 1 vary considerably. Whilst some as high as 40% have been achieved under research conditions, 5 – 15% survival rates are more common under commercial conditions. Taking a conservative 5% survival from larvae to crablet 1, a fully stocked 60 tonne hatchery should produce: 60 x 1000 x 75 x 0.05 = 225,000 crablets.

At a 15% survival rate, the same 60 tonnes of larval rearing tanks would produce 675,000 crablets. Indicating just how important the survival is. Improving survival through improving the system and its operating parameters can make a big difference to profitability.

If crablets were to be stocked at 1 per sq m, with 5% survival production, this would enable 22.5 hectares to be stocked, or at 0.5 per sq. m, 45 hectares.

Design

Broodstock tanks

16 of the 4 t and 3 t tanks would be designated for broodstock holding. Each tank would hold 4 female broodstock, so that any one time 64 female broodstock would be on hand. These crabs are fed and tanks cleaned daily.

Spawning tanks

Once broodstock have spawned and are carrying an egg mass, they will be put individually into spawning tanks. 8 of the 3 tonne tanks will be used to hold spawners.

Hatching tanks

When crabs are within 1 or 2 days of hatching, they will be transferred to hatching tanks. 4 of the 3 t tanks will be designated for hatching.

Live feed production area

A 70 sq. m area will be utilised for live feed production. To simplify production technology used, initially the Vietnamese hatchery approach will be adopted that uses *Artemia* as the primary live feed throughout their larval life. Should results be less than satisfactory, rotifers can also be added as another live feed, used during the first 2 zoeal stages.

Larval rearing tanks

10 (of the 20) 6 t larval rearing tanks will be used at any one time for larval rearing. The 20 t tank in the larval rearing area will be used to store high quality water for use in water exchange in the larval rearing tanks.

Nursery tanks

The tanks previously used for algae culture, will be converted to nursery tanks. If need be, some of the larvae tanks not being used could be used as nursery tanks as well.

Use of shrimp nursery tanks

In addition, to in-house nursery operations, arrangements can be made with operators of shrimp PL nurseries to try tanks of crab megalops, or crablets to trial short term culture for sale to farmers. If they take megalops they would require 4 weeks before they would be ready for sale; if they took advanced crablets (2 weeks old), they would need to hold them for only another 2 weeks before sale to farmer at a matchbox size.

Risk Factors

1. We were unable to test the operational status of pumps, aerators and generator sets. Should they not be working, they will either require maintenance or replacement.

2. The freshwater supply is from a creek adjacent to the property. This water should be analysed to ensure it is free of any significant pollutants before any work is undertaken on the hatchery.

3. The cost of supplying saltwater to this facility will be an additional cost, compared to a hatchery adjacent to full strength seawater. Advice from a new shrimp hatchery in the region was that 350 tonnes of seawater currently costs 150,000 BDT (US$ 1880) to deliver to a nearby wharf facility and then there would be the extra cost to bring water by truck to the farm. The closest place to unload saltwater from a boat for this hatchery is Kalbaria, on the Kholpetua River, Munshigonj. This is part of the Shyamnagar sub-district of Satkhira. The spot is 22 kilometres from the hatchery. From the unloading point water would be carried by truck in tanks on a truck or using a water tanker, if such could be found.

4. To date no shrimp hatchery has used broodstock in the Khulna district for larval culture. This operation would be the first to raise marine crustacean larvae from broodstock in the area, using local seawater. In theory the imported seawater from offshore should be of an appropriate salinity and chemical composition with which to rear mud crabs. However as the first operation to use this water source, there is

an unknown risk associated with its use. The available salinity, 28-29 ppt is at the lower range of salinities that have been used to rear mud crabs in a hatchery.

5. If the economic conditions appear favourable for production of prawn or shrimp PL the operator may decide to rear these again. A contract would need to be negotiated to ensure that the hatchery was to be used for mud crab for a period of time to demonstrate the technology.

Standard operating costs of crustacean hatcheries in Bangladesh

Hatchery operators have estimated that the operating costs, per run of shrimp and prawn hatcheries in Bangladesh are from 3 - 3.5 m DBT (US$36 - 42,000) and 4 - 4.5 m DBT (US$ 48 - 54,000) respectively. However these are gross estimates, as hatchery size varies considerably. By Bangladesh standards, even if half of the potential larval rearing area (120 tonnes) in this hatchery is used, it is still a large one with 60 tonnes of larval rearing tanks.

Estimated cost of upgrading Anamika hatchery for use as a mud crab hatchery

Items required for hatchery upgrade	**No. required**	**Price per unit (US$)**	**Total Price (US$)**
Water treatment array (cartridge, carbon filters & UV sterilisers	2	5000	10000
Covers (wooden or plastic) for broodstock tanks	16	50	800
Chest freezers	2	1100	2200
Heaters for broodstock (16 x 1 each) / larval rearing (10 x 2each) / spawning (8 x 1 each) / hatching tanks (4 x1 each)	48	140	6720
Polycarbonate sheeting	50	20	1000
Painting of larval rearing tanks	10	300	3000
Preliminary Total			**26240**
+ 20% contingency			**5248**
Total Budget			**31488**

These costs are based on prices from Australia and the US. It is likely that savings may be possible purchasing goods from Taiwan, Bangladesh and other Southeast Asian nations. These prices are believed to be reasonably conservative. However they do not include any work required to upgrade electrics of hatchery. In addition

these estimates are based on a relatively brief visit to the hatchery. For such a project, at this stage of development a 20% contingency fund is realistic to cover unforeseen and unexpected costs, based on current understanding of the project.

These costs are for equipment and goods alone. Labour to undertake work e.g. painting tanks and freight from Dhaka to the hatchery is not included in these costs. It must be stressed that all prices are best estimates based on current catalogue prices.

I would **recommend that a budget in the order of US $50,000** should be put aside for upgrading this hatchery and would safely cover all eventualities that might arise in converting it. Whilst $50,000 is unlikely to be used, having a reserve to ensure the project is completed to an appropriate standard would be sensible, reflecting the many uncertainties with this activity.

The budget identified here is just for conversion of the facility, operational costs of operating the facility are discussed in other sections of this report.