Fuente: http://www.worldfishcenter.org/Pubs/IIRR/pdf/iirr_publication.pdf

UTILIZING DIFFERENT AQUATIC RESOURCES FOR LIVELIHOODS IN ASIA

Disinfection of pond

Before initiating the farming operation, it is essential to disinfect the pond by draining and sun drying until the pond bottom cracks. If possible, the bottom should also be scraped and the upper portion of the sediment removed. As an alternative, certain disinfecting materials such as quick lime (200-500 kg/ha depending upon soil pH) or bleaching powder (25-30 kg/ha) may be applied over the freshly dewatered pond bottom and left to react for a week before refilling the pond with water. An interval of about seven to ten days between filling the unit with water and stocking should also be observed to eliminate most of the obligate pathogens (those that will not survive without finding a host) from the environment.

Commonly encountered environmental stressors

- Polluting agents (pesticides, industrial wastes, city sewerage, etc.)
- Algal toxins
- Toxic gases (ammonia, hydrogen sulphide, excessive free carbon dioxide etc.)
- Nitrite
- Abrupt changes in environmental parameters like temperature, pH, dissolved oxygen, salinity, etc.

In the case of cage culture, it is important to disinfect the cage before and after harvesting. After the crop is harvested, the cage is lifted and thoroughly washed with quick lime solution and allowed to dry in the sun for two to three days. During the culture period, the cage should be cleaned once a week by wiping out all the dirt and wastes that remain.

Eradication of wild fish and other aquatic animals

Wild fish and crustaceans are potential sources of disease-causing agents. In case dewatering is not feasible, as with undrainable pond, certain safe piscicides are applied to the pond to eradicate the existing fish and other aquatic animals. Quick lime (1000-1200 kg/ha/m), bleaching powder (50-60 kg/ha/m), Mohua (Bassia latifolia) oil cake (2500 kg/ha/m), and tea seed powder (100-150 kg/ha/m) are some of the commonly used materials for this purpose. After the application of piscicides, the entry of fish and other animals into the pond should be prevented. As some fish eating birds and mollusks also serve as intermediate

hosts for many parasites that infect fish and humans, care should be taken to keep the pond clear of vegetation that provide substrate for molluskan larvae. Introducing some species such as black carp or any native species of mollusk-eating fish helps prevent digenetic trematode infections to a considerable extent. Hanging wide meshed net over the pond prevents entry of birds.

COMMON WATER QUALITY PROBLEMS AND CORRESPONDING MANAGEMENT TECHNIQUES

Low-alkalinity water and acid sediments

Liming can often solve problems with acid-base relationships in fishponds. Waters with alkalinity of less than 25 mg/l often need liming. Application of liming materials is not a type of fertilization. Liming may be best viewed as a remedial procedure, necessary in some ponds to permit the normal responses of fish population to fertilization and other management procedures.

Finely grounded limestone (<0.25 mm) has a high neutralizing value, thus, is the first choice for fishponds. Quicklime or slaked lime used in large quantities cause the pH to increase damaging the fine tissues coating the gills, thus causing the death of fish.

Liming rates

Application rates for lime are based on the efficiency rating of the liming material and its neutralizing value.
Lime requirement of bottom mud can also be based on pH and texture of mud.

Application rates of lime in different pH and types of soil

Mud pH	Lime requirement (kg/ha of $CaCO_3$)		
	Heavy loam or clay	Sandy loam	Sand
<4.0	14,320	7,160	4,475
4 - 4.5	10,740	5,370	4,475
4.6 - 5.0	8,950	4,475	3,580
5.1 - 5.5	5,370	3,580	1,790
5.6 - 6.0	3,580	1,790	895
6.1 - 6.5	1,790	1,790	0

Liming methods

1. Broadcasting / spreading at pond surface
2. Soil incorporation
3. Pump system – for hydrated lime
4. Platform spreading
5. Piling along shallow water edges of ponds and distributed by wind action

EFFECTS OF LIMING

Desirable effects

- High pH in mud and water stimulates microbial activity and rates of organic matter and nutrient recycling increase.

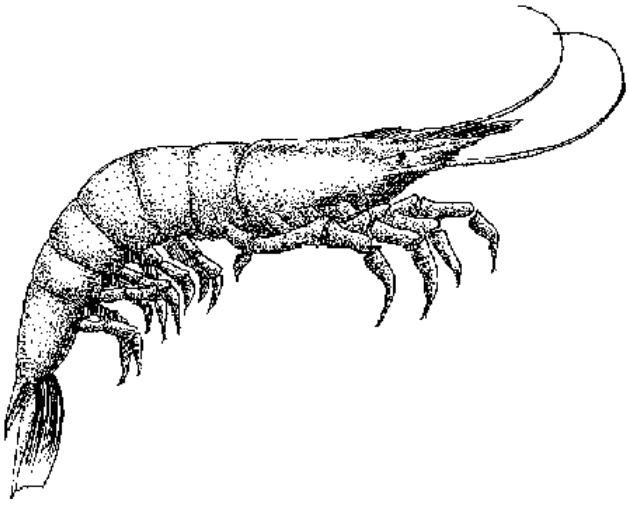
- Total alkalinity increases after liming because of greater concentration of bicarbonate, carbonate and hydroxide. An increase in total alkalinity, caused mostly by bicarbonate, results in increased concentration of CO_2 which is available for plant use.
- Fish food organisms increase.
- Production of benthic organisms increases.

In ponds with low concentrations of organic matter, the addition of readily decomposable organic matter during the liming application will hasten the dissolution of liming materials and the stabilization of water quality. The precipitation of colloidal materials in the water (following liming) may produce turbidity and encourage the growth of underwater weeds.

Undesirable effects

- The immediate insolubility of descending lime may cause phosphorous to react with sinking lime. As a result, P is lost from the solution.
- Appreciable levels of CO_2 cannot exist in the water when pH rises.

Management Practices to Improve Extensive Shrimp Aquaculture



Select the correct season for stocking shrimp fry

Shrimp post-larvae are sensitive to climatic changes. Low yields and disease have been experienced when shrimp post-larvae are stocked during rainy or cold months.

During cold months, temperature fluctuation in a day usually exceeds 2ºC.
Temperature less than 20ºC causes harm to shrimp post-larvae. Other reasons for avoiding the rainy season are:

- Sudden salinity decline in water is very stressful to shrimp post-larvae.
- Low salinity affects the molting process resulting in slow growth.
- Heavy loading of silt and suspended solids increases sediment accumulation (leading to depletion of oxygen in the water).

Nursery preparation before stocking

1. Dry the pond bottom thoroughly to reduce organic waste load and remove predators and competitors that entered the pond during the previous culture.

Take note of the following:

- After drying the pond, scrape the surface of the pond bottom to remove the waste. When scraping, avoid exposing the subsoil, which may contain acid sulphate layers.
- Avoid waste accumulation on pond dikes. Remove and dispose of accumulated waste away from the pond so that the rain will not wash it back into the pond.
- Dry and wash the pond bottom again after scraping and plowing.

2. Apply lime to the pond to correct the soil pH and neutralize the acidic layer in the pond bottom and dike surface. Liming will also disinfect the pond. Spread lime all over the pond bottom, applying more on areas that remain wet. Also spread along dike walls up to the top of the dike. Agricultural lime or dolomite is better than hydrated or quick lime because of its buffering action that can regulate the pond pH. Always remember to use the right amount of lime.

Types of lime

- Agricultural lime/limestone or crushed shell (calcium carbonate or $CaCO_3$); use lime with more than 75% calcium carbonate as it does not cause a dramatic increase in pH.
- Hydrated lime [calcium hydroxide - $Ca(OH)_2$] can cause a dramatic increase in pH. Do not apply this type of lime in the afternoons when pH would normally be at its highest.
- Quick lime/burned lime or burned shell lime (calcium oxide – CaO) causes dramatic increase in pH and should not be used in ponds with shrimps. Use this to control very low soil pH during pond preparation.
- Dolomite [calcium carbonate – $CaMg(CO_3)_2$] can increase pH gradually.

Use the correct amount of lime

The correct amount of lime depends on the type of lime to be used and soil pH. Use the following table to select the type and quantity of lime.

Soil pH	Quantity of dolomite or agricultural lime (mt/ha)*	Quantity of calcium oxide (mt/ha)*
6.0 – 7.0	1.0-2.0	0.5-1.0
5.0 – 6.0	2.0-3.0	1.0-1.5
less than 5.0	3.0-5.0	1.5-2.5

** 1 mt (metric ton) = 1,000 kg*

3. After liming the pond bottom, fill the pond with 30 cm of water and add fertilizer. It is necessary to fertilize the pond water to grow natural food (plankton) in the water. Some common fertilizers used are:

    - inorganic fertilizer: urea and trisuper phosphate (TSP)
    - organic fertilizer: cowdung The usual fertilization amounts are as follow.
    - First application: 1 kg of urea and 1 kg of TSP or 6-10 kg of cowdung per ha.
    - Before the second application, leave the pond for 3-4 days until the pond water turns green- brown in color.
    - Completely fill the pond with water.
    - Second application: 1 kg urea and 1 kg TSP per ha each day for 5–7 days or 6–10 kg cowdung per ha every 2–3 days for 12-15 days.
    - Do not apply cowdung daily because it is slow acting; daily application might overfertilize the pond.
    - Applying more fertilizers if the pond water does not turn greenbrown. As a last resort, add some green water from a known pond.

4. Control the entry of predators and competitors. The practice of stocking shrimp post-larvae into ponds containing other species favors predation soon after stocking, thus, causing significant production losses. To avoid this, do the following.

    - Screen the incoming water through a nylon net screen with 576 holes per square inch or 24 holes in a linear inch.
    - Use two net screens: a straight net screen fixed into a frame and placed in the gate at the outer side of the pond

and a filter bag net screen (2 - 3 m long) fixed into the gate at the inner side of the pond.

Provide supplemental food for post-larvae

Supplemental food helps increase the survival and growth of shrimp before being released into the main pond. Large and healthy shrimp can avoid predation and withstand unfavorable conditions in the main pond.

Use the best quality feed that can be afforded. Own preparation of supplemental food would be advantageous, especially if available commercial post-larval feeds are too costly.

Supplemental food

- Use chopped fish, rice bran and cooked rice or potato. Mix the ingredients, using the following percentages:

Ingredient	Percent by weight
Whole fresh fish	50-60
Rice bran	20
Cooked rice/potato	20-30

- Mash all the ingredients and rub through a sieve in small bits (2 mm in diameter). If shrimp fry are large enough, use larger pieces about 4 – 5 mm diameter.
- Sun dry the feed for six hours before using.
- Do not use shrimp, mussel, clam or cockle meat as it might transmit virus infections.

The following daily food amounts are recommended for a nursery stocked with 20-25 post-larvae/sq m:

Period (days)	Feed per day (kg)	Expected survival (%)
1–7	0.8-1.4	100-86
8–14	1.5-2.2	84-71
15–22	2.4-3.2	70-63
23–30	3.3-4.1	62-60

Feeding

- Feed four times a day, preferably between 7-8 a.m., 11 a.m. to 12.00 noon, 4-5 p.m. and 10-11 p.m.
- Feed 25% of the daily food ration on each occasion.

- Dampen the food before adding into the pond.
- Spread the food in an area not more than 2-4 m from the slope of the dike, asthis is where healthy post-larvae usually stay.

Perform regular health checks on shrimps

There are two ways to perform health checks during culture:

1. observation from the dike; and
2. observation of sampled shrimp.

Observation from the dike

Observation of sampled shrimp

- Avoid doing the observation during hot afternoons as handling would stress the shrimp.
    - Make the observation fortnightly.
    - The following conditions would indicate that the shrimp is normal. If anyone of them is not observed, then there might be a disease problem.

Characteristics of a normal and healthy shrimp

- Appendages are clean.
- No blackening of appendages.
- Tail is not swollen or eroded.
- The body color is greenish cream.
- The body is clean and shiny.
- The shell is not soft or does not crack easily.
- The gills are clean, shiny and has a cream color.
- Hepatopancreas has a yellowish green color, not shrunk or enlarged.