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AFFORDABLE WATER SUPPLY AND SANITATION

Deterioration of sanitary conditions in coastal waters

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SHRIMP CULTURE IS one of the fastest growing industry in Sri Lanka. Shrimp farms were initiated during mid 80's. During year 1992 number of shrimp farms amounted to 260 while the total area developed or earmarked amounted to 1400 ha. Total annual shrimp exports varied between 940 mt to 2500 mt during last 5 years. Shrimps contribute significantly to the total foreign exchange earnings (48 to 70%) from the fisheries sector.

Shrimp farms are operated at semi-intensive level at present with stocking densities between 6 and 20 post larvae (PL) per m^2. The average production from one ha varies between 1500 mt to 2000 mt per crop.

During the growth phase of the industry (1985-1989) most of the farms operated under intensive conditions with stocking densities up to 70-90 post larval per m2.

All the shrimp farms developed in Sri Lanka are located in North Western Province of Sri Lanka (Figure 1). Chilaw lagoon, Dutch canal, Mundal lagoon system and Puttalam lagoon as the water source for farms. More than 70% of the developments are concentrated along the Dutch canal and Mundal lagoon system.

Farms replenish water in their ponds to provide a better aquatic environment in culture ponds. The recommended exchange rate varies from 5% to 25% of the total pond volume daily, depending on the culture cycle and the stocking density of shrimps. (Kongkeo, 1990). Most of the established farms in Sri Lanka does not have capacity infrastructure and water of required quality to adopt recommend water exchange rates.

Inadequate exchange rates together with other poor management practices resulted in unfavourable and water quality condition in shrimp culture ponds during disease outbreaks.

The discharged water contained relatively high concentrations of nutrients, suspended solids and toxic metabolites.

It was apparent that the total suspended solid concentrations were beyond acceptable range (Poernomo, 1990 Jayasighe 1991). Relatively high concentrates of Nitrites and sulphides were also recorded. These concentrations are highly toxic to the culture organisms (Poernomo 1990). High nitrate concentrations damage gills of cultured shrimps causing changes in gill colour, while relatively high sulphide concentrations can affect survival growth and general health conditions of cultured shrimps.

Trends indicating increase in pH, sulphides, nitrites and total suspended solids levels in Dutch canal and Mundal lake system have been observed from 1987 to 1992.

Commonly observed symptoms in shrimps during disease outbreaks were microfouling on shells, reduced feeding, black gills, soft shell condition, tail rot, size disparity, empty guts, red / brown deposits on abdomen and reduced growth. A new pathogen, Monodon baculovirus (MBV) has ben recorded in cultured as well as in wild shrimp population after major disease outbreaks (ADB, 1990).

An increased incidence of heavy infestations in gills with an ectocommensal protozoan, were observed in cultured shrimps. These protozoans were found attached to the tops of the gill filaments. Zoothamnium establishes a colony between gill lammelae and each colony get attached to the gill epithelium by means of a circular disc. At severely infested stages, organism can obstruct respiratory currents of the shrimp affecting normal gas exchange.

More than 70% of the shrimp farms in Sri Lanka are on pyritic soils (Jayasinghe 1991), Pyrite (FeS_2) in deeper layers of soil get exposed during pond construction. The oxidation of pyrites result in production of various hydrated oxides of iron and acids. A detailed study (Jayasinghe 1991) has indicated several acid sulphate and potential acid sulphate soil classes in areas developed for shrimp farming. In shrimp culture ponds constructed on acid sulphate soils there is an inherent tendency for decrease in pH levels. Very low pH values (3.2 to 4.7) have

Table 1: Water quality: acceptable ranges for Penaeus monodon culture and ranges recorded in shrimp culture ponds during disease outbreaks.

Water quality parameter	Acceptable range	Range recorded in source of water
Temperature °C	26 — 33	28 — 31
Total suspended solids (mg/1)	2 — 14	110 — 150
Salinity (ppt)	10 — 35	2 — 31
pH	7 — 8.7	7.6 — 8.5
Nitrate conc: (ppm)	up to 200	0.01 — 2.05
Nitrite conc: (ppm)	<0.25	0.07 — 0.50
Hydrogen sulphide conc: (ppm)	<0.25	0.24 — 0.48
BOD_5 (mg/1)	<10	5 — 48

Figure 1. Distribution of shrimp farms in Sri Lanka

been recorded in ponds under extreme conditions. The water discharged from acidic ponds to natural waters have very high concentration of aluminium (1.8 to 2.5 mg / 1) iron (12.7 to 19.3 mg / 1) and manganese (0.16 to 3.2 mg / 1) levels particularly at pond preparatory stages.

Considering the quality of the source of water for majority of shrimp farms, sediment quality and the infrastructure facility at farm sites, to exchange water, semi-intensive type of operations, no exceeding 15 post larvae per M^2 can be recommended. Low stocking densities reduce the total suspended solid loadings, nutrient loadings and toxic metabolites loadings to the main water can be overcome by constructing sediment tanks.

Establishment of zoning system incorporating buffer zones in between farms will promote dilution of farm effluents and enhance the capacity for natural processes to improve the water quality.

References

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