WATER QUALITY OF BRACKISH WATER ECOSYSTEM FROM DEDERU OYA TO MUNDEL LAKE:AREA OF EXTENSIVE SHRIMP FARMING

T.N. Ariyananda[1] and E.I.I.Silva[2]

1. *Intermediate Technology Development Group, No.5, Lionel Edirisinghe Mawatha, Kirulapone Colombo 5*
2. *Institute of Fundamental Studies, Hantana Road, Kandy*

Introduction

Shrimp farming has been expanding lucrative business operating on the north-west coast of Sri Lanka since 1985. There are over 500 farms operating in the area surrounding the Dutch Canal from Deduru Oya to Mundel Lake. For these farms Dutch Canal and the Mundel Lake is the main source of water and also the main water body receiving farm effluent. The effluent containing high organic load, nutrients, chemicals and disease (white spot) has lead to many economic and environmental losses. This study looks at the change in water quality in the Dutch Canal over one year period November 1995 to October 1996 and Mundel Lake from February 1997 to January 1998. Following water quality parameters were determined in situ at each site: Temperature, Salinity, pH, and alkalinity and in the laboratory: dissolved oxygen, suspended solids, nitrates, nitrite, phosphorous, COD (Chemical Oxygen Demand) ,BOD_5 (Biological Oxygen Demand) and Chlorophyll-a.

Study Area

Mundel Lake and the Dutch Canal, is situated in the Puttalam District of the North Western Province between the sea and the Colombo-Puttalama road/railway (Figure 1).

The Lake is ($\pm$12 x 3-4 km, 3,600 ha) and shallow (< 1m), brackish lagoon fringed by mud flats, salt water marshes and remnants of mangrove strands. It is separated from the sea by a narrow sandy dune ridge. At the north is connected to the Puttalama lagoon and eventually to the sea by a narrow corridor channel. In the south, through the Dutch Canal to Deduru Oya estuary. Close to Udappuwa village as it connects to the Dutch Canal the it is separated from the sea by a sandy dune ridge, that narrow to a causeway. Dutch Canal connecting the Deduru oya estuary and the Mundel Lake is approximately 15 km long and also linked to the Muthupantiya lagoon. The Canal is 2-40 m in width and 2-3 m in depth and fringed with mangrove strands, marsh land and shrimp farms.

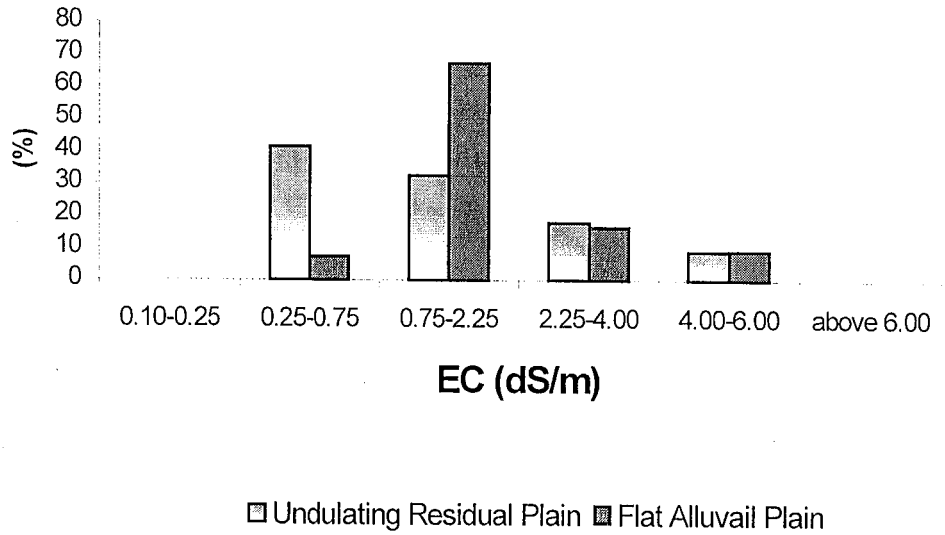


Figure 7 Percentage of average EC values in wells categorized by the irrigation salinity class

Shrimp Farming system in Sri Lanka

The Dutch Canal and the Mundel Lake is the main source of water for approximately 70% of the total area under shrimp cultivation. Majority of the farms are unauthorised, unplanned hazardous construction with poor operation practises.
Contemporary prawn farming methods are usually described as extensive, semi-intensive and intensive, depending on the stocking density and the amount of inputs used. Most shrimp farms in Sri Lanka now operate semi-intensive level with stocking densities between 6-20 post larvae (PL) per m^2 with artificial aeration of the pond water. The average production from one ha varies between 1500 mt –1200 mt per crop.
During the growth phase of the industry (19985-1989) most of the farms operated under intensive condition with stocking densities up to 70-90 post larval per m2.

Water quality impact of shrimp Farming

1. Water pollution

Contaminated waste water from the ponds are discharged into the same Canal Lake from which other farms draw water to their ponds. The aquatic pond effluents are: residual of fertilisers and supplementary feed, acidic discharge's from new pond constructed on potential acid sulphate soil, and chemical used for water treatment , insect control, predator fish control and fish health control. Toxic chemicals such as teaseed cake used to kill predatory fish species and Malchte green currently banned in USA used to control bacterial and fungal infection are used in the ponds. These chemicals when out of the ponds produce a serious chemical threat to aquatic life.

High Concentration of nutrients, suspended solids and toxic metabolites are recorded from effluent discharged from ponds (Jayasinghe, et al., 1994). Comparing to earlier studies by NARA (Table 1), present survey indicates a change in the pH, salinity, nutrients and suspended solids in of the Dutch Canal. High organic loading were indicated at sites of high shrimp farming intensity in the Dutch Canal. Temperature, BOD_5, Suspended solids and Salinity recorded during this survey was below the acceptable range for *Panaeus monodon* culture (Jayasinghe, et al., 1994)

2. Eutrophication

High nutrient loading into the Canal and Lake can result in eutrophication or even hypertropication of the water body result in algal bloom (some of which are toxic), severe oxygen depletion and fish or shrimp mortality. Relative high concentration of nitrites and sulphide recorded by previous surveys (Jayasinghe, et al., 1994) as well as this survey (Table 1) indicate high nutrient loading to the Dutch Canal and Mundel Lake.

The concentration of cholorophyll-a in the water is often taken as an index of biomass of algae present. Highest chlorophyll a values were recorded from sites of high shrimp farm intensity.
Certain algae species of genus Cheatophora and Entermorpha which are indicative of eutrophication was observed from the Dutch Canal and Mundel Lake.

3. Salt water intrusion

Abstraction of ground water for fresh water supply to pond culture will result in salinization of the fresh water aquifers through the sub-surface sea water intrusion. Some farms abstracted fresh water from boreholes to avoid spread of white spot disease and some growth deficiencies in hatcheries. Salinization of ground water can result in degradation of domestic and agricultural water supplies, which can cause serious conflicts with local and resident community. Extend of salt water intrusion has been assess yet for this area and will be a part of this study.

Conclusion

Evidence of eutrophication of the Dutch Canal and Mundel Lake is indicated due ti high nutrient input from farm effluent in areas of high intensity of shrimp farms. Inadequate excahnge rate and poor water management in ponds has result in poor water quality in Dutch Canal and Mundel Lake. As an result outbreak of White spot disease in shrimp ponds occurred in this area causing severe environmental and economic losses to the area. More recently a epizootic disease has been reported from the areas which is thought to be the Yellow head disease in shrimp. Eutrophication and increased sediment loading to these water bodies likely to have more severe long term effect on the natural fauna and flora of this water body.

Mundel Lake and the Dutch Canal have a narrow fringe of mangroves. A significant proportion of these mangroves has been eliminated to due to construction of shrimp farms. Since mangroves areas are vital breeding and nursing areas for many commercially important coastal fish, shrimp and crab species, their removal has a most serious negative impact on marine and coastal fisheries.

Inadequate exchange rate and poor management practises resulted in outbreak of white spot disease in most farms in 1995. Many of these farms were shut down for long periods causing serious economic losses to the industry and to the area. Release of the disease to the wild was not assess, but the consequences can be serious and long term..

Many other environmental and social cost of shrimp farming industry has not been adequately assess for this district. Salinization of the ground water, decline in wild fish and other sea life, flooding, deforestation, loss of agriculture land and production are

some of the many problems encountered in other countries like Taiwan, India, Bangladesh due to shrimp farming. Despite the bitter experiences of many farmers in the far east, prawn farming is being still been promoted other areas without adequate precautions.

Recommendations

1. Strengthening of legal framework particularly enforcement measures and institutional capacity to follow up conditions laid on permits, rules and regulations introduced by the government monitoring system.
2. An effluent treatment system should be installed in every farm to treat effluent before discharge. The quality of the discharged effluent monitored for compliance with the standards.
3. Rehabilitation of the water bodies, removal of sediment, clearing of sandbars to improve tidal exchange.
4. Built in a condition in the licensing of shrimp farms, to replant and maintain a buffering mangrove belt.
5. Establish a technical and environmental advisory service to agree detailed sustainable guidelines for production for each site specifically for small scale developers.
6. Research and development effects should be directed towards building on traditional, integrated and polycultural production system which are suitable for small farmers and sustainable.
7. Develop strategies to stop the deterioration of the ecosystem identified.

References

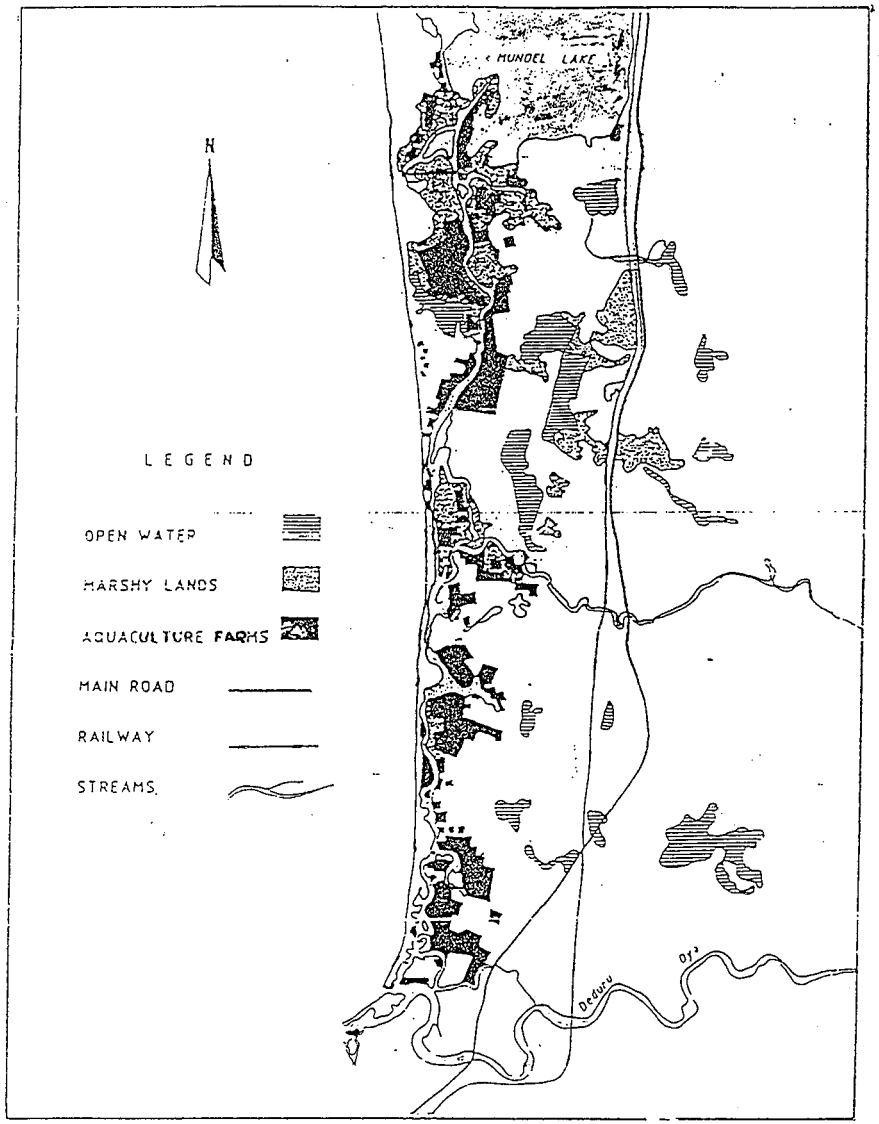
Bundell, K. & Maybin, E. (1996). After the Prawn Rush. EMBARGO 8pm BST May, Christian Aid, London

Jayasinghe, J.M.P., Corea, S.C. & Wijegunawardena, p.K.M. (1994). Deterioration od sanitary Condition in Coastal Water. Proceedings of the 20th WEDC Confernce-Affordable Water Supply and Sanitation, Colombo, Sri Lanka. p 133-134.

Wetland Conservation Project-Sri Lanka (1994). Mundel Lake & Puttalam corridor Channel. Report prepared by Wetland Conservation project: CEA/Euroconsultant.

Table 1: Comparison of Water Quality Range Recorded in the Dutch Canal and Mundel Lake with previous data

Parameters	Recorded Water Quality Range					
	Dutch Canal			Mundel Lake		Acceptable range for *Paneus Monodon*
	1983 (NARA)	1993-94 (NARA)	1995-1996 (This study)	1987 (NARA)	1997-1998 (This study)	
Temperature (C^o)	23-32	25-30.5	21-33.8	25.5-37.5	28-33	28-31
DO (mg/l)	NA	8.4-13.2	4.1-17.2	4.3-9.8	1.8-7.4	
pH	4.8-6	7.2-8.0	7.01-8.77	7	7.73-9.06	7-8.7
Salinity (ppt)	0-26	0-28	0-42	19-50	10-109	10-35
Phosphate (mg/l)	0.02-0.05	0.0005-0.46	0-254	0.04-0.30	2-44	
Nitrate (mg/l)	0.01-1.6	0-0.052	0.05-30.3	0.02-0.4	1.2-141	up to 200
Nitrite (mg/l)	NA	0.005-0.042	0-39.3	0.1-8	0-28	<0.25
BOD_5	NA	8.6-42.4	0.5-29.25	NA	1-4.2	<10
Suspended solids (mg/l)	10-22	50-225	13-330	NA	31-306	110-150



.: shrimp farm development between Mundel Lake and Deduru Oya (CEA/Euroconsult, 1994)

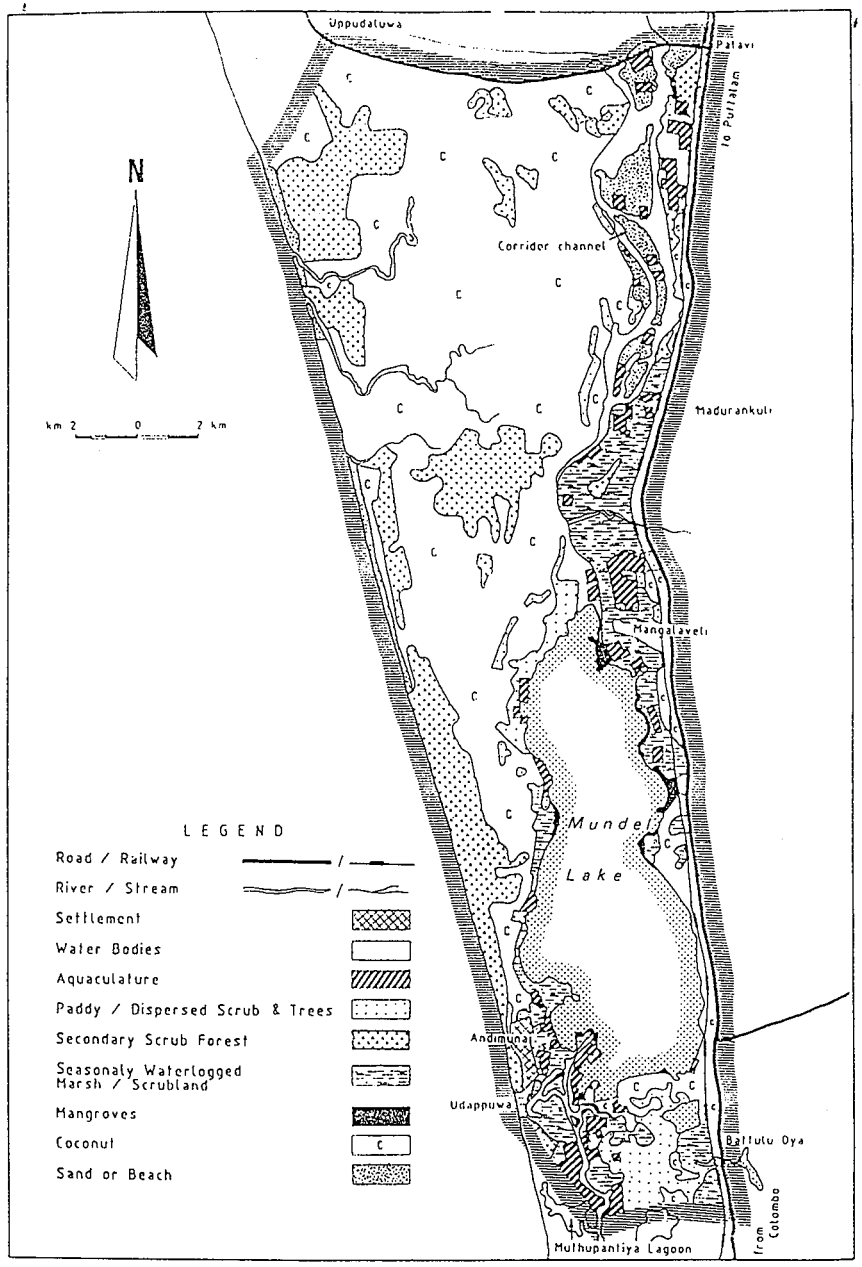


Figure 1 Study area and environs