Effect of Water Quality Parameters of Seagrass Shrimp Fishery Linkages in Negombo Lagoon

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Abstract

Seagrass ecosystems act as major nursery and sheltering grounds for many finfish and crustaceans group during the juvenile phases of their life cycle.There is little information on seagrass bed ecosystems of Sri Lanka and the study of these ecosystem is important to relationship between shrimp larval stage and Salinity and Nutrient levels of water.The objectives of the present study are therefore to study water quality parameters in sea grass beds of the Negombo Lagoon and to investigate the suitability of the seagrass beds to serve as breeding grounds.

The seagrass beds located in the Negombo lagoon namely, Kadolkele on the northern side Aluthkuruwa, Thalahena and Sethapaduwa on the western shore and Liyanagemulla Katunayake and Kurana on the eastern shore were selected for the study. Water samples were collected twice a week for a period of one year. Environmental parameters such as temperature, salinity, pH, turbidity, dissolved oxygen Ammonical–Nitrogen, Nitrate–N, Nirtite-N and Phosphate –P were measured.

When average values for each location were considered, only salinity showed higher values than the standard values for optimal growth (Jayasinghe, 1991; Johnson and Jonston 1985).However, close monitoring need to be carried out to investigate the parameters that are reaching critical levels.

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Introduction

Negombo Lagoon is situated almost 35km north of Colombo. It is one of the major fish landing centers in the west coast of Sri Lanka mainly due to the high productivity associated with the shallow coastal waters of the continental shelf area off Negombo. The lagoon cover area is 3,164 ha in extent is one of the most productive lagoons in the west coast of the island. Negombo lagoon is a down stream fishery in Muthurajawela wetland.

Seagrasses are flowering vascular plants that inhabit shallow areas of lagoon. They are the only flowering plants that live their entire lives totally in brackish water. Seagrass beds are one of the most important habitats of the Negonbo Lagoon. The major function of the blades is photosynthesis, but they also function in nutrient absorption and in elimination of waste products. The short shoot can be thought of as the stem of the plant, where the blades originate. Rhizomes are subterranean organs that function in propagation of the clone, in anchoring the plants to the substrate, in translocation of materials throughout the clone, and are also involved in nutrient absorption and gas exchange. Short shoots and roots emanate from the rhizomes. Roots are much thinner than rhizomes and function primarily in nutrient absorption. They also contribute to anchorage of the plant and to the elimination of waste products.

The lagoon and the adjacent boundary area provided by the major nursery and sheltering ground for many finfish and crustacean group during the juvenile phase of their life cycle. Sea grass bed and mangrove vegetation provide fish breeding and nursery ground elaborated rhizome and root systems that trap and stabilize the sediments. So these ecosystem has a good light peretration and plant material produced is decomposed by fungi and bacteria.

So than around Seagrass beds are highly productive areas and provide critical habitat for many species of invertebrates and fishes. Seagrass beds are important elements in the

lagoon's detrital food webs, and constitute important links in the mineral and nutrient cycles of the Negombo Lagoon. In addition, they function as sediment stabilizers and offer protection aginst shoreline erosion. Seagrass beds support many threatened and endangered species

The lagoon area is a mixing ground for both sea water coming through the tidal inlet and fresh water entering through the canal along with dissolved inorganic and organic constitutents, particulate matter sediments and biomass. Therefore its physical nature chemical composition and biological diversity are always determined by the diurnal seasonal in rhythms and catchment induced freshwater inflow.

Objective

(1). Idendification of seagrasss ecosystem distribution in Negombo Lagoon.

(ii). Estimation of shrimp production function relationship to Salinity and Nutrients Levels.

Material and Methods

The study was carried out in the Negombo Lagoon. Eight sampling locations of seagrass beds were selected and to get a water samples were collected twice a week for a period of one year fro 2007-07-30 to 2008-07-30.

The total seagrass beds of the lagoon was covered by walking and using a boat. The seagrass bed ecosystem wee studied along transects (T_1 -T_8) perpendicular to the coastline. Transects were selected in such a way that as many different ecosystem and one squre meter quadrat samples were taken (1mx1m) along each transect and the

number of different seagrass species living shrimp larval were counted. (Jayasuriya 1991).

Water quality parameters in seagrass bed ecosystem as Temperature, Salinity Ammonical-N, Nitrate-N, Nitrite –N and Phosphate –P were measured using standard method of APHA 20^{th} Edition.

Environmental parameters Temperature, Salinity, were measured using Mercury Filled Celsius thermometer (range 0^0-100^0 C) Refractometer (0ppt -100 ppt) Ammonical–Nitrogen, Nitrate–N, Nirtite-N and Phosphate–P were measured using a UV - 1601 Spectrophotometer colour metric methods.

Seasonal variations mainly determined by rainfall of the area are influenced by the south –west monsoon (April-May) and 2^{nd} inter-monsoon (October-November) but it also receives a considerable amount of rain throughout the year.

Nutrient and Salinity Measurments

In addition to primary production measurements water samples for nutrients and salinity analyses were taken from each sampling site. So salinity is given an insitu measurement in field. So nutrients are self collecting samples were also taken from put on ice or transport to research work done to be frozen until analysed and all nutrient analyses were carried out according to satandard methods.

Determined by plotting the change in concentration overtime for each salinity and nutrient and then applying a linear regression to the data analyses. The data collected was analysed statistically using a range of methods. These included linear regression, multiple linear regression and ANOVA.

Sea grass Distribution

Sea grass distribution within the lagoon was determined by conducting parallel transects laterally across the lagoon with a separation of 100m border of a seagrass was encountered.Sampling point and transect location were determined using a Garmin map – 76 GPS. (Jayasuriya.A 1991).

Result

Community Production Function

Result From the salinity, nutrients levels and no of Shrimp larval catch measurements showed a seagrass ecosystem at all sites.

Data Analysis

Multiple Regression Analysis in Anova Minitab Statistical Programme

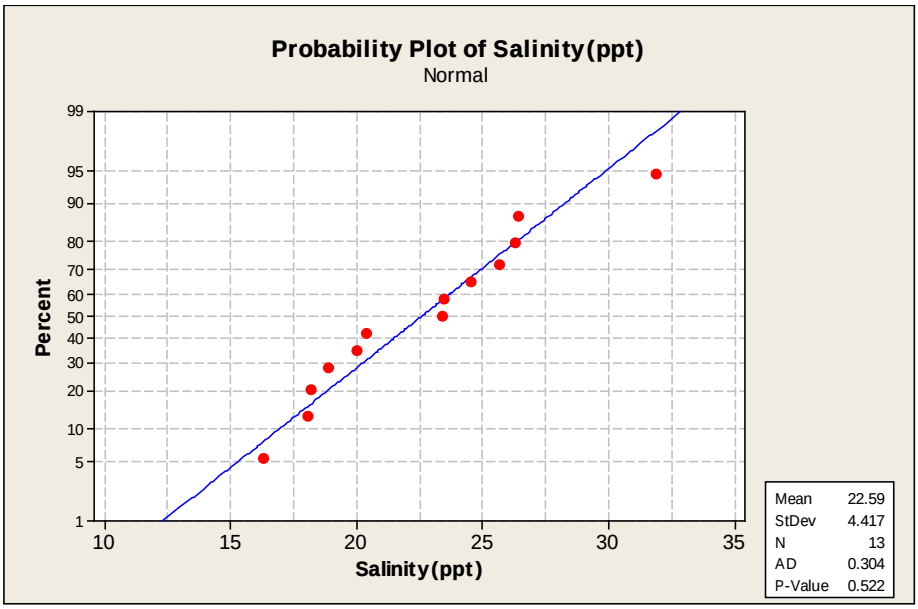

Figure 1 Probability Plot of Salinity (ppt)

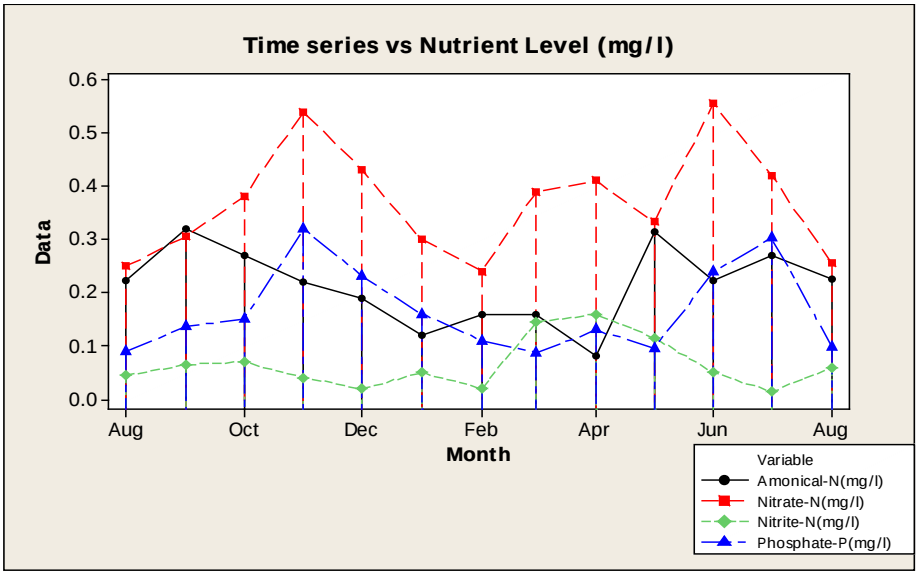

Figure 2 Time Series vs. Nutrient Level

The regression equation is

Shrimp larval catch = - 59 + 6.9 Salinity (ppt) + 34 Amonical N (mg/l)
+ 638 Nitrate-N (mg/l) - 1550 Nitrite-N (mg/l)
+ 175 Phosphate -P (mg/l)

One-way ANOVA: Shrimp larva, Salinity (ppt, Amonical-N (mg/l), Nitrate-N (mg/l), Nitrite-N (mg/l), Phosphate-P (mg/l)

r^2= 0.83 and P =0.01

Production function was estimated by deriving significant models for there relationship between the monthly shrimp larval catch in seagrass bed and water quality parameters in salinity and nutrients levels of the site. These models reveal that the physical and chemical parameters of the studied eight locations are having quite different contributions to the final catch.

Discussion

Out of the six species of seagrasses found in Negombo Lagoon, *Halophila ovalis*, Halophila *beccari*, *Halodule pinifolia*, *Halophila minor* and *Ruppia mantima*.Distribution pattern of these six speices are influenced by the nature of the habitat and physico chemical parameters of the lagoon.

The Salinity level of the water in the southern part of the lagoon is fairly low (around 10-15 ppt) compared to the southern part of muthurajawela marsh main fresh water input connected to lagoon met to Jaela canal and Dandugam Oya and Hamilton canal.

The Salinity levels in the Northern part of lagoon is considerably high (30ppt-33ppt).Because of the open to northern sea mouth. The lagoon considering a depth is less than 0.5 m to 1.5 m.

Most sea grass ecosystem also widely spread in the survey area in northern part of the lagoon .More favaorable to salinity condition are more species have been observed to grow closely to mangrove vegetation and grow from low water level to a depth of 1.5m with a salinity range of 25ppt-35ppt.

Other factor that is likely to play an important role in determining community production levels is nutrient availability. Primarily nitrogen and phosphorous. A comparison of the data obtained relationship between water nutrient and salinity levels and ecosystem production despite the fact that there were seasonal changes of both dissolved inorganic nitrogen and soluble reactive phosphorous at all site. This study was carried out during the beginning of the northeast monsoon and south east monsoon.

All sites showed considerable nutrient pools Nitrate and Phosphate levels of highest level of the October-December and May –July. Because of the south west monsoon period.

Conclusion

Our model of seagrass shrimp fishery linkages demonstrates that it is possible to modify a satanderd water quality change in seagrass ecosystem area on relationship between shrimp production most of the parameters of within the acceptable limits.However close monitoring need to be carried out to investigate the parameters that are reaching critical levels. Open access fisheries else where supported by seagrass or estuaring and coastal wetlands that provide breeding habitats and nurseries for the fisheries.

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