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Relationships between Nesting Activities of Cichlids and Vegetation in Batticaloa lagoon, Sri Lanka

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ABSTRACT
The aim of this study was to investigate the relationship between nesting activity and the vegetation. A line transect, 300 m in length parallel to the western shore was put up. There were total of 30 sites, including 3 Avicennia, 7 Cocos, 5 Excoecaria, 3 Derris, 2 Delicodendron, 5 Sonneratia, and 5 non-vegetational, was included in the study. Quantitative data were collected during a period of one year from an inlet of the Batticaloa Lagoon, Sri Lanka. This study showed that nesting activity for three cichlids Etroplus maculates, E. suratensis and Oreochromis mossambicus was considerably high in the area of mangrove vegetation.The presence of mangroves in the lagoon shore had many advantages to the cichlids. Total number of nests of E. maculates and O. mossambicusin each site of the transect was significantly different (F29=1.58, p=0.034) and (F29=1.79, p=0.010) respectively (One-way ANOVA). The total number of nests of E. suratensisthat were found in each of the thirty sites was not significantly different (F29=1.38, p=0.101) (One way ANOVA).Non-vegetational sites were not preferred by the fish to nest. There were 5 non-vegetational sites in the study area. Both E. maculates and E. suratensis had almost all 5 non-vegetational sites in a cluster that consisted of less number of nests. Whereas, O. mossambicus had 4 nonvegetational sites in lower numbers in a cluster. In fact, O. mossambicus had the highest number of nests found in a non-vegetational site. It showed that all three cichlids need vegetational sites for nesting but O. mossambicus seem to nest in the non-vegetational sites as well.
Keywords: Aquatic vegetation, Cichlids, Nesting activities, Site selection.

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INTRODUCTION

The plant associated with water bodies is probably one of the most influential factors in fish ecology [1]. The direct and indirect influences plants have on the reproduction of fishes was long overlooked [2].Some type of vegetation or complex structure nearby [3] are important to create optimal spawning and nesting sites [4, 5]. The aquatic vegetation stimulates the spawning is important to the reproductive behavior of fish.

Many environmental factors involve in the nest site selection [6]. Nesting activity for fish is high near by the vegetation. The Litter fall from vegetation is a suitable substrate for adherence of the eggs. The food and nutrition availability will also be high in such areas. The dense vegetation is convenient to escape from predators and prevent nesting materials and the eggs from drifting by water current. It has been defined the nesting material is that the eggs were found attached to a substratum in each nest [7]. The availability of nesting materials effects the distribution of the nests [8].In that context, aim of the study is to investigate the relationships between nesting activity and vegetation for three cichlids in Batticaloa lagoon, Sri Lanka.

MATERIALS AND METHODS

A line transect was put up about 1.5 m distance from the shore and parallel to the southern shore of the study site. It was 300 m in length. Number tags were placed at each 10m intervals. Each 10m sector was termed as a site. In each of these 10 m interval sites all nests were recorded; [9]. The locations of all nests were also logged on the map prepared earlier.

For each nest of the two species, the nesting materials were noted for each nest. A total of 272 fish nests were measured during the study period; 111 of *E. maculatus*, and 161 of *E. suratensis*. The study site Mattikali has an area with natural vegetation: a mangrove whereas, the previous study on cichlids in the Negombo lagoon was done on artificial brushpile[6].

Total number of nests of the three cichlids and mangrove shore vegetation were carefully recorded in relation to the nesting positions that were grouped on the basis of similarities among common characteristics using cluster analysis and dendrogram using SPSS 10.0 for Windows package. Mangrove vegetation's effect on the nest distribution was analysed.

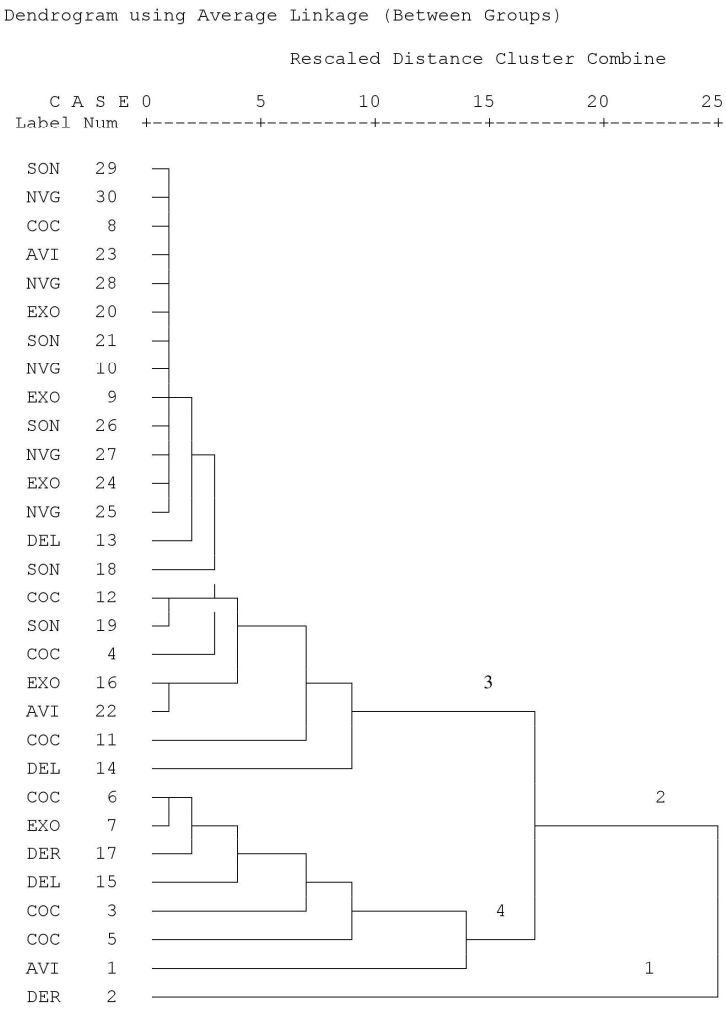
RESULTS AND DISCUSSION

a) Intersite variation of total number of nests of the three cichlids

E. maculatus

Total number of nests of *E. maculates* in each site of the transect was significantly different (F_{29}=1.58, p=0.034) (One way Anova). Two major clustering groups (cluster 1 and cluster 2) were observed in the dendrogram. Cluster 1 corresponds to site of 2. Cluster 2 has two clusters, which are cluster 3 and cluster 4. Cluster 4 corresponds to the sites of 06, 07, 17, 15, 03, 05 and, and cluster 3 has the sites of 29, 30, 08, 23, 28, 20, 21, 10, 09, 26, 27, 24, 25, 13, 18, 12, 19, 4, 16, 22, 11 and 14. There were 22 sites in cluster3: 5 non-vegetational, 5 *Soneratia*, 4 *Exocaria*, 2 *Avicinia*, 4 *Cocos* and 2 *Delicodendron* sites. The dendrogram clarifies cluster 3 as the abnormality observation which had high number of non-vegetation sites in cluster 3 compared to the other clusters (Figure 1).

Fig. 1. Dendrogram showing the grouping of 30 sites in the transact and the number of nest of *E. maculatus.*



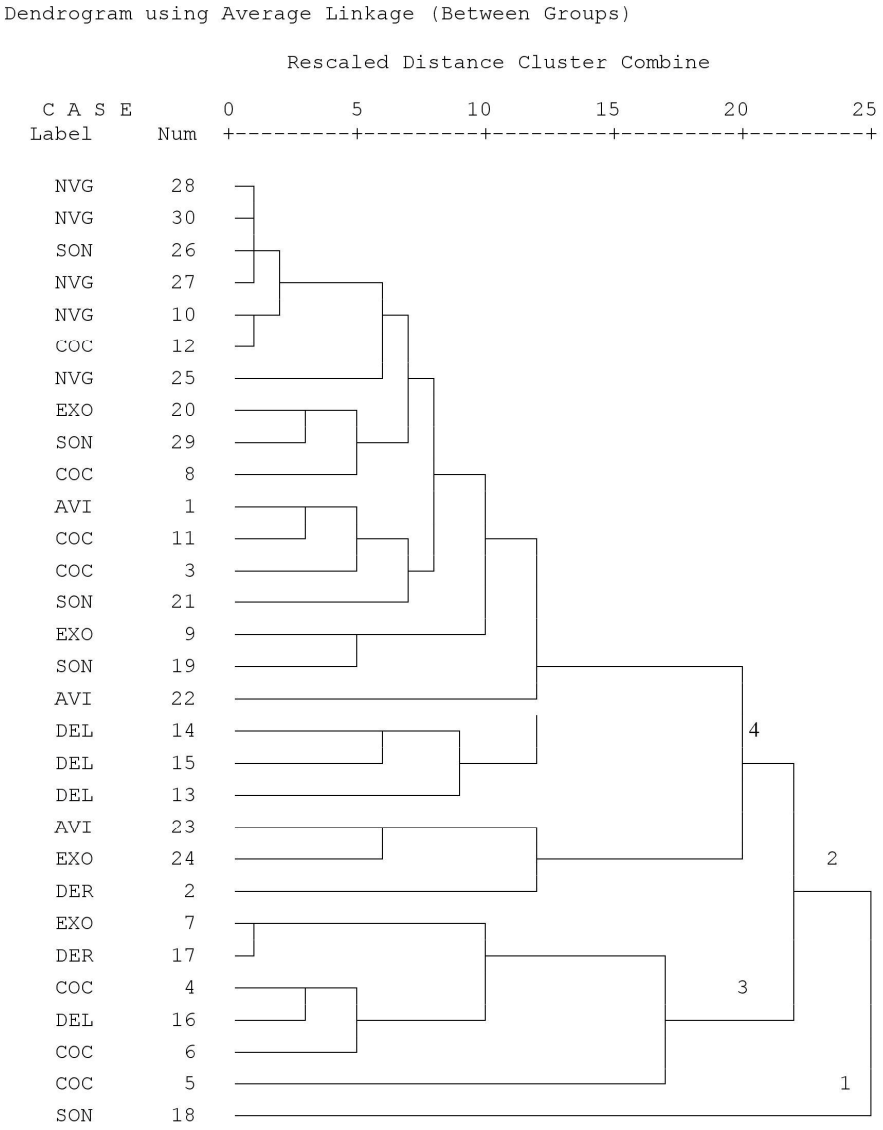
NVG = Nonvegetation, SON =*Soneratia*, TER=*Terminalia*, EXO=*Exoecaria*, DER=*Deris*, AVI=*Avicinia*, COC=*Cocos*, CRB=*Cerbera*,

E. suratensis

The total number of nests of *E. suratensis*that were found in each of the thirty sites was not significantly different (F_{29}=1.38, p=0.101) (One way ANOVA). Two major clustering groups (cluster 1 and cluster 2)

were observed in the dendrogram. Cluster 1 corresponds to site of 18. Cluster 2 had two clusters: cluster 3 and cluster 4. Cluster 3 corresponds to the sites of Sites 07, 17, 04, 16, 06 and 05. Cluster 4 had the sites of 28, 30, 26, 27, 10, 12, 25, 20, 29, 08, 01, 11, 03, 21, 09, 19, 22, 14, 15,13, 23, 24 and 02. 5 non-vegetational, 4 *Cocos,* 3 *Avicinia,* 3 *Exocaria* 3*Delicodendron,* 3 *Soneratia* and 1 *Deris* sites in cluster 4.The dendrogram clarifies cluster 4 as the abnormality observation which had high number of non-vegetation sites in cluster 4 compared to the other clusters.(Figure **2**).

Fig. 2. Dendrogram showing the grouping of 30 sites in the transact and the number of nest of *E. suratensis.*



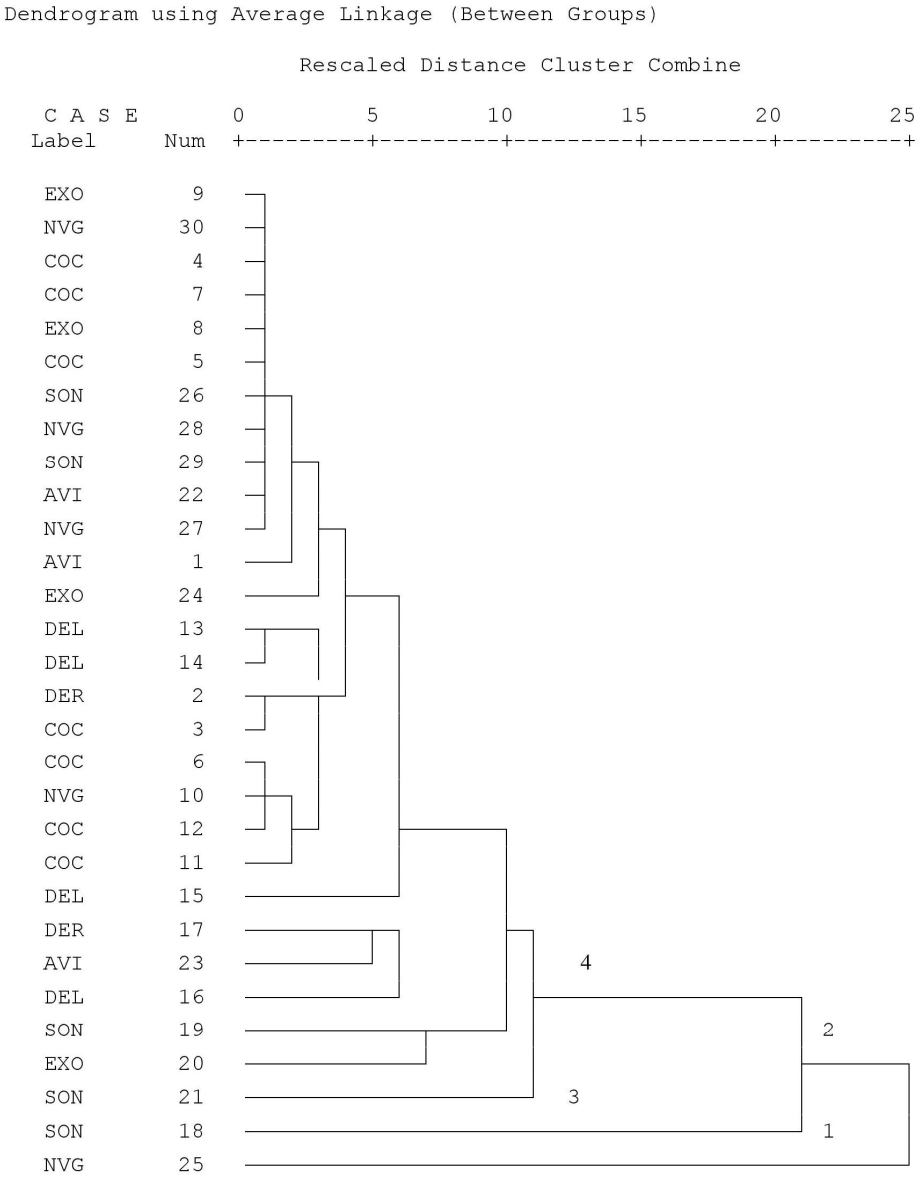
NVG = Nonvegetation, SON =*Soneratia*, TER=*Terminalia*, EXO=*Exoecaria*, DER=*Deris*, AVI=*Avicinia*, COC=*Cocos*, CRB=*Cerbera*,

O. mossambicus

Total number of nests of *O. mossambicus*that were found at each of the site of the transect was significantly different (F_{29}=1.79, p=0.010) (One way ANOVA). Two major clustering groups (cluster 1 and cluster 2) were observed in the dendrogram. Cluster 1 corresponds to site of 25, which was non vegetational site. Cluster 2 had two clusters: cluster 3 and cluster 4. Cluster 3 corresponds to the site of

18. Cluster 4 had the sites of 09, 30, 04, 07, 08, 05. 26, 28, 29, 22, 27, 01, 24, 13, 14, 02, 03, 06, 10, 12, 11, 17, 23, 16, 19 and 20.Including 28 sites:7 *Cocos,* 4 Non-vegetational, 4 *Exocaria*, 4 *Soneratia*, 3 *Avicinia*, 3 *Delicodendron*and 2 *Deris* sites.The dendrogram clarifies that no abnormality in the major clusters(**Figure 3**).

Fig. 3. Dendrogram showing the grouping of 30 sites in the transact and the number of nest of *O. mossambicus.*



NVG = Nonvegetation, SON =*Soneratia*, TER=*Terminalia*, EXO=*Exoecaria*, DER=*Deris*, AVI=*Avicinia*, COC=*Cocos*, CRB=*Cerbera*.

Vegetation and nesting materials:

My study showed that non-vegetational sites were not preferred by the fish to nest. There were 5 non-vegetational sites in the study area. Both *E. maculatus* and *E.* suratensis had almost all 5 non-vegetational sites in a cluster that consisted of less number of nests. Whereas, *O. mossambicus* had 4 non-vegetational sites in lower numbers in a cluster. In fact, *O.mossambicus* had the highest number of nests found in a non-vegetational site. It showed that all three cichlids need vegetational sites for nesting but *O. mossambicus* seem to nest in the non-vegetational sites as well.

Nest site selection involves many environmental influences [6]. Nesting activity for indigenous cichlids was considerably high in the area of mangrove vegetation. The presence of mangroves in the lagoon shore

will have many advantages to the cichlids. Litter fall from mangrove vegetation is a suitable substrate for adherence of the eggs. Secondly, food and nutrition availability will also be high in such areas. Thirdly, the dense mangroves are convenient to escape from predators. The presence of shore vegetation will also prevent nesting materials and the eggs from drifting by water current. *Etroplus*spp prefers vegetational sites as a substratum which is required for the adherence of the egg mass.

*E. maculatus*and *E. suratensis* used a variety of nesting materials to attach the eggs. In India and Sri Lanka, stones, pieces of wood, coconut husks, water logged coconuts, petioles and mid-ribs of coconut leaves and palm leaves, tiles, bamboo pieces, asbestos sheets or any hard objects were used as nesting materials by *E. suratensis*[7, 10].Whereas, *O. mossambicus* which is a mouth brooder, does not require a substratum for the attachment of the eggs. Because of its mouth brooding habit it has greater mobility so that there is no need for being choosy about the nesting habitat. Anyhow, it is necessary to hide, shaddy and escape from the predators.

A study done in Negombo lagoon on utilisation of mangroves and seagrasses by fishes of 62 species (39 families) collected from mangroves and seagrasses indicated the habitat preference of the different species. Of this collection 70% species were marine, 27% estuarine and 3% freshwater. Sixteen species were caught only from mangroves which included the two *Etroplus* spp. The number of species and individuals caught increased at the beginning of the north-east monsoon when the rainfall was low [11]. The results of the above study reiterate the fact that mangroves are essential for the existence of *Etroplus* species.

Utilization of mangrove species in brushpark construction and their effects on Negombo Estuary fishery was studied by [12]. Experimental brushparks were constructed in the Negombo estuary using branches of six mangrove and two non-mangrove species to investigate whether these materials had any effect on fish yields. It was observed that amongst the mangroves, highest yields were obtained with *Avicennia marina*; lowest yields were with *Excoecariaa gallocha* and *Sonneratia caseolaris*. The yields from non-mangrove *Syzygium corymbosa* brushparks were similar to those of the mangrove species *A. marina*. My study also proved this pattern that coconut materials played important role as nesting materials. Both mangroves nesting materials from the mangrove vegetation as well as non mangroves nesting materials from the *Terminalia cathapa*, *Thespeceasp*, *Cocosnucifera* and so on are very important to the cichlids to nest.

It is reported that between the period from 1986-91, 10-21% of the mangroves in the Batticaloa district had been destroyed [13]. No one has really estimated the impacts of various factors of these fragile ecosystem. The lagoon has become the dump yard of Municipal and domestic waste. It is also quite common for households adjacent to the lagoon to use the waters as the dumping ground for their domestic waste. A similar observation was also made in the study site; the number of nests was also generally less in the areas where there the lagoon was used as a waste dumping site.

The decrease in vegetation is related to an increase in soil erosion. Therefore, that will effect in the environmental parameters such as turbidity which will increase. Garbage dumping and influx of effluents will also be another turbidity increasing agent, that hinder the visibility of the fishes. This in turn will effect the breeding of cichlids.Therefore, in conclusion, it could be said that The presence of shore vegetation will also prevent nesting materials and the eggs from drifting by water current. *Etroplus*spp prefers vegetational sites as a substratum is required for the adeherence of the egg mass. Mangrove as well as other vegetation along the shore should be preserved.

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