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Role of Mangrove Forests of Pichavaram as Fish Nurseries

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An account of the food web pattern of 67 species of fishes, belonging to 51 genera and 33 families, of the Pichavaram mangrove ecosystem, is given. Of these, 32 species were omnivores, 30 species carnivores, and only 5 species herbivores. The food of the omnivores consisted of varying combinations of plant, animal and detrital materials. Strict detritus-feeders were absent, although about 88% of omnivores take detritus as part of food. This could be a result of the shallowness of the channels (usually from 40 to 150 cm depth) and high detritus potential of the ecosystem. The occurrence of considerable percentage (about 45%) of carnivorous fishes might be related to the impressive availability of the prey population like the prawn larvae and juveniles and nematodes and copepods and amphipods. Due to high suspended materials in the water, the penetration of sunlight into the channels would restrict the growth of microflora, algae, seaweeds and plants. The nature of the substratum was not conducive to a thick growth and colonisation of plants, like algae and seaweeds. Hence herbivore proportion of fish population was minimum. The stress of monsoon on feeding norms is discussed.

Key Words: Mangrove ichthyofauna, feeding norms, monsoon stress, food web changes, value as nursery grounds

Introduction

The marine living resources particularly prawns, crabs, molluscs and fish use successfully the channels within the mangroves as nursery grounds. We have few studies on the fishes of the mangroves. The juvenile fishes occurring in the mangroves of Puerto Rico and their feeding habits have been studied (Austin & Austin 1971*a*, *b*). It has been observed that the channels of mangrove forests and brackish waters are used by many species of fish for either feeding or reproduction or as nursery grounds or for these multiple uses. The fish species using the above waterways as nursery grounds will spawn in inshore waters and the juveniles are transported to the waterways by means of inshore and tidal currents (Macnae 1974). These waterways are giving shelter to juvenile fish by possessing extensive prop-root system of *Rhizophora* spp. and save them from predators. Odum & Heald (1975) studied the detritus-based foodweb of an estuarine mangrove community.

We have so far recorded 133 species from the mangrove waterways of Pichavaram. The present report deals with 67 species belonging to 51 genera and 36 families. The study, which covers the monsoon season

from October to December 1977, deals with the occurrence of the major feeding types among these fishes.

Brief Description of the Study Area

The mangroves of Pichavaram region (located near Porto Novo) occupy an area of about 12 sq. km. The waterways alone account for about 40% of the total area (figure 1). The mangroves lie within the Vellar—Coleroon estuarine complex and are bathed with waters from three sources viz., sea, estuary and freshwater irrigation channel, the first two with tidal ebb and flow and the third drains the water into the aquatic system irregularly. A brief description of the area can be found in an earlier paper (Krishnamurthy 1967).

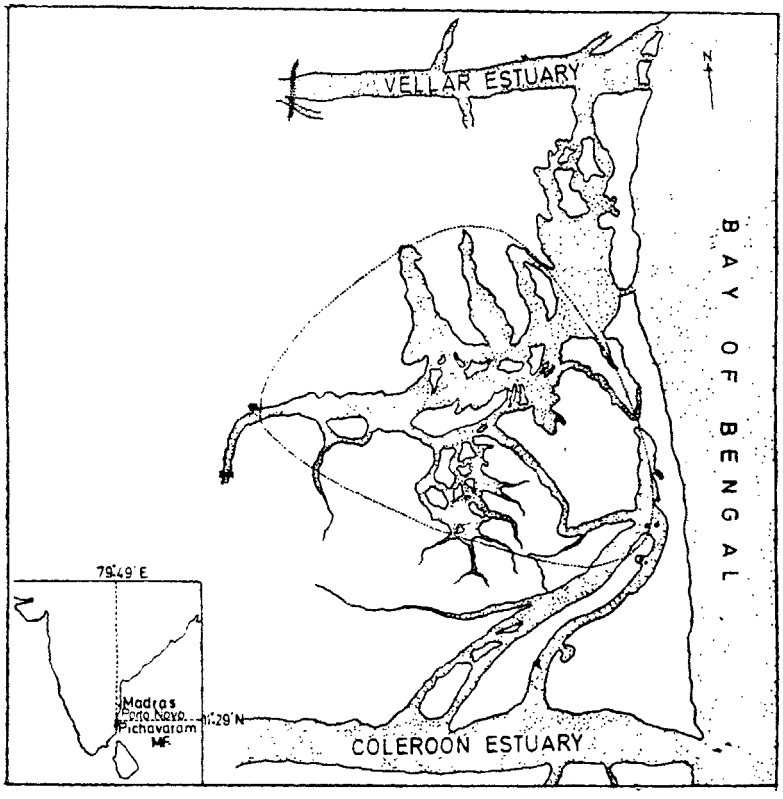

Figure 1 Map showing Pichavaram mangrove forest. Encircled portion shows the collection area from within the mangroves.
Pichavaram M.F.=Pichavaram Mangrove Forests.

Material and Methods

The environmental parameters were measured fortnightly from different stations of the waterways. Fish collections were made at low tide by using cast net. In each species random samples of about 10 specimens excluding the fish with empty stomachs were analysed. The materials were preserved and analysed as per the procedures described by Holden and Raitt (1974). The qualitative analysis dealing with the occurrence of food items in the stomach was taken into consideration in the present study.

Table 1 *Feeding habits and size ranges analysed in the fishes of Pichavaram mangroves*

Species	Feeding habits	Size range* analysed (in mm)
Dasyatis imbricatus (Schneider)	C	164–190@
Dasyatis sephen (Forskal)	C	186–224@
Elopis machnata (Forskal)	C	172–236
Escualosa thoracata (Valenciennes)	O_3	65–89
Anodontostoma chacunda (Ham. Buch.)	O_2	73–96
Nematalosa nasus (Bloch)	O_4	61–90
Ilisha kampeni (Weber and de Beaufort)	O_4	82–105
Thryssa malabarica (Bloch)	C	130–168
Thryssa mystax (Schneider)	C	78–140
Chanos chanos (Forskal)	O_2	97–185
Arius falcarius (Richardson)	C	53–357
Arius subrostratus Valenciennes[2]	O_3	210–270
Plotosus canius Hamilton	O_4	190–322
Macrones gulio (Ham. Buch.)	O_3	68–148
Muraenesox bagio (Ham. Buch.)	C	216–586
Pisoodonophis boro (Hamilton)	O_4	377–520
Tylosurus leiurus (Bleeker)	C	383–485
Tylosurus strongylurus (Van Hasselt)	C	155–248
Hemirhamphus gaimardi Valenciennes	O_1	154–197
Sphyraena jello Cuvier	C	149–220
Liza dussumieri (Valenciennes)	O_2	124–172
Liza macrolepis (Smith)	O_4	149–276
Liza parsia (Hamilton)	O_2	129–190
Mugil cephalus Linnaeus	O_4	290–461
Osteomugil cunnesius (Valenciennes)	O_2	87–126
Osteomugil speigleri (Bleeker)	O_2	117–140
Atherina forskali (Ruppell)	C	73–88
Atherina duodecimalis (Cuv. & Val.)	C	83–102
Eleutheronema tetradactylum (Shaw)	C	96–175
Ambassis commersoni Cuvier	C	76–134
Ambassis gymnocephalus (Lacepede)	O_3	42–59
Lates calcarifer (Bloch.)	C	43–362
Epinephelus tauvina (Forskal)	C	67–115
Therapon puta Cuvier	O_1	63–86
Sillago sihama (Forskal)	C	79–103
Caranx sexfasciatus Quoy and Gaimard	O_3	86–144
Caranx williamsi (Smith)	C	66–98
Lutjanus janthinuropterus (Bleeker)	C	84–120
Lutjanus johni (Bloch.)	C	171–213
Gerres filamentosus Cuvier	O_4	90–123
Gerres limbatus Cuvier	O_4	87–137
Leiognathus equulus (Forskal)	O_3	58–78
Leiognathus sp.[3]	C	48–79
Secutor ruconius (Ham. Buch.)	C	40–76
Pomadasys hasta (Bloch.)	C	54–112
Daysciaena albida (Cuvier)	C	235–343
Dendrophysa russelli (Cuvier)	O_3	81–152
Nibea soldado Lacepede	C	279–330
Drepane punctata (Linnaeus)	O_4	75–127

Species	Feeding habits	Size range* analysed
Scatophagus argus (Linnaeus)	H	37–130
Etroplus suratensis (Bloch.)	H	25–99
Tilapia mossambica Peters	O_2	95–123
Siganus javus (Linnaeus)	H	39–136
Acentrogobius madraspatensis (Day)	H	42–50
Acentrogobius cyanomos (Bleeker)	C	51–87
Acentrogobius viridipunctatus (Valenciennes)	O_1	80–132
Oxyurichthys microlepis (Bleeker)	O_4	98–138
Oxyurichthys opthalmonema (Bleeker)	O_4	100–163
Parachaeturichthys polynema (Bleeker)	C	85–125
Boleophthalmus boddarti (Pallas)	H	109–148
Parapocryptes rictuosus (Valenciennes)	O_4	82–125
Taenioides cirratus (Blyth.)	O_3	110–152
Trypauchen vagina (Bloch & Schneider)	O_3	141–190
Prionobutis koilomatodon (Bleeker)	C	49–63
Platycephalus indicus (Linnaeus)	C	86–320
Pseudorhombus arsius (Hamilton)	C	68–109
Cynoglossus puncticeps (Richardson)	O_1	54–114

C, Carnivore; *H*, Herbivore; O_1, Omnivore with plant and animal matter; O_2, Omnivore with plant and detritus matter; O_3, Omnivore with animal and detritus matter; O_4, Omnivore with plant, animal and detritus matter

*, Total length; @, Disc length

2, A new record to east coast of India; 3, To be described by G. Kuhlmorgen—Hille (Fischer and Whitehead, 1974); 4, A new record to Indian waters

Results and Discussion

The depth of the waterways ranged usually from 40 cm to 120 cm. However, in certain parts it would be even 150 cm during high tide. The secchi disc reading ranged from 15 to 36 cm. The surface temperature varied from 24.5 to 34.5°C. Salinity showed a minimum of 0.4‰ and a maximum of 27.5‰. Oxygen level was between 3.9 and 6.4 ml/l. The *p*H showed a narrow range of fluctuation from 7.15 to 8.25. The seston content (particulate matter) retained on 0.45 μm Millipore filter showed a minimum of 0.06 g/l and a maximum of 0.97 g/l.

The sixty-seven species analysed comprised of (*i*) 30 juveniles and 37 non-juveniles; (*ii*) 32 omnivores, 30 carnivores and 5 herbivores; (*iii*) 18 species feed on diatoms, 2 on dinoflagellates and 20 on algae, other than diatoms and dinoflagellates—in 28 species, detritus formed a part of their food.

Omnivores: Omnivores were dominant in the waterways showing the diverse type of feeding. They were classified into four groups depending on the presence of plant, animal and detritus matter. The major feeding norms encountered may thus be classified as follows:

(*i*) Plant+animal matter
(*ii*) Plant+detritus matter
(*iii*) Animal+detritus matter
(*iv*) Plant+animal+detritus matter

Among the 32 species of omnivores analysed, 14 species were represented by juveniles and 87.5% were found to take detritus as part of their food. Copepods

constituted the major animal matter in the omnivores. The higher detritus potential was evident by the particulate material (seston) in water (usually up to 1 g/l). The secchi disc reading showed a lower sunlight penetration value of 15 cm. The possible reason for higher seston content and lower value of secchi disc reading may be due to degradation of litter derived from mangrove vegetation and the greater concentration of alluvial matter in the waterways during monsoon season. The monsoon season would disturb the food web relationship of many organisms. Food links would be lost. Hence far more omnivores were encountered when the feeding norms perforce changed with the monsoon season. The fact that there was a higher percentage of detritus feeders among omnivores clearly shows that the detritus production went up during the monsoon season. The depth of the mangrove waterways during low tide was very low, being up to 40 cm, whereas at high tide it varied up to 150 cm in certain parts. The fishes feeding on dinoflagellates were few, when compared to those feeding on diatoms. This might be due to the poor census of dinoflagellates in the mangrove ecosystem. They accounted for about 4% even during peak phytoplankton season.

Carnivores: Of the 30 carnivore species analysed, 14 were represented by juveniles only. About 77% of the species, took prawns and shrimps as part of their food.

The occurrence of 45% of carnivores, among the 67 species analysed, was due to the dominance of prey organisms like prawns and shrimps. This was evident by the colonisation of the prawn in the mangroves due to favourable detritus potential of the ecosystem. The carnivorous fish, feeding on prawns, were also abundant (twenty-three species were taking prawns as part of food). This could be due to the scarce occurrence of bigger carnivores which are primarily piscivores. The mangrove environment is not suitable to those bigger carnivores due to very shallow depth of the mangrove waterways (40–150 cm). Hence it is evident that the mangroves serve as an efficient nursery ground for fishes.

Herbivores: Only five species of herbivores were met with. Their representation was very poor when compared to the number of omnivores and carnivores. Only 2 species of the herbivores took diatoms as part of their food.

The higher detritus and seston content existing in mangrove waterways prove lethal to bigger diatoms by affecting the light penetration and disturbing the respiration of aquatic plants. Instead, an impressive nannophytoplankton crop (usually below 30 μm) was quite evident. The uprooting of benthic algae and marine angiosperms like *Halophila* spp. might upset the herbivores. These could be the reasons for the occurrence of a poor number of herbivores in the mangroves during monsoon.

The waters bathing the mangroves and its sediments are very fertile and productive (Krishnamurthy & Sundararaj 1974, Sundararaj & Krishnamurthy 1974). The dissolved oxygen, *p*H and the food web links among plankters enable functioning it as a flourishing dynamic ecosystem (Krishnamurthy, Santhanam & Sundararaj 1974, Prince Jeyaseelan & Krishnamurthy 1978).

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