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Distribution of catfishes in wetlands of two flood plain districts in Tamil Nadu, India

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Abstract: A study was conducted on the distribution of catfishes in selected wetlands in Kancheepuram and Kanyakumari districts of Tamil Nadu, southern India. Different types of wetlands such as tanks, pools, lakes, open wells and estuaries were selected for the study based on their different environmental set up. Fishes were collected with the help of fishermen using cast and seine nets. Twelve species of catfishes from five families (Ariidae, Bagridae, Heteropneustidae, Schilbeidae and Siluridae) were recorded, of which 10 species from four families were from Kanyakumari and six species belonging to three families were from Kancheepuram District. In Kancheepuram, the species recorded were *Heteropneustes fossilis, Mystus seengtee, M. gulio, M. keletius, M. vittatus* and *Neotropius atherinoides*, and in Kanyakumari the species recorded were *Arius arius, Arius subrostratus, Heteropneustes fossilis, Mystus armatus, M. seengtee, M. gulio, M. montanus, M. vittatus, Ompok bimaculatus* and *O. malabaricus.* Among the wetlands, the highest species richness was seen in Puthery and Erachakulam tanks in Kanyakumari and Chembarampakkam Lake in Kancheepuram. The lowest species richness was observed was in Vishnupuram, Thotiode tanks and Mavadi pool of the former district and Vandalur Tank, Kalpakkam Estuary of the latter. Environmental factors such as microhabitat diversity and substrate diversity in the wetlands significantly influenced species richness.

Keywords: Catfish, distribution, environmental factors, Kancheepuram, Kanyakumari, species richness, Tamil Nadu.

Catfish, which is a significant group of the fishes in wetlands, are economically important with a high nutrient value. About 197 species of catfishes from 52 genera are found in India. The Indian families include Bagridae, Siluridae, Schilbeidae, Pangasiidae, Amblycipitidae, Sisoridae, Clariidae, Heteropneustidae, Chacidae, Olyridae, Akysidae, Ariidae and Plotosidae (Jayaram 2006).

Catfishes dwell in diverse habitats such as upland streams, large river channels and seasonal floodplain lagoons (Winemiller & Winemiller 1996). Although, there are many studies conducted on the systematics, feeding, breeding ecology and morphometrics of fishes in India, studies on their distribution including species richness, abundance and composition are limited (Kumar & Mittal 1993; Kumar et al. 1995, 1999).

The freshwater catfishes of Tamil Nadu are mainly of the genera *Glyptothorax, Sperata, Neotropius*, *Mystus*, *Heteropneustes, Ompok, Clarias* and *Wallago*. The estuarine catfishes of the region are from the genera *Arius* and *Mystus*.

Raj (1916) recorded eight species, and more recently, Venkateswarlu et al. (1975) recorded 18 species from six families from Kancheepuram and its adjacent districts.

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Chembarampakkam Lake is an important water body for catfishes in Kancheepuram. Raghunathan (1978) listed six species from three families; Daniels & Rajagopal (2004) recorded four species from two families in this lake.

The catfish records from Kanyakumari District of Tamil Nadu include that of Singh (1976), who has listed 11 species of catfish, of which four were marine and seven were freshwater species. Indra (1992) recorded five species of catfishes from Kanyakumari. Among these, four species belong to the genus *Mystus* and one belongs to the genus *Heteropneustes* of the families Bagridae and Heteropneustidae respectively. The present study was conducted in the two regions of southern India in order to: (1) survey the distribution and species richness of catfishes in wetlands of these regions and (2) identify the factors influencing their distribution.

Methods

Study Area: The study regions were located in Kancheepuram and Kanyakumari Districts of Tamil Nadu State, southern India. The study regions were selected based on the difference in geography, climate and catfish species composition. Kancheepuram District is located on the northeastern coast of Tamil Nadu, closer to the Eastern Ghats, covering 440km^2 area, approximately between 12^{0}30'–13^{0}10'N & 79^{0}40'–80^{0}20'E (Fig. 1). Kanyakumari is located on the southern most end of the Indian peninsula near the Western Ghats at about 8^{0}03'–8^{0}35'N & 77^{0}15'-77^{0}36'E. Kanyakumari district has an area of 167km^2 (Fig. 2).

For the present study, 25 wetlands were studied, of which, 10 were located in Kancheepuram and 15 were located in Kanyakumari (Figs. 1 & 2).

The wetlands of Kancheepuram District obtain water from the River Palar and its tributaries such as Cheyyar and Vegavathy. Palar originates from the 'Western Ghats' in Karnataka State and finally empties into the Bay of Bengal.

Five main rivers such as Tamiraparani, Pazhayar, Valliar, Ponniavaikal, Paralayar and their tributaries fill the ponds and lakes of Kanyakumari District. The major river of the district, Tamiraparani originates from the Western Ghats and has two main tributaries viz., Kodayar and Paralayar. The river empties into the Arabian Sea at Thenkapatnam. Among the other rivers, Valliar originates in Velimalai Hills and joins the Arabian Sea near Manavalakurichi while river Pazhayar originates from Shorlacode and joins the Arabian Sea near Manakudy.

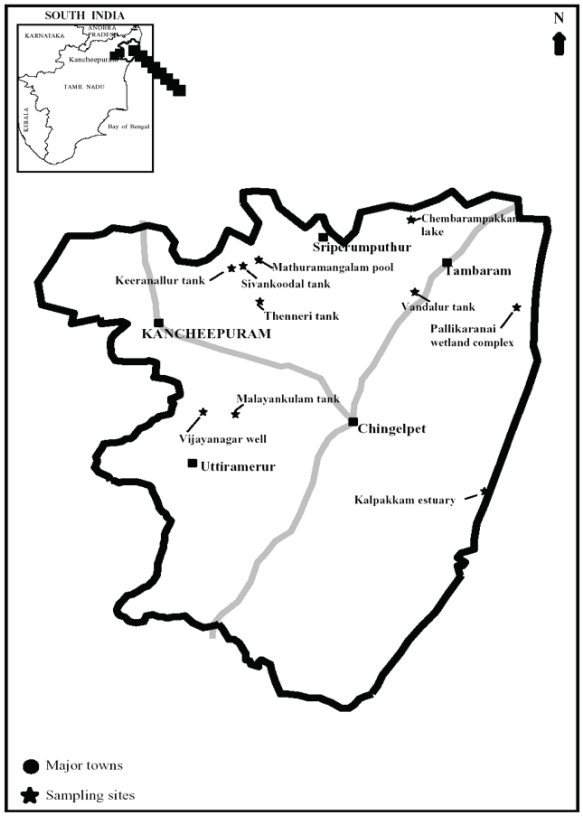

Figure 1. Map showing the study sites in Kancheepuram District (79^{0}40'–80^{0}20'E & 12^{0}30'–13^{0}10'N).

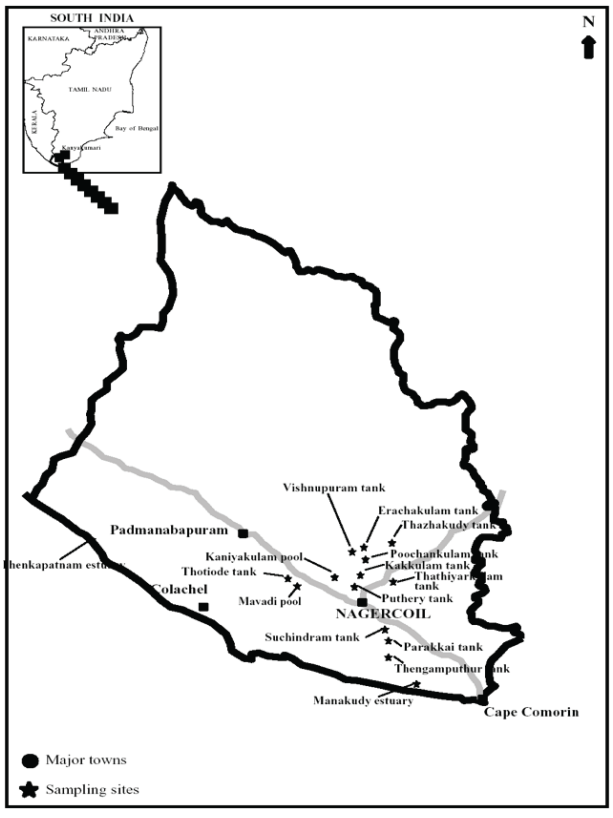

Figure 2. Map showing the study sites in Kanyakumari District (77^{0}15'–77^{0}36'E & 8^{0}03'–8^{0}35'N).

Different types of wetlands such as tanks, pools, lake, open wells and estuaries were selected for the study based on the nature of their surface and substrate (open/closed with vegetation), seasonality (seasonal/perennial) and size (Large, Medium, Small) based on the findings that different cat fish species prefers diverse habitats (Kumar & Mittal 1993).

Among the 25 wetlands studied, 21 of them were fresh water and four were brackish water. The different wetland types and their distribution in the two study regions along with their environmental factors have been provided in Table 2 and Fig. 3.

Fish sampling: Fish sampling was carried out from February 2003 to April 2004 in the wetlands of Kancheepuram and Kanyakumari districts in different seasons. However, sampling was mostly concentrated during the summer, considering the low water level in wetlands and bottom dwelling habit of the catfish. Moreover, the wetlands were sampled at different sites so that a representative section of all habitats could be covered and the sampling effort was higher in the larger wetlands. In addition, sampling was also done during the peak summer when the level of water was less. Hence, all catfish species of a wetland were sampled and the chance of escape of any species during sampling was avoided.

Fishes were collected with the help of fishermen using cast and seine nets. Seines were used for tanks and pools with shallow (<2m) waters and the cast net was used for tanks, lake and estuaries with deep waters (>2m). The selection of nets was also based on the fact that different species of catfish inhabits various habitats such as open water, closed water with vegetation and sluice in the wetlands as recorded by Kumar et al. (1995), Zacharias et al. (1996) and Kumar et al. (1999). The cast net used was of 4m radius with 0.005m mesh. Two types of seines were used, one was of 70m long and 6m wide with 0.01m mesh, and the other one was of 5m long, 2m wide with 0.003m mesh.

The fish sampling effort for cast net depended upon the size (small/medium/large) of the studied wetland. As the sampling area covered in this net was comparatively smaller, three/five/ten samples were done according to the size of the respective wetland.

Two samples for large seine and five samples for small seine nets were maintained. However, the number of catch effort varied for the cast net, uniform effort was maintained for the seines that covered the major sampling area. The duration of sampling effort for large seine was on an average of 5 hours/seine/day and for small seine it was 30 minutes /seine/day.

Identification and preservation: Fishes collected from different wetlands were labelled and preserved in 10% formalin solution. They were identified in the laboratory using the standard taxonomic keys (Talwar & Jhingran 1991; Jayaram 1999).

Habitat characterization: Each wetland was surveyed and the biotic and abiotic parameters were recorded to find out their influence on fish species richness. The biotic factors were vegetation strata, vegetation diversity of the wetlands and abiotic factors were wetland area, substrate type (sandy/muddy/rocky), microhabitat (the temporary, permanent pools, sluices and channels), depth (High, low, medium) and type of water.

The vegetation was classified into three categories including emergent, floating and submerged. The wetland

Table 1. Distribution of fish species and their relative abundance in two districts

Family	Species	Relative abundance (%)	
		KP (Total N = 753)	KK (Total N = 811)
Ariidae	*Arius arius* (Hamilton, 1822)	0	9.80
	Arius subrostratus Valenciennes, 1840	0	1
Bagride	*Mystus armatus* (Day, 1865)	0	29
	Mystus gulio (Hamilton, 1822)	13.80	11.40
	Mystus keletius (Valenciennes, 1840)	0.13	0
	Mystus montanus (Jerdon, 1849)	0	4.90
	Mystus seengtee (Sykes, 1839)	0.53	0.12
	Mystus vittatus (Bloch, 1794)	43.20	23.90
Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	28.50	15.80
Schilbeidae	*Neotropius atherinoides* (Bloch, 1794)	13.80	0
Siluridae	*Ompok bimaculatus* (Bloch, 1794)	0	0.37
	Ompok malabaricus (Valenciennes, 1840)	0	3.30

KP - Kancheepuram; KK - Kanyakumari

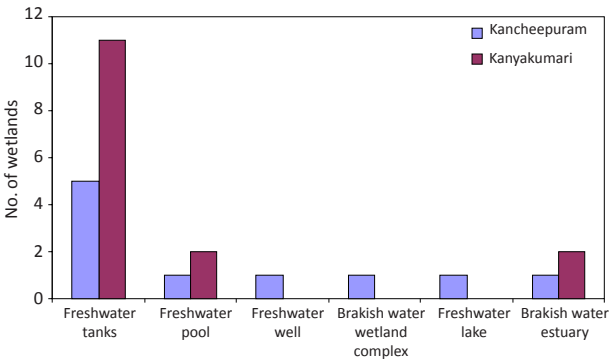

Figure 3. Types of wetlands in both districts.

vegetation was identified using the wetland vegetation key of the Botanical Survey of India (BSI), Calcutta (Subramanyam 1961). The nature of the substratum (sand/mud/rock) was checked by visual observation. The different microhabitats of the wetlands including the temporary, permanent pools, sluices and channels were noted during the summer when the wetland had little water. The approximate length and breadth of the water body were recorded in meters and then the area of the wetland was calculated to hectares. The list of environmental parameters recorded are given in Table 2.

Statistical analysis: Species diversity (Margalef species diversity index) was calculated using online biodiversity calculator <http://www2.plymouth.ac.uk/science/south_africa/Docs/Field_course_calc.xlsx>. The relationship between species richness and the wetland characteristics such as area, substrate, depth, biotic and abiotic factors were analyzed by multiple regression analysis using Minitab 15 trial version.

Results

Species distribution: Twelve species representing five families (*Ariidae, Bagridae, Heteropneustidae, Schilbeidae and Siluridae)* were recorded in this study. In Kanyakumari, ten species from four families and in Kancheepuram six species from three families were recorded. Catfish of the family *Siluridae* was not found in Kancheepuram and *Schilbeidae* was not found in Kanyakumari District respectively (Table 1).

Mystus gulio and *Mystus vittatus* were found in both fresh and brackish waters. *Arius arius* and *Arius subrostratus* were found only in brackish water and the other species were seen only in freshwater wetlands.

The highest number of species was seen in Puthery tank (six species), Erachakulam Tank (five species) of Kanyakumari and Chembarampakkam Lake (five species) in Kancheepuram. The lowest number of species was observed in Vishnupuram Tank (one species), Thotiode Tank (one species), and Mavadi Pool (one species) of the former District and Vandalur Tank (one species), Kalpakkam Estuary (one species) of the latter district (Table 2).

Species diversity (Margalef index): Species diversity was more in Chembarampakkam Lake (0.985) in Kancheepuram and Thathiyarkulam Tank (0.971), Puthery Tank (0.967) in Kanyakumari. Diversity was less in Sivankoodal (0.206), in Kancheepuram and Kaniyakulam (0.213) in Kanyakumari, respectively (Table 2).

% Relative abundance: The % relative abundance was more for species such as *Mystus vittatus*, *Heteropneustes fossilis, Neotropius atherinoides, Mystus gulio* and the abundance was less for species such as *Mystus seengtee* and *Mystus keletius* in Kancheepuram. The % relative abundance was more for species such as *Mystus armatus, Mystus vittatus, Heteropneustes fossilis, Mystus gulio* and the abundance was less for species such as *Ompok bimaculatus* and *Mystus seengtee* in Kanyakumari, respectively (Table 1).

Factors influencing species richness: Among various environmental factors tested against species richness, only vegetation diversity and vegetation strata correlated significantly with species richness (Table 3).

Discussion

Mystus vittatus and *Heteropneustes fossilis* are widely distributed geographically, whereas *Arius subrostratus* and *Mystus keletius* have a restricted distribution. The reason can be attributed to their ecological competence and adaptation to various habitats. Although *Mystus gulio* was commonly seen in many wetlands, their distribution seems to be restricted to the brackish water wetlands such as Manakudy, Thenkapatnam, Suchindram, Parakkai, Thengamputhur wetlands in Kanyakumari and Pallikaranai, Kalpakkam wetlands of Kancheepuram. All these are located within approximately 10km from the sea. These findings suggest that this species prefers to live in wetlands that are located in proximity to the estuary which support their easy migration between the estuary and fresh water wetlands.

The previous catfish surveys in Kanyakumari District (Singh 1976; Indra 1992) have listed about 16 species of catfish from marine and freshwaters. Among these, four were from the marine water, 11 from freshwater and one from brackish water.

Among the eight freshwater catfishes recorded by Singh (1976), *Sperata aor, Mystus cavasius, Ompok bimaculatus, Ompok malabaricus, Wallago attu and Clarias dussumieri* were not recorded by Indra (1992). Some of the fishes that were recorded such as *Mystus armatus, Mystus montanus* and *Mystus oculatus* by Indra (1992) were not done earlier.

During the present study in Kanyakumari, *Sperata aor, Wallago attu, Clarias dussumieri, Mystus oculatus, Arius dussumieri* and *Arius sagor* which were already recorded in the previous two surveys (Singh 1976; Indra 1992) were not seen. The marine catfish *Arius subrostratus* is reported for the first time in this region from Thengapatnam Estuary. Although Talwar & Jhingran (1991) and Jayaram (1999) have reported its distribution in general in Kerala and Tamil Nadu States, their occurrence in the study site have not been specifically reported.

In Kancheepuram, species such as *Wallago attu*, *Mystus bleekeri* and *Clarias* cf. *batrachus* recorded by (Raj 1916; Venkateswarlu et al. 1975; Raghunathan 1978; Devi 1998) were not found in this survey.

Table 2. Number of species, species diversity, biotic and abiotic parameters in wetlands of Kancheepuram and Kanyakumari districts.

Name of the Site	No. of species	Margalef index	Water type	Area (ha)	Substrate diversity	Depth category	Micro habitat diversity	Vegetation strata	Vegetation diversity
Kancheepuram (12°30'–13°5'N & 79°45'–80°15'E)									
Chembarampakkam (12°55'–13°5'N & 80°0'–80°5'E)	5	0.985	FW	35700	4	2	6	3	9
Kalpakkam (12°30'–12°35'N & 80°10'–80°15'E)	1	0	BW	30	2	3	1	0	0
Keeranallur (12°55'–13°0'N & 79°45'–79°50'E)	2	0.213	FW	75	1	1	1	3	7
Malayankulam (12°40'–12°45'N & 79°50'–79°55'E)	2	0.402	FW	250	1	1	1	2	5
Mathuramangalam (12°55'–13°0'N & 79°45'–79°50'E)	2	0.514	FW	0.1	1	1	1	2	2
Pallikaranai (12°55'–13°0'N & 80°10'–80°15'E)	2	0.221	BW	594	4	2	5	3	5
Sivankoodal (12°55'13°0'N & 79°45'–79°50'E)	2	0.206	FW	100	1	1	1	1	3
Thenneri (12°50'–12°55'N & 79°50'–79°55'E)	3	0.393	FW	800	3	1	1	2	4
Vandalur (12°50'–12°55'N & 80°0'–80°5'E)	1	0	FW	75	1	1	4	3	6
Vijayanagar (12°40'–12°45'N & 79°45'–79°50'E)	2	0.219	FW	0.025	2	1	1	0	0
Kanyakumari (8°05'–8°15'N & 77°15'–77°30'E)									
Erachakulam (8°10'–8°15'N & 77°25'–77°30'E)	5	0.813	FW	100	3	2	5	3	14
Kakkulam (8°10'–8°15'N & 77°25'–77°30'E)	3	0.519	FW	0.84	2	2	3	3	9
Kaniyakulam (8°10–8°15'N & 77°20–77°25'E)	2	0.213	FW	0.06	1	1	1	0	0
Manakudy (8°5'–8°10'N & 77°25'–77°30'E)	2	0.476	BW	30	3	3	1	0	0
Mavadi (8°10–8°15'N & 77°20–77°25'E)	1	0	FW	0.5	2	1	1	3	7
Parakkai (8°5'–8°10'N & 77°25'–77°30'E)	4	0.668	FW	200	1	3	3	3	8
Poochankulam (8°10'–8°15'N & 77°25'–77°30'E)	4	0.749	FW	0.6	2	1	3	2	8
Puthery (8°10'–8°15'N & 77°25'–77°30'E)	6	0.967	FW	300	4	2	6	3	7
Suchindram (8°5'–8°10'N & 77°25'–77°30'E)	2	0.621	FW	50	1	2	4	3	6
Thathiyarkulam (8°10–8°15'N & 77°25'–77°30'E)	4	0.971	FW	38	2	2	4	3	7
Thazhakudy (8°10'–8°15'N & 77°25'–77°30'E)	2	0.379	FW	100	1	3	4	0	0
Thengamputhur (8°5'–8°10'N & 77°25'–77°30'E)	4	0.891	FW	250	3	1	3	0	0
Thenkapatnam (8°10'–8°15'N & 77°10'–77°15'E)	3	0.504	BW	60	2	3	1	0	0
Thotiode (8°10–8°15'N & 77°20'–77°25'E)	1	0	FW	4	3	2	1	3	3
Vishnupuram (8°10'–8°15'N & 77°25'–77°30'E)	1	0	FW	25	2	2	4	2	5

BW - Brackish water; FW - Fresh water; KK - Kanyakumari; KP - Kancheepuram;

Mystus oculatus in Kanyakumari and *Mystus bleekeri* in Kancheepuram were not recorded during the present study, probably because the sampling was restricted only to the lentic fresh water wetlands (wells, pools, tanks and lake) and estuaries. Whereas, Indra (1992) in Kanyakumari and others in Kancheepuram have sampled various freshwater bodies such as rivers, streams and paddy fields. *Wallago attu, Clarias dussumieri* in Kanyakumari and *Wallago attu,*

Table 3. Regression analysis of relationship between number of species and independent variables.

Predictor	Coef	SE Coef	T	P
Constant	1.2533	0.7565	1.66	0.115
Area	0.00000900	0.00003519	0.26	0.801
Substrate diversity	0.4014	0.2484	1.62	0.124
Depth category	-0.0805	0.3074	-0.26	0.796
Microhabitat diversity	0.2359	0.1766	1.34	0.198
Vegetation strata	-0.6982	0.3190	-2.19	0.042*
Vegetation diversity	0.2977	0.1172	2.54	0.020*

* P < 0.05

Clarias cf. *batrachus* in Kancheepuram might be very rare as people tend to overexploit them for food as these fish are large in size.

The presence of *Sperata aor* in this region (Kanyakumari) is doubtful as it is distributed from northern India down to the Krishna River system of Andhra Pradesh in the south (Talwar & Jhingran 1991). No other survey has reported this species from the study region. *Arius subrostratus* might have been misidentified as *Sperata aor* as this also has a spatula shaped head like the former. The marine species such as *Arius dussumieri* and *Arius sagor* were not recorded as they are primarily marine and might be seasonal migrants to the estuary.

The wetlands such as Puthery (six species), Erachakulam (five species) and Chembarampakkam (five species) are species rich. The Margalef species diversity index is also more for Puthery in Kanyakumari and Chembarampakkam in Kancheepuram.

The statistical analysis proves that the species richness is related to the environmental factors such as vegetation diversity and vegetation strata.

Many authors have studied the influence of various environmental factors on fish species richness. Studies on the influence of environmental factors on fish species richness showed that the water temperature, total alkalinity, TDS and conductivity were highly correlated with this (Johal et al. 2001). Bhat (2004) found that the stream depth and altitude determines the species richness in the streams of central Western Ghats, India.

Angermeier & Schlosser (1989) found that the species richness was strongly correlated with habitat complexity and site volume of wetlands in Panama. Amarasinghe & Welcomme (2002) have also shown that the area and pH influence species richness in natural lakes of various geographic regions of the world.

The relative abundance is more for some species such as *Mystus armatus, Mystus vittatus*, *Heteropneustes fossilis, Neotropius atherinoides* and *Mystus gulio*. Whereas the relative abundance is less for species such as *Mystus seengtee, Mystus keletius* and *Ompok bimaculatus*.

The threats on few catfish species in the study region are mainly due to habitat destruction. Raj (2002) had also observed similar types of threats for the catfish, *Mystus montanus*.

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