

Present Status of Mangroves And Aspect of Pollution Index Along The Estuarine Area of Bhayander and Naigaon, Thane, Maharashtra, India



Zoology

KEYWORDS: Shannon's Index, Mangroves, Avicennia, Rhizophora, Sonneratia, Margalef Species Diversity Index.

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ABSTRACT

Mangrove ecosystems exist along the tropical and subtropical seashores. They are found on flat land between the high and low water marks. The present study aims in determining the composition of mangroves and aspect of pollution index along the estuarine area of Bhayander and Naigaon. About 29 different species of mangroves and mangrove associate plants belonging to 14 families are recorded at Station No.1 Bhayander and Station No.2 Naigaon with the family Rhizophoraceae being the dominant out of all the 14 families with 9 observed species. The mean Shannon – Wiener Diversity Index calculated for the mangroves and mangrove associate plant species was 3.28 ± 0.006 for Station No.1 Bhayander and it was 3.29 ± 0 for Station No.2 Naigaon. The mean Margalef Species Diversity Index of Station No.1 Bhayander for mangroves and mangrove associate plant species was 4.28 ± 0.006 and that of Station No.2 Naigaon was calculated to be 4.27 ± 0.017 . The Staub et.al. scale of pollution in terms of species diversity index for mangroves and mangrove associate plant species indicated slight pollution for both the stations under study.

INTRODUCTION

Mangroves are a group of highly evolved halophytes occupying the intertidal zone of creeks, lagoons and coastal mud flats. Mangrove ecosystems exist along the tropical and subtropical seashores. They are found on flat land between the high and low water marks. (Mandura 1997) Arroyo (1977) defines mangroves as "A small group of true mangrove plants and associated species belonging to systematically unrelated families, possessing similar physiological characteristics and structural adaptations with common preference to the intertidal habitat."

The special adaptation of these plants is that they are tolerant to fluctuating water salinity. The prop roots and the stilt roots form a firm anchorage in the sinking substratum, also trap the fine suspended particles in water leading to accumulation of sediment and formation of the mudflats. The mudflats enhance the settlement and growth of different mangrove species and their associate plants there by developing mangrove forest or "mangrove ecosystem". The mangrove forests grow by taking nutrients from the tidal waters and in turn provide natural food to the mangrove dwelling fauna (Odum et. al., 1982).

The mangroves are wide spread along the Indian coast, Gangetic Sunderbans occupying an area of 2067 Km² is the largest single block formation of mangroves in the world. Mangroves of the Andaman and Nicobar islands are the second largest in India. The other prominent mangrove formations are in the deltaic areas of the Mahanadi, Godavari, Krishna and Pichavaram and Puthupet on the East coast. Mangroves, though to a lesser extent, also occur along the West coast in the states of Gujarat, Maharashtra, Goa, Karnataka and Kerala. The total area under mangroves along the Indian coast is estimated at 4460 Km². (Nayak 1998)

The estuarine area along the Station No.1 Bhayander and Station No.2 Naigaon are covered with dense mangrove forest. At present many of these mangroves, particularly in the vicinity of the habitations have been over exploited, neglected, destroyed and degraded for different reasons. Encroachments, urbanization, industrialization have caused serious setback to mangroves habitats. The mangroves of western region are known through the works of Untawale (1982), Kothari and Rao (1998), Kothari and Singh (1998).

The present study aims in determining the composition of mangroves and aspect of pollution index along the estuarine area of Bhayander and Naigaon.

MATERIAL AND METHODS

The present study on status of mangrove is carried out for three seasons in a year at both the Station No.1 Bhayander and Station No.2 Naigaon. Vegetation plots of 25 m² were laid out and then total number of mangrove, associate floral species and the number of individuals of each species were noted. Observed data was utilized for determining pollution index by using ecological indices such as Shannon's and Margalef. By using the Staub et. al. (1970) scale of pollution in terms of species diversity index the pollution status of the overall estuarine area of Bhayander and Naigaon was determined. (Staub et. al., 1970)

The Shannon - Wiener Diversity Index, H, is calculated using the equation $H = - \sum P_i (\ln P_i)$ where P_i is the proportion of each species in the sample. Also the Species Diversity is calculated using the Margalef method where D is calculated as $D = (S - 1) / \log N$, where S = number of species, N = total number of individuals.

Staub et. al. (1970) proposed a different scale of pollution in terms of species diversity index that is being used to determine the pollution status of the overall estuarine area of Bhayander and Naigaon.

Shannon's Index 3.0 to 4.5	Slight Pollution.
Shannon's Index 2.0 to 3.0	Light Pollution.
Shannon's Index 1.0 to 2.0	Moderate Pollution.
Shannon's Index 0.0 to 1.0	Heavy Pollution.

Study Area

The present study was carried out at two stations Bhayander and Naigaon respectively.

Station 1: The first station at Bhayander is located 19° 19' N and 72° 51' E. (Google Earth 2008) The Bhayander is geographically surrounded by sea from the West side, by the estuary from the north side and by open and occupied land from the south and east side. The estuarine water is mainly from the buffering of Ulhas River with the Arabian sea which amalgamates its water in the Thane creek and Vasai creek.

Station 2: The second station Naigaon is located 19° 20' N and 72° 51' E. (Google Earth 2008) Naigaon is a small town in the Thane District of the Maharashtra state and situated diagonally opposite to Bhayander on the another side of the estuary. The approximate distance between Bhayander and Naigaon is about 5 Km.

Table No. 1 Average No. of Mangrove plant species and Mangrove Associate Floral species recorded at Station No.1 Bhayander from June 2008 to May 2009.

Species	Premon- soon	Mon- soon	Post- mon- soon	Overall Average
Family: - Avicenniaceae				
1) <i>Avicennia marina</i> .	43	44	43	43.33
2) <i>Avicennia officinalis</i> .	27	28	27	27.33
3) <i>Avicennia alba</i> .	21	23	21	21.67
Family: - Rhizophoraceae				
4) <i>Rhizophora mucronata</i> .	32	31	32	31.67
5) <i>Rhizophora apiculata</i> .	14	15	15	14.67
6) <i>Bruguiera gymnorhiza</i> .	22	23	24	23.00
7) <i>Bruguiera cylindrica</i> .	40	41	40	40.33
8) <i>Bruguiera parviflora</i> .	19	17	16	17.33
9) <i>Bruguiera caryophylloides</i> .	13	14	14	13.67
10) <i>Ceriops tagal</i> .	36	35	35	35.33
11) <i>Ceriops decandra</i> .	25	25	26	25.33
12) <i>Kandelia candel</i> .	31	32	32	31.67
Family: - Myrsinaceae				
13) <i>Aegiceras corniculatum</i> .	34	33	33	33.33
Family: - Euphorbiaceae				
14) <i>Excoecaria agallocha</i> .	26	27	27	26.67
Family: - Salvadoraceae				
15) <i>Salvadora persica</i> .	18	19	19	18.67
Family: - Sonneratiaceae				
16) <i>Sonneratia apetala</i> .	15	16	16	15.67
17) <i>Sonneratia caseolaris</i> .	19	17	17	17.67
18) <i>Sonneratia griffithii</i> .	31	33	32	32.00
Family: - Meliaceae				
19) <i>Xylocarpus granatum</i> .	22	23	22	22.33
Family: - Combretaceae				
20) <i>Lumnitzera racemosa</i> .	45	43	42	43.33
Mangrove Associate Floral Species				
Family: - Acanthaceae				
21) <i>Acanthus ilicifolius</i> .	29	28	29	28.67
Family: - Fabaceae				
22) <i>Derris trifoliata</i> .	26	26	25	25.67
23) <i>Derris heterophylla</i> .	15	17	15	15.67
24) <i>Cynometra iripa</i> .	24	24	25	24.33
Family: - Chenopodiaceae				
25) <i>Suaeda maritima</i> .	13	14	14	13.67
Family: - Pteridaceae				
26) <i>Acrostichum aureum</i> .	10	11	10	10.33
Family: - Aizoaceae				
27) <i>Sesuvium portulacastrum</i> .	12	15	13	13.33
Family: - Poaceae				
28) <i>Aeluropus lagopoides</i> .	14	16	16	15.33
29) <i>Urochondra setulosa</i> .	10	11	09	10.00
Total No. of Mangroves and Mangrove Associate Flora. (Total No. of Species)	686 (29)	701 (29)	689 (29)	

Table No. 2 Average No. of Mangrove plant species and Mangrove Associate Floral species recorded at Station No.2 Naigaon from June 2008 to May 2009.

Species	Premon- soon	Mon- soon	Post- mon- soon	Overall Average
Family: - Avicenniaceae				
1) <i>Avicennia marina</i> .	15	16	16	15.67
2) <i>Avicennia officinalis</i> .	23	22	22	22.33
3) <i>Avicennia alba</i> .	31	34	32	32.33
Family: - Rhizophoraceae				
4) <i>Rhizophora mucronata</i> .	44	45	44	44.33
5) <i>Rhizophora apiculata</i> .	32	33	32	32.33
6) <i>Bruguiera gymnorhiza</i> .	15	16	15	15.33
7) <i>Bruguiera cylindrica</i> .	12	13	13	12.67
8) <i>Bruguiera parviflora</i> .	20	21	22	21.00
9) <i>Bruguiera caryophylloides</i> .	42	43	43	42.67
10) <i>Ceriops tagal</i> .	22	23	23	22.67
11) <i>Ceriops decandra</i> .	17	18	17	17.33
12) <i>Kandelia candel</i> .	19	20	20	19.67
Family: - Myrsinaceae				
13) <i>Aegiceras corniculatum</i> .	19	21	20	20.00
Family: - Euphorbiaceae				
14) <i>Excoecaria agallocha</i> .	22	23	23	22.67
Family: - Salvadoraceae				
15) <i>Salvadora persica</i> .	26	27	26	26.33
Family: - Sonneratiaceae				
16) <i>Sonneratia apetala</i> .	32	31	31	31.33
17) <i>Sonneratia caseolaris</i> .	15	15	16	15.33
18) <i>Sonneratia griffithii</i> .	18	19	21	19.33
Family: - Meliaceae				
19) <i>Xylocarpus granatum</i> .	35	36	36	35.67
Family: - Combretaceae				
20) <i>Lumnitzera racemosa</i> .	31	32	32	31.67
Mangrove Associate Floral Species				
Family: - Acanthaceae				
21) <i>Acanthus ilicifolius</i> .	29	29	29	29.00
Family: - Fabaceae				
22) <i>Derris trifoliata</i> .	12	11	12	11.67
23) <i>Derris heterophylla</i> .	23	24	24	23.67
24) <i>Cynometra iripa</i> .	25	26	29	26.67
Family: - Chenopodiaceae				
25) <i>Suaeda maritima</i> .	21	24	24	23.00
Family: - Pteridaceae				
26) <i>Acrostichum aureum</i> .	23	25	25	24.33
Family: - Aizoaceae				
27) <i>Sesuvium portulacastrum</i> .	34	34	38	35.33
Family: - Poaceae				
28) <i>Aeluropus lagopoides</i> .	10	11	11	10.67
29) <i>Urochondra setulosa</i> .	9	11	10	10.00
Total No. of Mangroves and Mangrove Associate Flora. (Total No. of Species)	676 (29)	703 (29)	706 (29)	

**Note: Premonsoon: February 2009 to May 2009.
Monsoon: June 2008 to September 2008.**

Postmonsoon: October 2008 to January 2009.

Table No. 3 The Shannon - Wiener Diversity Index and Margalef Species Diversity Index for the Mangroves of the Station No.1 Bhayander from June 2008 to May 2009.

Months	Shannon - Wiener Diversity Index (H)	Margalef Species Diversity Index (D)
Premonsoon	3.28	4.28
Monsoon	3.29	4.27
Postmonsoon	3.28	4.28
Maximum	3.29	4.28
Minimum	3.28	4.27
Mean	3.28	4.28
Standard deviation	0.006	0.006

Table No. 4 The Shannon - Wiener Diversity Index and Margalef Species Diversity Index for the Mangroves of the Station No.2 Naigaon from June 2008 to May 2009.

Month	Shannon - Wiener Diversity Index (H)	Margalef Species Diversity Index (D)
Premonsoon	3.29	4.29
Monsoon	3.29	4.26
Postmonsoon	3.29	4.26
Maximum	3.29	4.29
Minimum	3.29	4.26
Mean	3.29	4.27
Standard deviation	0	0.017

Table No. 5 Pollution Analysis of Station No.1 Bhayander and Station No. 2 Naigaon based on the Staub et. al. scale of pollution in terms of species diversity index for Mangroves and Mangrove Associate Flora.

Shannon's Index	Pollution Level	Mean Shannon index of Station No. 1 Bhayander	Pollution level of Station No.1 Bhayander	Mean Shannon index of Station No. 2 Naigaon	Pollution level of Station No. 2 Naigaon	Pollution level of Overall Estuarine area of Bhayander and Naigaon
Shannon's Index 3.0 to 4.5	Slight Pollution.	3.28	Slight Pollution	3.29	Slight Pollution	Slight Pollution
Shannon's Index 2.0 to 3.0	Light Pollution.					
Shannon's Index 1.0 to 2.0	Moderate Pollution.					
Shannon's Index 0.0 to 1.0	Heavy Pollution.					

CONCLUSION AND DISCUSSION

About 29 different species of mangroves and mangrove associate flora belonging to 14 families are observed at Station No.1 Bhayander and Station No.2 Naigaon. The vegetation in the mangrove at Bhayander and Naigaon consisted of 20 species and 11 genera of mangrove plants and 9 species and 8 genera of associated flora. Among all 14 families, 3 families were dominating like Rhizophoraceae, Avicenniaceae and Sonneratiaceae. In family Rhizophoraceae 9 species were available out of which the frequency of *Bruguiera cylindrica* and *Ceriops tagal* were high at Bhayander where as high frequency of *Rhizophora mucronata* and *Bruguiera caryophylloides* were found at Naigaon station. The family Avicenniaceae supports 3 species in which frequency of *Avicennia marina* was high at Bhayander whereas frequency of *Avicennia alba* was dominating over remaining two species at Naigaon. The family Sonneratiaceae supports 3 genera in which frequency at *Sonneratia griffithii* was high at Bhayander whereas at Naigaon the frequency of *Sonneratia apetala* was found to be dominating.

Among mangrove associate floral species, genus *Acanthus* belongs to family Acanthaceae was typical having only one species *ilicifolius* available in the present investigation. In the family Fabaceae there were two genera among which *Derris trifoliata* was

found to be dominant at Bhayander where as high frequency of *Cynometra iripa* was found at Naigaon. The mean Shannon - Wiener Diversity Index calculated for the mangroves and mangrove associate plant species was 3.28 ± 0.006 for Station No.1 Bhayander and it was 3.29 ± 0 for Station No.2 Naigaon. The mean Margalef Species Diversity Index of Station No.1 Bhayander for mangroves and mangrove associate plant species was 4.28 ± 0.006 and that of Station No.2 Naigaon was calculated to be 4.27 ± 0.017 . The Staub et.al. scale of pollution in terms of species diversity index for mangroves and mangrove associate plant species indicated slight pollution for both the stations under study.

In these perspectives, it is also noted that an urgent and well planned programmes like the mass awareness programme on eco - development and campaigns for protection of these mangroves are needed for the conservation and protection of the National resources for sustainable utilization.

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