e-ISSN No.: 2582-4228

Journal of Indian Association for Environmental Management

Journal homepage: www.http://op.niscair.res.in/index/php/JIAEM/index

Estimation of the plankton population, diversity and correlation analysis with sustainable fishery of the Ashtamudi estuary and Thekkumbhagam creek, Kerala India

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Submitted: December 05, 2020 Revised: January 14, 2021 Accepted: January 27, 2021

***Abstract*-- The Thekkumbhagam creek of Ashtamudi estuary is having a high potential for fishery development and as per the available records no scientific study on availability of the commercial fauna pertaining to the Thekkumbhagam creek alone has been conducted so far. The present study deals with the evaluation of the impact of eco-touristic activities on the availability of commercial fauna of the creek. For adequate information the study focuses on the four selected stations of Thekkumbhagam creek namely Pallikodi (station 1), Kaadanmoola (station 2), Munambathukadavu (station 3), Sankaravilasam kadavu (station 4). Around 51 species of fishes, 7species of shrimps, 2 species of crabs, 5 species of bivalves and a single species of oyster were encountered from the selected four stations. In station 1, the Shannon Diversity index and species richness of fishes and shrimps were comparatively higher than other stations. In station 2, the evenness index was greater than that of station1. Station 3, diversity indices and species richness were much lesser than that of station 1 and station 2 but greater than station4.Study point out that many species in the study area are being threatened by various human activities. Correlation analysis between phytoplankton and diversity indices revealed that a significant positive relationship existed between species richness and diatoms in all stations except station 4. A significant positive correlation between rotifer and dominance index was noted. From the present study it is concluded that the best approach to the conservation of this species is to disseminate conservation information, education and practices to fisherman and stake holders about the danger of extinction of species. It is important to adopt measures for the rehabilitation of fishery stocks that shows symptoms of depletion.**

Key words - Dominance, evenness, richness, shell fishes, bivalves

I. INTRODUCTION

Fishes have a great significance in the life of mankind, being an important natural source of protein since time immemorial. Marine fisheries sector had undergone vast structural changes during the last few years. The shift from traditional fishing methods to motorized and mechanized fishing is a major one. Throughout the world, estuaries and associated coastal waters support numerous essential fisheries, but estuaries in particular are among the most modified and threatened of aquatic environments. Due to irrational fishing practices, environmental aberrations like reduction in water volume, increased sedimentation, water abstraction and pollution over the years, led to the decline of fish diversity and few species had been lost from the aquatic ecosystems of India and they may be categorized in to endemic, endangered and threatened category. Unbridled sand mining in most of the rivers in the state had resulted in changes in the aquatic system and dwindling of fish wealth. This has also led to the endangering of certain endemic and endangered fish species of the state.

Neendakara harbour adjacent to the Thekkumbhagam creek of Ashtamudi estuary was one of the foremost centres of marine fish production and landings across the Kerala coast (Thressiama & Nair, 1980) and receives much attention due to its varied fishery resources (Kurup and Thomas,2004).Gill nets, cast nets, pole and line, hook and line, seine, driving and dredging are the major types of fishing methods used in this area. Stake nets are also another destructive fishing methods (mesh size less than 10mm) that catch a large quantity of juvenile prawns returning to the sea after completing their larval stage in the backwaters while the post-larvae migrating into the estuary from the adjoining sea.(Pauly *et al.,* 1990). For a better tomorrow we must keep a strong monitoring on the changing environment. Fishes have been regarded as an efficient biological indicator of environmental quality and anthropogenic stress in the aquatic ecosystem. Since fishes are sensitive to changes in water quality, they have been identified as suitable for biological assessment due to its easy identification and economic values (Vijaylaxmi et al.,2010).Habitat loss and environmental degradation had drastic impacts on fish fauna(Jordan *et al.*,2008).

The incredibly large number of retting pits scattered around the creek considerably polluted this aquatic environment converting this water bodies into cess pools of foul-smelling stagnant water. Fishery the major direct use value of this creek is facing severe threat and signs of decline in fish availability that had been noticed according to the fisherman as outcomes of various sources of pollution from inadequate sanitation facilities, slaughter wastes, waste thrown out from house boats .For promoting eco-tourism in a sustainable way, the programme should encompass education, sustainable development, respect for fragile environments and the local people should be benefitted. If the idea of eco-tourism is well planned, then it can work beautifully, if not, then disastrous to both the environment and people occur. Thus, eco-tourism should be a purposeful travel to enjoy the natural resources to understand the economic, cultural, spiritual, aesthetic values and natural history of the environment, taking care not to alter the integrity of these natural paradises. Hence the present chapter deals with the assessment of fishes and other commercial fauna such as shrimps, crabs, bivalves, oysters etc found in the Thekkumbhagam creek of Ashtamudi estuary. It also points out to the need for giving a top most priority for the conservation of fish diversity under changing circumstances of gradual habitat degradation. This may provide future strategies for sustainable development and fishery conservation. Hence the present study reminds the need for initiating concerted efforts with the participation of the public to conserve the fish stock of the estuary in a sustainable manner.

II. Materials and Methods

Fish fauna collected from the four stations were taken on a monthly basis from June2008-May2010(Figure 1.1).The fishing was carried out by local fishermen. The fishes were carefully removed from the net and was preserved in 10% formalin and transported to the laboratory. All the fishes and other commercial fauna in each collection were sorted separately and identified up to species level following the fish identification keys (Munro,2000).The diversity of commercial fauna was calculated by following Shannon-Weaver Diversity index (1948).

Station 1 Station 2

Station 3 Station 4

Figure 1.1 Photographs of selected stations

III. Results

Around 51 species of fishes, 7species of shrimps, 2 species of crabs,5species of bivalves and a single species of oyster were encountered from the four stations.(Figure 1a,1b).

The collected fishes were belonging to 11 orders, 35 families, 43 genera and 51 species. Of the 35 families, Cyprinidae and Cichlidae dominated with 3 species among all the families. Cyprinidae was represented by *Puntius filamentosus, Barbodus sarana,Catla catla* etc while Cichlidae was represented by *Etroplus suratensis, Etroplus maculates* and *Tilapia mossambica.* The other families such as Ambassidae, Anguillidae, Bagridae, Chanidae, Stromatidae, Polynemedia, Clupeidae, Gerreidae, Gobidae, Mugilidae were represented by two species each. The other families had only one species each.

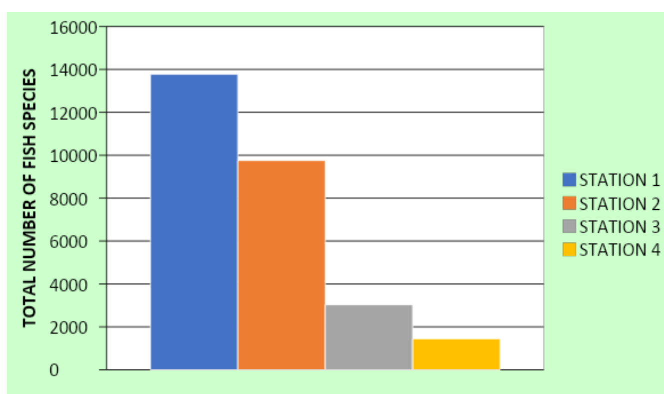

Figure 1a Total number of fish species collected from different stations. 2008-2009

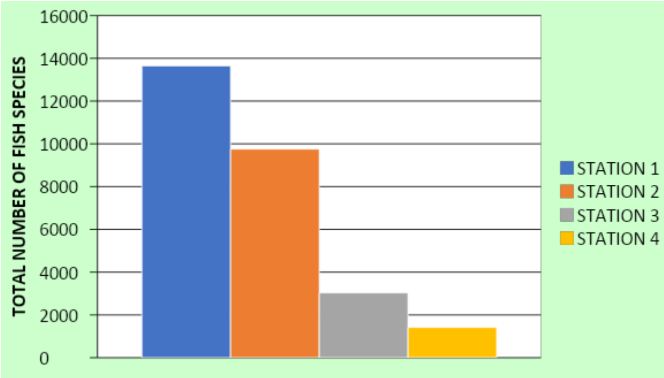

Figure 1 b Total number of fish species collected from different stations. 2009-2010

Analysis of station wise observation revealed that a greater number of species was found in station 1.*Anchoviella commersoni* comes under the abundant category during 2008-2009 and common in the second year(2009-2010). *Anchoviella indica, Mugil cephalus, Mugil dussumeri, Therapon jarbua,Sillago sihama,Caranx carangus, Lactarius delicatulus, Mene maculate, Gerres abreviatus, Gerres filamentosus, Equula daura, Etroplus suratensis, Etroplus maculates, Tilapia mossambica, Arius venosus,Oxyurichthys microlepis,Dayella malabarica, Parambassis dayi, Parambassis ranga, Horabagrus brachysoma, Heteropneustis fossilis, Mystus vitatus etc belongs to the common category. Catla catla, Macrones keleticus, Hemirhamphus limbatus, Aplocheilus panchax, Sphyraena obtusa, Polynemius sextarius, Ambassis urotaenia,Epinepheles fario Lobotes surinamensis, Pampus argenteus, Pampus chinensis, Anabas testudineus,Cynoglossus quinquelineatus, Cynoglossus elongates, Puntius filamentosis, Anodontostoma charunda, Trichiurus savala, Chanos chanos, Glossogobius giuris, Pseudoprominus cupanus, Anguilla bengalensis, Monopterus digresus,Barbodes sarana, Pisodonophis boro, Scatophagus argus, Pristolepis marginata etc comes under uncommon category.Among the collected fishes,ornamental fishes include Macrones keleticus, Aplocheilus panchax,Terapon jarbua,Etroplus suratensis, Etroplus maculates, Anabus testudineus, Puntius filamentosus, Oxyurichthys microlepis, Dayella malabarica, Pseudosprominus cupanus, Parambassis ranga, Horabagrus brachysoma, Heteropneustis fossilis, Mystus vitatus, Anguilla bengalensis, Anguilla bicolor, Scatophagus argus, Pristolepis marginata.Based on the conservation status,the collected fishes were categorized as Critically endangered (Dayella malabarica), Endangered (Horabagrus brachysoma, Anguilla bengalensis), Lower risk near threatened(Glossogobius giuris), Lower risk least concern (Aplocheilus panchax, Etroplus suratensis,Etroplus maculates, Pseudoprominus cupanus), Least concern (Macrones keleticus, Mugil cephalus,Ambassis urotaenia, Terapon jarbua, Caranx carangus, Gerres filamentosus, Puntius filamentosus, Barbodes sarana, Pisodonophisboro, Scatophagus argus),Vulnerable(Catla catla, Anabus testudineus, Parambassis dayi, Heteropneustis fossilis, Mystus vitatus, Pristolepis marginata, Data Deficient (Anguilla bicolor, Monopterus digressus).* (Table 1.21a, 1.21b, 1.22a, 1.22b, 1.23a, 1.23b, 1.24a,1.24b).

Taking into account of other commercial fauna there were nearly 7 species of shrimps coming the class Malacostraca, order Decapoda and family Penaeidae.There are 2 species of crabs coming under class Malacostraca, order Decapoda and family Portunidae. Bivalves includes 5 species of bivalves belonging to class Bivalvia, order Veneroida and family Carbiculidae. Oyster include one species *Crassostrea madrasinesis*.

In the present study, Shannon index of diversity ranged from 1.64 to3.33 in 2008-2009 and from 1.58 to 3.34 in 2009-2010.Highest Shannon index of diversity was noticed in the month of February in station1 of the first year and lowest in September for station 4.In the second year the highest Shannon index of diversity was for station 1 during February and lowest at station 1 for the end of monsoon season. Evenness index or equitability was higher at station 4 (0.97) during the month of October and lowest at station 1 during the month of April for the first year. In the second-year evenness index was maximum at station 3 (0.95) and lowest at station 4 during the month of September (Table 1.5a, 1.6a, 1.7a, 1.8a).Species richness showed maximum value at station 1 (8.04) and lowest value at station 4 (1.66) in September during the first year. During the second year at station 1 (8.07) and lowest at station 4 during September (1.64) (Table 1.5b,1.6b,1.7b,1.8b).

Dominance index showed the highest value at station 4 (0.3233) and lowest value at station 1 during the first year. In the second year the dominance index was maximum at station 4 (0.3530) and lowest at station 1 (0.0510). (Table 1.5b,1.16b, 1.7b, 1.8b).

Shannon diversity index showed its peak in station 1 (1.9909) and the lowest in station 4 in the first year. In the second year Shannon index was maximum at station 1 (1.99) and lowest value at station 4 (1.29). Dominance index of shrimps raised to the highest value at station 2 (0.328) and lowest value at station 1 (0.1543) during the first year. Shrimps showed its maximum species richness in station 1 (1.8205) and minimum value in station 4 (0.6224) during the first year. In the second year, species richness reached its peak at station 1(1.8205) and minimum value at station 4 (0.6277). Evenness index of shrimps exhibited its maximum at station 4 (0.9844) and minimum at station 2 (0.6865) during the first year. In the second-year shrimp showed a maximum value of evenness index at station 4 (0.9889) and minimum value at station 1 (0.7686) (Table 1.9a, 1.10a, 1.11a, 1.12a, 1.10b, 1.11b, 1.12b).

Shannon diversity indices of bivalves exhibited its maximum at station1 (1.6063) and minimum at station 2 (0.2145) during 2008-2009. During 2009-2010, the Shannon index reached the highest value at station 1 (1.6012) and minimum at station 2 (0.2055). Dominance index of bivalves showed the highest value at station 2 (0.6909) and minimum value at station 1 (0.2013) in the first year. In the second-year dominance index reached a maximum value at station 2 (0.7387) and minimum value at station 1 (0.2032). Species richness of bivalves exhibited its peak at station 4 (1.1761) and minimum at station 2 (0.3804) in the first year. In the second year it showed the highest value at station 1 (1.3352) and the minimum value at station 2. (0.3903). Evenness index of bivalves reached its peak at station 4 (0.9986) and minimum at station 1 (0.5338) in the first year. In the second-year evenness index of bivalves reached its highest value at station 3 (0.9952) and minimum at station 2 (0.187). (Table 1.13a, 1.13b, 1.14a, 1.14b, 1.15a, 1.15b, 1.16a, 1.16b,1.17a,1.17b,1.18a,1.18b,1.19a,1.19b).

Station 1: about 51 species of fishes, 7 species of shrimps, 2 species of crabs, 5 species of bivalves and a single species of oyster were observed during the study period. Species abundance was comparatively higher than other three stations (Table 1.1a, 1.1b).

Station 2: Nearly 37 species of fishes, 4species of shrimps, 3 species of bivalves and a single species of oyster were listed. (Table 1.2a, 1.2b)

Station 3: In this station, there are only 16 species of fishes, 4 species of shrimps, 2 species of crabs and 3species of bivalves. (Table 1.3a, 1.3b)

Station 4: In this station about 16 species of fishes and 2 species of shrimps, 2 species of crabs and 3 species of bivalves (Table 1.4a,1.4b).

Among the collected fishes, ornamental fishes such as *Macrones keleticus, Aplocheilus panchax, Terapon jarbua,Etroplus suratensis, Etroplus maculatus, Anabus testudineus ,Puntius filamentosus, Oxyurichthys microlepis,Dayella malabarica ,Pseudosprominuscupanus ,Parambasssis dayi, Parambassis ranga ,Horabagrus brachysoma, Heteropneustis fossilis, Mystus vitatus ,Anguilla bengalensis ,Anguilla bicolor, Scatophagus argus, Pristolepis marginata* were also categorized. (Table 1.21a, 1.21b, 1.22a, 1.22b, 1.23a, 1.23b, 1.24a, 1.24b)

Correlation analysis revealed that a significant positive correlation was observed for species richness with diatoms (at 1% level) in station 1, station 2 (at 5% level), and station 3 (at 1% level) of 2008-2009 and in station 1 (at 5% level) of 2009-2010. A significant positive correlation was also exhibited between total phyto plankton with species richness in station 1 (2008-2009). A significant positive relationship between diatom and dominance index (at 5% level) in station 3 during the first year. A significant positive relationship between chlorophyta and dominance 130 index at (1% level) at station 4 during the first year.(Table 1.25a, 1.25b, 1.26a, 1.26b, 1.27a, 1.27b, 1.28a, 1.28b). A significant positive relationship (at 5% level) was observed between rotifers and dominance index in station 1 during 2008-2009. Cladocera exhibited an inverse relationship between species richness in all stations except station 4 during both years. It also exhibited an inverse relationship between dominance indices in all stations except station 2 in the first year. However, the relationships were not statistically significant. At the same time an inverse relationship was expressed between crustacean larvae with Shannon diversity and species richness in all stations. A significant positive relationship was exhibited in station 2 between copepod and dominance index during the second year. A significant positive relationship was seen between protozoa and species richness. A positive relationship significant (at 1 % level) was observed between Bryozoa and dominance index .(Table 1.29a, 1.29b, 1.30a, 1.30b, 1.31a, 1.32b, 1.33a, 1.33b).

TABLE 1.1a
Distribution of commercial fauna in station 1(2008-2009)

Sr.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	250	270	230	260	300	200	210	190	8	5	3	9
2	*Anchovilla indica*	245	263	225	250	280	180	190	200	7	4	3	2
3	*Catla catla*	1	1	1	2	3	4	5	1	6	2	1	1
4	*Macrones keleticus*	1	1	1	1	5	25	30	1	3	4	1	1
5	*Hemirhamphus limbatus*	5	3	7	15	11	22	6	2	24	9	7	1
6	*Aplocheilus panchax*	1	1	1	8	2	21	22	1	9	2	1	1
7	*Sphyraena obtusa*	3	2	1	11	26	23	30	27	21	7	6	18
8	*Mugil cephalus*	17	100	16	90	125	110	150	111	15	14	18	12
9	*Mugil dussumeri*	18	99	16	80	70	56	60	45	12	16	19	14
10	*Polynemius plebius*	23	27	29	31	40	4	8	2	12	4	2	3
11	*Polynemius sextarius*	25	29	22	23	28	4	5	3	18	2	5	7
12	*Ambassis urotaenia*	1	1	1	8	4	21	23	1	9	2	1	1
13	*Epinepheles fario*	1	1	4	5	6	9	24	1	6	2	1	1
14	*Therapon jarbua*	7	4	8	2	12	19	27	23	22	26	23	29
15	*Sillago sihama*	103	120	95	16	11	1	3	87	90	83	100	109
16	*Caranx carangus*	50	60	70	3	12	18	16	14	5	3	1	1
17	*Lactarius delicatulus*	75	65	55	6	18	16	17	14	4	6	1	1
18	*Mene maculata*	40	35	45	12	39	43	50	9	16	4	8	7
19	*Lobotes surinamensis*	6	5	3	2	17	19	15	12	4	7	1	6
20	*Gerres abbreviatus*	15	17	16	12	30	47	50	5	4	2	4	4
21	*Gerres filamentosus*	16	18	13	14	33	40	32	7	4	6	8	7
22	*Equula daura*	67	70	50	12	19	60	55	5	44	50	45	60
23	*Etroplus suratensis*	50	60	43	35	44	54	24	42	37	34	33	35
24	*Etroplus maculatus*	55	65	60	70	34	45	52	50	43	34	67	45
25	*Tilapia mossambica*	40	34	45	32	16	17	18	16	3	7	17	12
26	*Pampus argenteus*	8	5	7	1	1	1	1	5	1	1	1	1
27	*Pampus chinensis*	4	8	6	1	1	1	1	6	1	1	1	1
28	*Anabus testudineus*	7	3	6	9	23	26	30	35	15	6	5	6
29	*Cynoglossus quinquelineatus*	4	5	7	7	14	17	21	25	5	2	8	6
30	*Cynoglossus elongatus*	4	5	4	8	15	12	17	14	8	7	6	7
31	*Arius venosus*	34	25	30	34	40	35	31	24	16	19	14	15
32	*Puntius filamentosus*	3	6	8	1	1	1	9	8	1	1	1	1
33	*Anodontostoma charunda*	8	2	5	1	1	1	7	4	1	1	1	1
34	*Trichiurus savala*	3	6	6	1	1	1	1	1	1	1	1	1
35	*Chanos chanos*	6	4	5	1	1	1	8	5	1	1	1	1
36	*Oxyurichthys microlepis*	100	90	76	29	50	45	65	77	65	44	80	95
37	*Dayella malabarica*	16	30	29	12	18	15	34	35	19	9	2	8
38	*Glossogobius giuris*	16	14	12	6	4	9	26	8	5	2	8	9

Sr.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
39	*Pseudosprominus cupanus*	4	5	8	4	6	13	2	4	4	6	9	4
40	*Parambassis dayi*	14	15	35	40	33	7	17	40	50	7	9	9
41	*Parambassis ranga*	16	18	35	28	41	12	5	27	34	5	4	7
42	*Horabagrus brachysoma*	19	30	33	26	14	15	29	16	6	9	2	9
43	*Heteropneustis fossilis*	17	28	27	30	17	15	26	14	7	5	6	2
44	*Mystus vitatus*	20	27	30	28	16	16	29	19	4	9	5	5
45	*Anguilla bengalensis*	4	5	4	9	4	8	4	7	1	1	1	1
46	*Anguilla bicolor*	8	8	6	8	6	5	7	8	1	1	1	1
47	*Monopterus digressus*	7	9	5	7	8	1	1	1	1	1	1	1
48	*Barbodes sarana*	6	8	2	9	8	1	1	1	8	4	6	8
49	*Pisodonophis boro*	1	9	6	9	8	3	1	1	1	1	1	1
50	*Scatophagus argus*	16	23	20	21	8	3	21	25	19	14	5	8
51	*Pristolepis marginata*	23	25	21	27	25	15	4	9	5	8	4	9
	Shrimps												
52	*Penaeus indicus*	100	76	55	87	78	19	4	6	15	14	12	18
53	*Penaeus monodon*	123	85	79	80	77	12	8	4	13	18	15	18
54	*Penaeus semisulcatus*	12	14	18	12	19	6	8	5	9	8	7	8
55	*Metapenaeus dobsoni*	14	15	19	9	7	6	2	7	2	8	6	9
56	*Metapenaeus monoceros*	14	12	15	12	19	14	8	5	4	8	7	2
57	*Metapenaeus affinis*	12	19	13	14	15	18	5	7	8	4	6	8
58	*Macrobrachium rosenbergii*	5	9	5	8	1	1	1	1	1	1	1	1
	Crabs												
59	*Portunus pelagicus*	30	34	29	30	21	34	25	23	25	26	21	25
60	*Scylla serata*	30	34	29	30	21	34	25	23	25	26	21	25
	Bivalves												
61	*Villorita cyprinoides*	200	240	210	99	211	9	2	9	4	155	230	150
62	*Katalesia opima*	15	15	99	67	6	8	7	6	2	8	22	25
63	*Paphia malabarica*	16	12	55	57	6	8	6	6	8	18	16	12
64	*Meretrix meretrix*	12	15	17	16	12	8	2	9	8	45	35	37
65	*Meretrix casta*	12	13	7	4	9	7	3	8	8	4	8	7
	Oysters												
66	*Crassostrea madrasensis*	19	15	12	15	12	16	18	16	100	75	65	95

TABLE 1.1b
Distribution of commercial fauna in station 1 (2009-2010)

Sr.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	225	290	200	230	325	235	247	150	8	5	3	9
2	*Anchovilla indica*	275	223	210	270	295	165	212	226	7	4	3	2
3	*Catla catla*	1	1	1	2	3	4	5	1	6	2	1	1
4	*Macrones keleticus*	1	1	1	1	5	20	35	1	3	4	1	1
5	*Hemirhamphus limbatus*	5	3	7	18	13	30	6	2	32	9	7	1
6	*Aplocheilus panchax*	1	1	1	8	2	21	22	1	9	2	1	1
7	*Sphyraena obtusa*	3	2	1	11	20	23	22	21	21	7	6	18
8	*Mugil cephalus*	17	90	16	65	100	80	125	111	15	14	12	12
9	*Mugil dussumeri*	18	99	16	60	55	56	63	45	12	16	19	14
10	*Polynemius plebius*	23	20	22	24	33	4	8	2	12	4	2	3
11	*Polynemius sextarius*	25	29	22	21	20	4	5	3	18	2	5	7
12	*Ambassis urotaenia*	1	1	1	8	4	21	23	1	9	2	1	1
13	*Epinepheles fario*	1	1	4	5	6	9	21	1	6	2	1	1
14	*Therapon jarbua*	7	4	8	2	12	19	24	23	22	26	23	24
15	*Sillago sihama*	110	85	95	16	11	1	3	87	90	83	80	90
16	*Caranx carangus*	35	50	45	3	12	15	16	12	5	3	1	1
17	*Lactarius delicatulus*	45	35	45	6	15	16	17	12	4	6	1	1
18	*Mene maculata*	40	25	36	12	29	43	40	9	13	4	8	7
19	*Lobotes surinamensis*	6	5	3	2	11	12	14	12	4	7	1	6
20	*Gerres abbreviatus*	15	17	16	12	35	47	55	5	4	2	4	4
21	*Gerres filamentosus*	16	18	13	14	36	45	32	7	4	6	8	7
22	*Equula daura*	67	70	50	12	19	60	44	5	48	39	35	55
23	*Etroplus suratensis*	47	54	43	30	40	48	24	42	33	34	30	31
24	*Etroplus maculatus*	60	72	65	63	34	45	52	44	43	34	60	45
25	*Tilapia mossambica*	35	34	42	32	12	17	18	16	3	7	17	12
26	*Pampus argenteus*	8	5	7	1	1	1	1	5	1	1	1	1
27	*Pampus chinensis*	4	8	6	1	1	1	1	6	1	1	1	1
28	*Anabus testudineus*	7	3	6	9	20	26	25	35	15	6	5	6
29	*Cynoglossus quinquelineatus*	4	5	7	7	14	17	21	25	5	2	8	6
30	*Cynoglossus elongatus*	4	5	4	8	15	12	17	12	8	7	6	7
31	*Arius venosus*	34	25	30	32	40	35	31	24	12	19	14	15
32	*Puntius filamentosus*	3	6	8	1	1	1	9	8	1	1	1	1
33	*Anodontostoma charunda*	8	2	5	1	1	1	7	4	1	1	1	1
34	*Trichiurus savala*	3	6	6	1	1	1	1	1	1	1	1	1
35	*Chanos chanos*	6	4	5	1	1	1	8	5	1	1	1	1
36	*Oxyurichthys microlepis*	150	90	76	21	50	45	65	66	55	44	90	95
37	*Dayella malabarica*	16	36	25	12	18	15	36	38	19	9	2	8
38	*Glossogobius giuris*	15	11	12	6	4	9	24	8	5	2	8	9

39	*Pseudosprominus cupanus*	4	5	8	4	4	11	2	4	4	4	9	4
40	*Parambassis dayi*	14	15	31	44	36	7	17	40	45	7	8	9
41	*Parambassis ranga*	16	18	30	25	41	12	5	27	30	5	4	7
42	*Horabagrus brachysoma*	19	30	33	26	14	15	25	16	6	9	2	9
43	*Heteropneustis fossilis*	17	28	27	35	17	15	22	12	7	5	4	2
44	*Mystus vitatus*	20	27	30	22	16	16	29	19	4	9	5	5
45	*Anguilla bengalensis*	4	5	4	9	4	9	4	6	1	1	1	1
46	*Anguilla bicolor*	8	7	6	8	6	5	7	8	1	1	1	1
47	*Monopterus digressus*	7	9	5	7	8	1	1	1	1	1	1	1
48	*Barbodes sarana*	6	8	2	9	5	1	1	1	8	4	6	8
49	*Pisodonophis boro*	1	9	6	9	8	3	1	1	1	1	1	1
50	*Scatophagus argus*	16	23	20	21	8	3	23	25	19	14	5	8
51	*Pristolepis marginata*	23	25	21	21	25	15	4	9	5	7	4	9
	Shrimps												
52	*Penaeus indicus*	125	76	50	87	82	19	8	6	15	18	12	18
53	*Penaeus monodon*	123	90	79	80	66	12	8	4	13	18	15	18
54	*Penaeus semisulcatus*	12	14	18	12	19	6	8	5	8	8	7	8
55	*Metapenaeus dobsoni*	14	15	15	9	7	6	2	7	2	8	6	9
56	*Metapenaeus monoceros*	14	12	15	11	19	12	8	5	4	8	7	2
57	*Metapenaeus affinis*	12	19	13	14	15	18	5	7	4	4	6	8
58	*Macrobrachium rosenbergii*	5	9	5	8	1	1	1	1	1	1	1	1
	Crabs												
59	*Portunus pelagicus*	30	34	29	30	21	34	25	23	25	26	21	25
60	*Scylla serata*	30	34	29	24	21	34	20	23	25	22	21	25
	Bivalves												
61	*Villorita cyprinoides*	200	235	210	99	225	9	2	9	4	155	230	150
62	*Katalesia opima*	15	15	99	67	6	8	7	6	2	8	21	24
63	*Paphia malabarica*	16	12	45	57	6	8	6	6	8	18	16	12
64	*Meretrix meretrix*	12	15	17	16	12	8	2	9	8	35	35	37
65	*Meretrix casta*	12	13	7	4	9	6	3	8	8	4	8	7
	Oysters												
66	*Crassostrea madrasensis*	19	15	12	13	12	16	18	16	135	75	65	95

TABLE 1.2a
Distribution of commercial fauna in station 2(2008-2009)

Sr. No.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	18	200	180	11	12	15	185	212	2	6	6	2
2	*Anchovilla indica*	225	216	150	190	218	19	198	215	3	8	9	2
3	*Hemirhamphus limbatus*	5	2	6	15	16	25	9	5	6	8	5	1
4	*Mugil cephalus*	100	87	67	75	95	102	65	54	12	18	19	12
5	*Mugil dussumeri*	88	45	67	78	87	83	56	76	18	17	145	13
6	*Therapon jarbua*	2	6	5	4	12	13	15	23	25	27	29	28
7	*Sillago sihama*	100	90	56	17	18	5	7	58	56	45	34	58
8	*Caranx carangus*	16	14	18	4	19	15	14	16	7	2	1	1
9	*Lactarius delicatulus*	12	13	14	6	15	17	18	12	5	8	1	1
10	*Mene maculata*	45	38	42	16	55	32	29	5	14	4	2	9
11	*Gerres abbreviatus*	4	5	8	9	24	30	22	2	2	4	5	7
12	*Gerres filamentosus*	6	7	12	18	21	25	26	2	8	7	4	5
13	*Equula daura*	50	45	30	17	18	55	26	32	40	36	37	40
14	*Etroplus suratensis*	23	34	30	22	33	21	25	28	31	29	31	24
15	*Etroplus maculatus*	23	40	33	27	40	30	22	23	22	27	20	23
16	*Tilapia mossambica*	21	25	27	20	12	13	14	18	7	2	13	12
17	*Anabus testudineus*	4	8	3	2	27	22	12	19	18	3	4	7
18	*Cynoglossus quinquelineatus*	21	12	15	16	13	16	18	14	5	3	4	6
19	*Cynoglossus elongatus*	16	11	13	12	12	18	17	19	5	6	4	3
20	*Arius venosus*	18	15	1	21	15	12	2	8	13	12	15	14
21	*Trichiurus savala*	4	3	1	1	1	1	1	1	1	1	1	1
22	*Oxyurichthys microlepis*	52	65	58	72	48	43	59	46	45	45	49	46
23	*Dayella malabarica*	12	35	30	16	13	15	38	36	12	4	8	7
24	*Glossogobius giuris*	15	14	17	4	2	7	3	5	8	9	4	2
25	*Pseudosprominus cupanus*	2	8	9	5	4	19	4	6	3	2	7	8
26	*Parambassis dayi*	12	13	18	25	32	5	18	27	25	4	5	7
27	*Parambassis ranga*	19	13	26	35	34	12	5	32	34	7	8	6
28	*Horabagrus brachysoma*	15	14	23	21	15	16	24	13	2	4	5	9
29	*Heteropneustis fossilis*	12	21	27	24	13	14	12	12	3	4	5	4
30	*Mystus vitatus*	23	24	21	25	14	15	23	19	4	5	8	7
31	*Anguilla bengalensis*	4	2	9	7	5	5	6	3	1	1	1	1
32	*Anguilla bicolor*	4	8	7	2	3	9	7	2	1	1	1	1
33	*Monopterus digressus*	2	8	9	3	4	1	1	1	1	1	1	1
34	*Barbodes sarana*	7	6	3	8	4	1	1	1	2	5	8	5
35	*Pisodonophis boro*	1	2	8	9	6	4	1	1	1	1	1	1
36	*Scatophagus argus*	12	23	21	24	2	3	23	26	16	14	2	8
37	*Pristolepis marginata*	21	20	27	24	26	18	2	5	4	3	6	9

Sr. No.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
					Shrimps								
38	*Penaeus indicus*	123	100	142	123	132	12	5	6	18	19	12	14
39	*Penaeus monodon*	145	125	130	112	134	12	2	3	16	14	15	12
40	*Metapenaeus dobsoni*	16	12	19	7	8	5	4	3	6	2	9	4
41	*Metapenaeus monoceros*	12	12	18	19	15	17	2	4	8	7	4	2
	Crabs												
42	*Portunus pelagicus*	36	28	41	29	27	23	28	26	23	21	24	22
43	*Scylla serata*	23	21	21	25	23	20	27	22	29	21	24	21
					Bivalves								
44	*Villorita cyprinoides*	79	73	81	59	85	2	3	7	5	79	89	90
45	*Katalesia opima*	18	19	70	68	2	8	4	5	6	2	65	60
46	*Paphia malabarica*	16	15	12	65	2	3	4	5	6	16	12	18
					Oysters								
47	*Crassostrea madrasensis*	12	16	19	14	18	13	16	15	70	75	69	58

TABLE 1.2 b
Distribution of commercial fauna in station 2 (2009-2010)

	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	19	200	200	11	12	15	155	253	2	6	6	2
2	*Anchovilla indica*	225	216	150	190	200	19	198	230	3	8	9	2
3	*Hemirhamphus limbatus*	5	2	6	15	16	25	9	5	6	8	5	1
4	*Mugil cephalus*	100	87	67	45	95	142	65	54	12	18	19	12
5	*Mugil dussumeri*	88	45	67	78	87	83	63	76	18	17	145	13
6	*Therapon jarbua*	2	6	5	4	22	13	15	23	25	27	29	28
7	*Sillago sihama*	100	90	56	17	18	5	7	58	56	45	34	58
8	*Caranx carangus*	16	12	14	4	18	15	14	18	7	2	1	1
9	*Lactarius delicatulus*	12	13	14	6	14	17	19	12	5	8	1	1
10	*Mene maculata*	45	34	38	16	58	32	29	5	16	4	2	9
11	*Gerres abbreviatus*	4	5	8	9	29	33	22	4	2	8	5	7
12	*Gerres filamentosus*	6	7	12	18	21	25	26	2	8	7	5	5
13	*Equula daura*	50	45	30	17	18	54	26	32	40	36	37	40
14	*Etroplus suratensis*	23	34	30	22	29	21	25	24	31	29	31	24
15	*Etroplus maculatus*	23	40	33	27	35	28	22	23	21	25	20	23
16	*Tilapia mossambica*	21	25	28	20	12	13	14	45	7	2	13	12
17	*Anabus testudineus*	4	8	3	2	27	22	12	19	18	3	4	7
18	*Cynoglossus quinquelineatus*	21	12	15	14	11	14	18	14	5	3	4	6
19	*Cynoglossus elongatus*	16	11	13	12	15	18	17	17	5	6	4	3
20	*Arius venosus*	18	15	1	25	15	12	2	8	13	12	15	14
21	*Trichiurus savala*	4	3	1	1	1	1	1	1	1	1	1	1
22	*Oxyurichthys microlepis*	52	65	58	65	33	35	59	46	45	45	38	46
23	*Dayella malabarica*	12	28	30	16	13	15	38	32	12	4	8	7
24	*Glossogobius giuris*	15	14	17	4	2	7	3	5	8	9	4	2
25	*Pseudosprominus cupanus*	2	8	9	5	4	14	4	6	3	2	7	8
26	*Parambassis dayi*	12	13	18	25	32	5	18	27	25	4	5	7
27	*Parambassis ranga*	19	13	26	35	33	12	5	32	34	7	8	6
28	*Horabagrus brachysoma*	15	14	23	21	15	14	24	13	2	4	5	9
29	*Heteropneustis fossilis*	12	21	27	24	13	14	12	12	3	4	5	4
30	*Mystus vitatus*	23	24	23	25	14	15	21	19	4	5	8	7
31	*Anguilla bengalensis*	4	2	9	7	5	5	4	2	1	1	1	1
32	*Anguilla bicolor*	4	8	7	2	3	9	7	2	1	1	1	1
33	*Monopterus digressus*	2	8	9	3	4	1	1	1	1	1	1	1
34	*Barbodes sarana*	7	6	3	8	4	1	1	1	2	5	8	5
35	*Pisodonophis boro*	1	2	8	9	6	4	1	1	1	1	1	1
36	*Scatophagus argus*	12	21	21	22	2	3	23	26	16	14	2	8

37	*Pristolepis marginata*	21	20	27	21	24	18	2	5	4	3	6	9
						Shrimps							
	Fishes	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
38	*Penaeus indicus*	123	100	142	123	142	12	5	6	18	19	12	14
39	*Penaeus monodon*	145	125	120	112	134	12	2	3	14	14	15	12
40	*Metapenaeus dobsoni*	16	12	19	7	8	5	4	3	6	2	9	4
41	*Metapenaeus monoceros*	12	12	18	19	15	12	2	4	8	7	4	2
						Crabs							
42	*Portunus pelagicus*	36	28	35	29	27	23	22	26	23	21	24	22
43	*Scylla serata*	23	21	21	25	23	20	27	22	21	21	24	21
						Bivalves							
44	*Villorita cyprinoides*	79	73	60	59	90	2	3	7	5	79	89	90
45	*Katalesia opima*	18	19	50	68	2	8	2	4	6	2	65	60
46	*Paphia malabarica*	16	15	12	65	2	3	4	5	6	12	12	18
						Oysters							
47	*Crassostrea madrasensis*	12	16	19	14	18	13	16	15	56	50	62	58

TABLE 1.3a
Distribution of commercial fauna in station 3 (2008-2009)

	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	12	16	19	15	14	15	12	13	2	6	3	9
2	*Anchovilla indica*	45	30	29	32	31	15	12	13	8	5	3	2
3	*Hemirhamphus limbatus*	3	5	6	19	12	20	2	4	2	8	9	1
4	*Mugil cephalus*	21	24	25	18	15	13	17	20	12	13	15	14
5	*Mugil dussumeri*	22	27	24	22	13	12	15	17	14	19	12	17
6	*Therapon jarbua*	2	8	9	6	16	15	12	12	13	17	17	20
7	*Sillago sihama*	25	30	23	13	13	3	5	27	30	19	21	23
8	*Mene maculata*	2	5	6	18	27	30	22	4	17	5	8	7
9	*Equula daura*	22	19	27	12	19	13	19	25	22	27	19	24
10	*Etroplus suratensis*	25	21	24	21	12	16	11	7	15	17	15	22
11	*Etroplus maculatus*	24	23	30	35	40	24	31	41	28	35	24	27
12	*Tilapia mossambica*	12	15	16	11	12	15	12	17	9	8	19	12
13	*Anabus testudineus*	3	2	4	8	22	22	14	15	13	2	9	2
14	*Arius venosus*	21	23	25	15	12	11	19	20	12	16	18	12
15	*Trichiurus savala*	7	5	1	1	1	1	1	5	6	3	7	1
16	*Oxyurichthys microlepis*	24	30	32	28	24	24	11	28	21	23	25	27
	Shrimps												
17	*Penaeus indicus*	90	100	120	85	45	13	8	6	18	17	12	12
18	*Penaeus monodon*	100	120	134	125	60	11	5	6	11	19	12	17
19	*Metapenaeus dobsoni*	13	19	12	7	8	9	6	2	4	7	8	6
20	*Metapenaeus monoceros*	11	14	15	19	13	11	9	6	5	8	4	6
	Crabs												
21	*Portunus pelagicus*	22	21	30	24	26	23	22	23	24	27	30	21
22	*Scylla serata*	25	23	22	32	29	28	28	25	27	29	23	21
	Bivalves												
23	*Villorita cyprinoides*	50	38	29	26	21	8	2	7	9	26	25	22
24	*Katalesia opima*	14	13	19	12	27	2	7	9	8	3	26	28
25	*Paphia malabarica*	15	16	13	9	24	9	2	4	7	16	12	18

TABLE 1.3 b
Distribution of commercial fauna in station 3 (2009-2010)

Sr.	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	12	16	19	15	14	15	12	13	2	6	3	9
2	*Anchovilla indica*	45	30	29	28	28	15	12	13	8	5	3	2
3	*Hemirhamphus limbatus*	3	5	6	19	12	20	2	4	2	8	9	1
4	*Mugil cephalus*	21	24	25	15	15	13	17	24	12	13	15	14
5	*Mugil dussumeri*	22	27	24	22	15	12	15	17	14	19	12	17
6	*Therapon jarbua*	2	8	9	6	12	15	12	12	11	17	19	20
7	*Sillago sihama*	25	30	23	15	13	3	5	24	30	19	21	23
8	*Mene maculata*	2	5	6	18	27	35	22	4	19	5	8	7
9	*Equula daura*	22	19	27	12	19	13	19	25	22	27	19	24
10	*Etroplus suratensis*	25	21	24	21	14	16	11	7	18	17	15	22
11	*Etroplus maculatus*	24	23	25	35	35	24	31	51	28	35	24	27
12	*Tilapia mossambica*	12	15	14	11	11	15	12	17	9	8	19	12
13	*Anabus testudineus*	3	2	4	8	21	22	11	15	12	2	9	2
14	*Arius venosus*	21	23	25	15	12	11	19	25	12	16	18	12
15	*Trichiurus savala*	7	5	1	1	1	1	1	5	6	3	7	1
16	*Oxyurichthys microlepis*	24	28	32	28	24	24	12	28	22	23	24	27
	Shrimps												
17	*Penaeus indicus*	90	100	120	85	45	13	8	6	18	17	12	12
18	*Penaeus monodon*	100	120	134	125	60	11	5	6	11	19	12	17
19	*Metapenaeus dobsoni*	13	19	12	7	8	9	6	2	4	7	8	6
20	*Metapenaeus monoceros*	11	14	15	19	13	11	9	6	5	8	4	6
	Crabs												
21	*Portunus pelagicus*	22	21	30	24	26	23	22	23	24	27	30	21
22	*Scylla serata*	25	23	22	32	29	28	28	25	27	29	23	21
	Bivalves												
23	*Villorita cyprinoides*	50	38	29	26	21	8	2	7	9	26	25	22
24	*Katalesia opima*	14	13	19	12	27	2	7	9	8	3	26	28
25	*Paphia malabarica*	15	16	13	9	24	9	2	4	7	16	12	18

TABLE 1.4a
Distribution of commercial fauna in station 4 (2008-2009)

	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	15	12	13	14	12	19	16	17	4	3	6	7
2	*Anchovilla indica*	15	16	14	11	19	19	12	13	2	7	5	8
3	*Mugil cephalus*	2	3	4	9	12	13	17	5	8	4	6	2
4	*Mugil dussumeri*	8	7	2	4	12	17	19	5	3	9	4	6
5	*Sillago sihama*	4	2	9	122	17	4	6	28	27	23	29	31
6	*Equula daura*	3	3	6	17	16	25	22	30	24	27	28	26
7	*Etroplus suratensis*	12	13	11	14	9	2	9	6	14	18	8	3
8	*Etroplus maculatus*	17	17	18	14	4	7	4	5	12	13	6	5
9	*Anabus testudineus*	2	5	7	4	8	9	14	18	18	3	4	7
10	*Oxyurichthys microlepis*	14	17	14	15	16	5	6	5	8	6	9	4
	Shrimps												
11	*Penaeus indicus*	34	38	40	24	25	17	14	17	19	18	11	14
12	*Penaeus monodon*	28	23	32	31	29	17	18	14	15	16	14	11
	Crabs												
13	*Portunus pelagicus*	21	23	30	33	21	28	25	27	23	24	23	32
14	*Scylla serata*	23	27	22	21	22	28	24	23	29	34	35	30
	Bivalves												
15	*Villorita cyprinoides*	25	22	30	21	27	8	5	3	5	30	28	34
16	*Katalesia opima*	17	14	15	16	7	9	4	3	2	6	35	36
17	*Paphia malabarica*	11	14	15	4	9	8	5	4	8	11	17	19

TABLE 1.4b
Distribution of commercial fauna in station 4 (2009-2010)

	Fishes	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	*Anchovilla commersonii*	15	12	12	14	12	15	16	13	4	3	6	7
2	*Anchovilla indica*	15	16	14	11	13	14	12	17	2	7	5	8
3	*Mugil cephalus*	2	3	4	9	12	13	17	5	8	4	6	2
4	*Mugil dussumeri*	8	7	2	4	11	17	19	5	3	9	4	6
5	*Sillago sihama*	4	2	9	135	17	4	6	25	24	23	27	30
6	*Equula daura*	3	3	6	15	16	21	22	35	24	27	28	26
7	*Etroplus suratensis*	12	13	11	14	9	2	9	6	14	18	8	3
8	*Etroplus maculatus*	17	17	13	14	5	7	4	5	11	13	6	5
9	*Anabus testudineus*	2	5	5	4	7	9	14	18	14	3	4	7
10	*Oxyurichthys microlepis*	14	17	12	15	13	5	6	5	9	6	9	4
	Shrimps												
11	*Penaeus indicus*	30	34	35	21	25	15	14	12	17	15	11	14
12	*Penaeus monodon*	28	22	32	30	24	17	15	14	15	14	14	11
	Crabs												
13	*Portunus pelagicus*	21	23	30	36	21	28	25	25	23	24	23	32
14	Scylla serata	23	27	22	21	22	28	24	23	28	26	28	30
	Bivalves												
15	*Villorita cyprinoides*	25	22	30	21	25	8	5	3	5	24	21	38
16	*Katalesia opima*	17	14	15	16	6	8	4	3	2	6	35	40
17	*Paphia malabarica*	11	14	12	4	9	8	5	5	8	13	19	19

TABLE 1.5a
Diversity indices of fishes at station 1(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	3.0839	0.0779	6.8476	0.7843
Jul	3.1311	0.0694	6.6887	0.7963
Aug	3.1956	0.0671	6.8432	0.8128
Sep	3.0366	0.0887	6.9319	0.7723
Oct	3.068	0.0877	6.807	0.7803
Nov	3.2386	0.0627	6.9462	0.8237
Dec	3.2899	0.0589	6.8246	0.8367
Jan	3.1165	0.0714	6.9824	0.7926
Feb	3.3353	0.0516	7.6224	0.8483
Mar	3.2213	0.065	8.043	0.8193
Apr	2.9863	0.0848	7.9037	0.7595
May	3.0152	0.0814	7.8081	0.7669

TABLE 1.5b
Diversity indices of fishes at station 1(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	3.0451	0.0822	6.8394	0.7745
Jul	3.1298	0.0718	6.7517	0.796
Aug	3.2226	0.0650	6.9137	0.8196
Sep	3.0326	0.0934	6.9977	0.7713
Oct	2.9995	0.0992	6.8332	0.7629
Nov	3.2197	0.0669	6.96	0.8189
Dec	3.2374	0.0662	6.8246	0.8234
Jan	3.1113	0.0733	7.0157	0.7913
Feb	3.3456	0.0510	7.6525	0.8509
Mar	3.2319	0.0645	8.0798	0.822
Apr	3.0142	0.0833	7.9951	0.7666
May	3.0626	0.0791	7.8773	0.7789

TABLE 1.6a
Diversity indices of fishes at station 2(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.9092	0.0901	5.207	0.8057
Jul	2.9426	0.0849	5.0823	0.8149
Aug	3.0853	0.0692	5.1466	0.8544
Sep	3.0375	0.0795	5.3054	0.8412
Oct	3.0163	0.082	5.2207	0.8353
Nov	3.224	0.0548	5.4315	0.8928
Dec	2.8996	0.0921	5.2055	0.803
Jan	2.8318	0.0987	5.1562	0.7842
Feb	3.1056	0.059	5.8674	0.8601
Mar	3.0863	0.0629	6.0524	0.8547
Apr	2.7856	0.1142	5.7762	0.7714
May	3.0477	0.0681	6.0315	0.844

TABLE 1.6b
Diversity indices of fishes at station 2(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.9212	0.0888	5.2003	0.809
Jul	2.9322	0.0864	5.0914	0.812
Aug	3.0583	0.0733	5.1366	0.8469
Sep	3.0512	0.0807	5.3418	0.845
Oct	3.0489	0.0775	5.2425	0.8443
Nov	3.1485	0.0661	5.407	0.8719
Dec	2.9279	0.0873	5.2253	0.8108
Jan	2.7861	0.1064	5.1063	0.7716
Feb	3.1071	0.0588	5.8654	0.8605
Mar	3.0997	0.0619	6.0471	0.8584
Apr	2.793	0.1155	5.7965	0.7735
May	3.0477	0.0681	6.0315	0.844

TABLE 1.7a
Diversity indices of fishes at station 3(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.5196	0.0911	2.6793	0.9087
Jul	2.5973	0.081	2.657	0.9368
Aug	2.5961	0.0801	2.6298	0.9363
Sep	2.625	0.0793	2.6723	0.9468
Oct	2.638	0.0787	2.657	0.9515
Nov	2.6439	0.0759	2.7186	0.9536
Dec	2.61	0.0806	2.793	0.9414
Jan	2.6019	0.0837	2.6829	0.9385
Feb	2.6024	0.0824	2.7718	0.9386
Mar	2.554	0.0892	2.7741	0.9212
Apr	2.6428	0.077	2.7718	0.9532
May	2.5064	0.0901	2.7811	0.904

TABLE 1.7 b
Diversity indices of fishes at station 3 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.5196	0.0911	2.6793	0.9087
Jul	2.5996	0.0807	2.6604	0.9376
Aug	2.5971	0.0801	2.6408	0.9367
Sep	2.6318	0.0783	2.6811	0.9492
Oct	2.6527	0.0762	2.674	0.9568
Nov	2.6321	0.0780	2.7089	0.9493
Dec	2.6082	0.0810	2.7978	0.9407
Jan	2.5732	0.0890	2.6553	0.9281
Feb	2.5966	0.0830	2.765	0.9365
Mar	2.554	0.0892	2.7741	0.9212
Apr	2.6437	0.0768	2.7695	0.9535
May	2.5064	0.0901	2.7811	0.904

TABLE 1.8a
Diversity indices of fishes at station 4 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.0824	0.1389	1.9904	0.9044
Jul	2.096	0.1377	1.9763	0.9103
Aug	2.1695	0.1241	1.9629	0.9422
Sep	1.6484	0.3233	1.6631	0.7159
Oct	2.2344	0.1123	1.864	0.9704
Nov	2.1021	0.1375	1.8799	0.9129
Dec	2.1878	0.1215	1.864	0.9502
Jan	2.066	0.1493	1.8432	0.8973
Feb	2.0579	0.1476	1.8799	0.8937
Mar	2.0481	0.1528	1.9038	0.8895
Apr	1.9992	0.1755	1.9338	0.8682
May	1.9278	0.1927	1.9586	0.8372

Table 1.8 b
Diversity indices of fishes at station 4(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.0824	0.1389	1.9904	0.9044
Jul	2.096	0.1377	1.9763	0.9103
Aug	2.184	0.1209	2.0101	0.9485
Sep	1.5807	0.3530	1.6485	0.6865
Oct	2.2521	0.1094	1.8968	0.9781
Nov	2.1365	0.1306	1.926	0.9279
Dec	2.1878	0.1215	1.864	0.9502
Jan	2.0517	0.1542	1.8375	0.891
Feb	2.0773	0.1440	1.9038	0.9022
Mar	2.0481	0.1528	1.9038	0.8895
Apr	2.0125	0.1718	1.9419	0.874
May	1.9355	0.1903	1.9629	0.8406

TABLE 1.9a
Diversity indices of fishes at station 1(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	3.0839	0.0779	6.8476	0.7843
Jul	3.1311	0.0694	6.6887	0.7963
Aug	3.1956	0.0671	6.8432	0.8128
Sep	3.0366	0.0887	6.9319	0.7723
Oct	3.068	0.0877	6.807	0.7803
Nov	3.2386	0.0627	6.9462	0.8237
Dec	3.2899	0.0589	6.8246	0.8367
Jan	3.1165	0.0714	6.9824	0.7926
Feb	3.3353	0.0516	7.6224	0.8483
Mar	3.2213	0.065	8.043	0.8193
Apr	2.9863	0.0848	7.9037	0.7595
May	3.0152	0.0814	7.8081	0.7669

TABLE 1.9b
Diversity indices of fishes at station 1(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	3.0451	0.0822	6.8394	0.7745
Jul	3.1298	0.0718	6.7517	0.796
Aug	3.2226	0.0650	6.9137	0.8196
Sep	3.0326	0.0934	6.9977	0.7713
Oct	2.9995	0.0992	6.8332	0.7629
Nov	3.2197	0.0669	6.96	0.8189
Dec	3.2374	0.0662	6.8246	0.8234
Jan	3.1113	0.0733	7.0157	0.7913
Feb	3.3456	0.0510	7.6525	0.8509
Mar	3.2319	0.0645	8.0798	0.822
Apr	3.0142	0.0833	7.9951	0.7666
May	3.0626	0.0791	7.8773	0.7789

TABLE 1.10a
Diversity indices of fishes at station 2(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.9092	0.0901	5.207	0.8057
Jul	2.9426	0.0849	5.0823	0.8149
Aug	3.0853	0.0692	5.1466	0.8544
Sep	3.0375	0.0795	5.3054	0.8412
Oct	3.0163	0.082	5.2207	0.8353
Nov	3.224	0.0548	5.4315	0.8928
Dec	2.8996	0.0921	5.2055	0.803
Jan	2.8318	0.0987	5.1562	0.7842
Feb	3.1056	0.059	5.8674	0.8601
Mar	3.0863	0.0629	6.0524	0.8547
Apr	2.7856	0.1142	5.7762	0.7714
May	3.0477	0.0681	6.0315	0.844

TABLE 1.10b
Diversity indices of fishes at station 2(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.9212	0.0888	5.2003	0.809
Jul	2.9322	0.0864	5.0914	0.812
Aug	3.0583	0.0733	5.1366	0.8469
Sep	3.0512	0.0807	5.3418	0.845
Oct	3.0489	0.0775	5.2425	0.8443
Nov	3.1485	0.0661	5.407	0.8719
Dec	2.9279	0.0873	5.2253	0.8108
Jan	2.7861	0.1064	5.1063	0.7716
Feb	3.1071	0.0588	5.8654	0.8605
Mar	3.0997	0.0619	6.0471	0.8584
Apr	2.793	0.1155	5.7965	0.7735
May	3.0477	0.0681	6.0315	0.844

TABLE 1.11a
Diversity indices of fishes at station 3(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.5196	0.0911	2.6793	0.9087
Jul	2.5973	0.081	2.657	0.9368
Aug	2.5961	0.0801	2.6298	0.9363
Sep	2.625	0.0793	2.6723	0.9468
Oct	2.638	0.0787	2.657	0.9515
Nov	2.6439	0.0759	2.7186	0.9536
Dec	2.61	0.0806	2.793	0.9414
Jan	2.6019	0.0837	2.6829	0.9385
Feb	2.6024	0.0824	2.7718	0.9386
Mar	2.554	0.0892	2.7741	0.9212
Apr	2.6428	0.077	2.7718	0.9532
May	2.5064	0.0901	2.7811	0.904

TABLE 1.11b
Diversity indices of fishes at station 3 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.5196	0.0911	2.6793	0.9087
Jul	2.5996	0.0807	2.6604	0.9376
Aug	2.5971	0.0801	2.6408	0.9367
Sep	2.6318	0.0783	2.6811	0.9492
Oct	2.6527	0.0762	2.674	0.9568
Nov	2.6321	0.0780	2.7089	0.9493
Dec	2.6082	0.0810	2.7978	0.9407
Jan	2.5732	0.0890	2.6553	0.9281
Feb	2.5966	0.0830	2.765	0.9365
Mar	2.554	0.0892	2.7741	0.9212
Apr	2.6437	0.0768	2.7695	0.9535
May	2.5064	0.0901	2.7811	0.904

TABLE 1.12a
Diversity indices of fishes at station 4 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.0824	0.1389	1.9904	0.9044
Jul	2.096	0.1377	1.9763	0.9103
Aug	2.1695	0.1241	1.9629	0.9422
Sep	1.6484	0.3233	1.6631	0.7159
Oct	2.2344	0.1123	1.864	0.9704
Nov	2.1021	0.1375	1.8799	0.9129
Dec	2.1878	0.1215	1.864	0.9502
Jan	2.066	0.1493	1.8432	0.8973
Feb	2.0579	0.1476	1.8799	0.8937
Mar	2.0481	0.1528	1.9038	0.8895
Apr	1.9992	0.1755	1.9338	0.8682
May	1.9278	0.1927	1.9586	0.8372

TABLE 1.12b
Diversity indices of fishes at station 4(2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	2.0824	0.1389	1.9904	0.9044
Jul	2.096	0.1377	1.9763	0.9103
Aug	2.184	0.1209	2.0101	0.9485
Sep	1.5807	0.3530	1.6485	0.6865
Oct	2.2521	0.1094	1.8968	0.9781
Nov	2.1365	0.1306	1.926	0.9279
Dec	2.1878	0.1215	1.864	0.9502
Jan	2.0517	0.1542	1.8375	0.891
Feb	2.0773	0.1440	1.9038	0.9022
Mar	2.0481	0.1528	1.9038	0.8895
Apr	2.0125	0.1718	1.9419	0.874
May	1.9355	0.1903	1.9629	0.8406

TABLE 1.13a
Diversity indices of shrimps at station 1(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.717	0.2390	1.3725	0.7814
Jul	1.9063	0.1838	1.4042	0.8676
Aug	1.939	0.1756	1.4367	0.8825
Sep	1.8257	0.2062	1.418	0.8309
Oct	1.7999	0.2087	1.4407	0.8192
Nov	1.9418	0.1644	1.6097	0.8838
Dec	1.8284	0.2012	1.796	0.8322
Jan	1.8776	0.1919	1.8205	0.8545
Feb	1.897	0.1740	1.7297	0.8634
Mar	1.95	0.1630	1.6923	0.8875
Apr	1.9909	0.1543	1.7527	0.9061
May	1.9342	0.1625	1.6891	0.8803

TABLE 1.13b
Diversity indices of shrimps at station 1 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.6777	0.2496	1.356	0.7636
Jul	1.8952	0.1873	1.4001	0.8625
Aug	1.9336	0.1780	1.4458	0.88
Sep	1.8096	0.2122	1.4243	0.8236
Oct	1.8128	0.2057	1.4478	0.8251
Nov	1.9354	0.1665	1.6143	0.8808
Dec	1.8972	0.1815	1.8007	0.8635
Jan	1.8776	0.1919	1.8205	0.8545
Feb	1.8528	0.1855	1.7487	0.8433
Mar	1.9644	0.1580	1.6923	0.894
Apr	1.9909	0.1543	1.7527	0.9061
May	1.9342	0.1625	1.6891	0.8803

TABLE 1.14a
Diversity indices of shrimps at station 2 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.3965	0.3045	0.8515	0.7794
Jul	1.3987	0.3056	0.8776	0.7806
Aug	1.44	0.2897	0.8451	0.8037
Sep	1.4095	0.2978	0.8692	0.7867
Oct	1.3446	0.3213	0.8582	0.7504
Nov	1.7035	0.1933	1.1139	0.9507
Dec	1.2981	0.3378	1.185	0.7245
Jan	1.4151	0.3003	1.2022	0.7898
Feb	1.6697	0.2050	1.0857	0.9319
Mar	1.624	0.2115	1.1285	0.9064
Apr	1.6557	0.2089	1.1167	0.924
May	1.5757	0.2284	1.1581	0.8794

TABLE 1.14b
Diversity indices of shrimps at station 2 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.3965	0.3045	0.8515	0.7794
Jul	1.3987	0.3056	0.8776	0.7806
Aug	1.4367	0.2929	0.8515	0.8018
Sep	1.4095	0.2978	0.8692	0.7867
Oct	1.3324	0.3257	0.854	0.7436
Nov	1.6983	0.1964	1.1285	0.9478
Dec	1.3311	0.3283	1.2115	0.7429
Jan	1.4151	0.3003	1.2022	0.7898
Feb	1.6952	0.1963	1.1112	0.9461
Mar	1.624	0.2115	1.1285	0.9064
Apr	1.6557	0.2089	1.1167	0.924
May	1.5757	0.2284	1.1581	0.8794

Table 1.15a
Diversity indices of shrimps at station 3 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.4507	0.2862	0.8986	0.8097
Jul	1.438	0.2939	0.8782	0.8026
Aug	1.3899	0.3076	0.8609	0.7757
Sep	1.4373	0.2916	0.8808	0.8022
Oct	1.6112	0.2251	0.9618	0.8992
Nov	1.6982	0.2000	1.098	0.9478
Dec	1.5809	0.2423	1.1477	0.8823
Jan	1.4809	0.2738	1.185	0.8265
Feb	1.5981	0.2261	1.1139	0.8919
Mar	1.6728	0.2038	1.07	0.9336
Apr	1.6126	0.2269	1.1139	0.9
May	1.6796	0.2013	1.1315	0.9374

TABLE 1.15b
Diversity indices of shrimps at station 3 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.4507	0.2862	0.8986	0.8097
Jul	1.438	0.2939	0.8782	0.8026
Aug	1.3899	0.3076	0.8609	0.7757
Sep	1.4373	0.2916	0.8808	0.8022
Oct	1.6112	0.2251	0.9618	0.8992
Nov	1.6982	0.2000	1.098	0.9478
Dec	1.5809	0.2423	1.1477	0.8823
Jan	1.4809	0.2738	1.185	0.8265
Feb	1.5981	0.2261	1.1139	0.8919
Mar	1.6728	0.2038	1.07	0.9336
Apr	1.6126	0.2269	1.1139	0.9
May	1.6796	0.2013	1.1315	0.9374

TABLE 1.16a
Diversity indices of shrimps at station 4 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.3686	0.2590	0.6433	0.9873
Jul	1.3631	0.2622	0.637	0.9833
Aug	1.3647	0.2607	0.6224	0.9844
Sep	1.3698	0.2581	0.6395	0.9881
Oct	1.3782	0.2541	0.6558	0.9942
Nov	1.3561	0.2649	0.6667	0.9782
Dec	1.3609	0.2623	0.6827	0.9817
Jan	1.3548	0.2657	0.6827	0.9772
Feb	1.3575	0.2645	0.6735	0.9792
Mar	1.3418	0.2732	0.6635	0.9679
Apr	1.2878	0.3006	0.6789	0.9289
May	1.2905	0.2961	0.6718	0.9309

TABLE 1.16b
Diversity indices of shrimps at station 4 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.3761	0.2551	0.6487	0.9926
Jul	1.371	0.2579	0.6433	0.9889
Aug	1.3726	0.2565	0.6277	0.9901
Sep	1.3589	0.2639	0.6407	0.9802
Oct	1.3839	0.2512	0.6635	0.9983
Nov	1.3479	0.2689	0.67	0.9723
Dec	1.3527	0.2666	0.6886	0.9758
Jan	1.3398	0.2728	0.697	0.9665
Feb	1.3561	0.2652	0.6789	0.9783
Mar	1.3498	0.2681	0.6866	0.9737
Apr	1.321	0.2822	0.6927	0.9529
May	1.2905	0.2961	0.6718	0.9309

TABLE 1.17a
Diversity indices of bivalves at station 1(2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.8186	0.6270	0.7219	0.5086
Jul	0.7386	0.6706	0.7034	0.4589
Aug	1.1672	0.3804	0.671	0.7252
Sep	1.3079	0.3016	0.7282	0.8127
Oct	0.5778	0.7528	0.7276	0.359
Nov	1.6063	0.2013	1.0843	0.9981
Dec	1.4737	0.2550	1.3352	0.9157
Jan	1.5932	0.2064	1.0996	0.9899
Feb	1.5066	0.2356	1.1761	0.9361
Mar	0.9718	0.5001	0.7356	0.6038
Apr	0.8591	0.5916	0.6997	0.5338
May	1.0124	0.4973	0.741	0.629

TABLE 1.17b
Diversity indices of bivalves at station 1 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.8186	0.6270	0.7219	0.5086
Jul	0.7478	0.6657	0.7055	0.4646
Aug	1.1442	0.3938	0.674	0.7109
Sep	1.3079	0.3016	0.7282	0.8127
Oct	0.5541	0.7650	0.7203	0.3443
Nov	1.6012	0.2032	1.0918	0.9949
Dec	1.4737	0.2550	1.3352	0.9157
Jan	1.5932	0.2064	1.0996	0.9899
Feb	1.5066	0.2356	1.1761	0.9361
Mar	0.9374	0.5300	0.7416	0.5824
Apr	0.8591	0.5916	0.6997	0.5338
May	1.0124	0.4973	0.741	0.629

TABLE 1.18a
Diversity indices of bivalves at station 2 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.8196	0.5342	0.4231	0.7461
Jul	0.8432	0.5166	0.428	0.7675
Aug	0.9026	0.4368	0.3926	0.8215
Sep	1.0969	0.3345	0.3804	0.9984
Oct	0.2145	0.9131	0.4456	0.1952
Nov	0.9251	0.4556	0.7797	0.8421
Dec	1.0901	0.3388	0.8341	0.9922
Jan	1.0852	0.3426	0.7059	0.9878
Feb	1.0951	0.3356	0.7059	0.9968
Mar	0.5445	0.6909	0.4372	0.4956
Apr	0.8912	0.4460	0.3912	0.8112
May	0.9414	0.4260	0.3903	0.8569

TABLE 1.18b
Diversity indices of bivalves at station 2 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.8196	0.5342	0.4231	0.7461
Jul	0.8432	0.5166	0.428	0.7675
Aug	0.9427	0.4195	0.4163	0.8581
Sep	1.0969	0.3345	0.3804	0.9984
Oct	0.2055	0.9176	0.4402	0.187
Nov	0.9251	0.4556	0.7797	0.8421
Dec	1.0609	0.3580	0.9102	0.9656
Jan	1.0717	0.3516	0.7213	0.9755
Feb	1.0951	0.3356	0.7059	0.9968
Mar	0.4854	0.7387	0.4412	0.4418
Apr	0.8912	0.4460	0.3912	0.8112
May	0.9414	0.4260	0.3903	0.8569

TABLE 1.19a
Diversity indices of bivalves at station 3 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.9116	0.4680	0.4577	0.8298
Jul	0.9818	0.4164	0.4757	0.8937
Aug	1.0463	0.3684	0.4865	0.9524
Sep	0.9926	0.4079	0.5195	0.9035
Oct	1.0934	0.3368	0.4677	0.9952
Nov	0.9551	0.4127	0.6792	0.8694
Dec	0.9075	0.4711	0.8341	0.8261
Jan	1.0487	0.3650	0.6676	0.9545
Feb	1.0934	0.3368	0.6293	0.9952
Mar	0.8652	0.4647	0.5254	0.7875
Apr	1.0479	0.3641	0.4827	0.9538
May	1.0823	0.3443	0.474	0.9851

TABLE 1.19b
Diversity indices of bivalves at station 3 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	0.9116	0.4680	0.4577	0.8298
Jul	0.9818	0.4164	0.4757	0.8937
Aug	1.0463	0.3684	0.4865	0.9524
Sep	0.9926	0.4079	0.5195	0.9035
Oct	1.0934	0.3368	0.4677	0.9952
Nov	0.9551	0.4127	0.6792	0.8694
Dec	0.9075	0.4711	0.8341	0.8261
Jan	1.0487	0.3650	0.6676	0.9545
Feb	1.0934	0.3368	0.6293	0.9952
Mar	0.8652	0.4647	0.5254	0.7875
Apr	1.0479	0.3641	0.4827	0.9538
May	1.0823	0.3443	0.474	0.9851

TABLE 1.20a
Diversity indices of bivalves at station 4 (2008-2009)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.0455	0.3685	0.5037	0.9517
Jul	1.0741	0.3504	0.5112	0.9777
Aug	1.0397	0.3750	0.4885	0.9464
Sep	0.9369	0.4242	0.5386	0.8528
Oct	0.9151	0.4646	0.5317	0.8329
Nov	1.097	0.3344	0.6213	0.9986
Dec	1.0934	0.3367	0.7578	0.9952
Jan	1.0889	0.3400	0.8686	0.9912
Feb	0.9701	0.4133	0.7385	0.883
Mar	0.8892	0.4785	0.5195	0.8094
Apr	1.0582	0.3591	0.4564	0.9632
May	1.0634	0.3551	0.4456	0.9679

TABLE 1.20b
Diversity indices of bivalves at station 4 (2009-2010)

Month	Shannon diversity	Dominance index	Species richness	Evenness index
Jun	1.0455	0.3685	0.5037	0.9517
Jul	1.0741	0.3504	0.5112	0.9777
Aug	1.0172	0.3906	0.4947	0.9259
Sep	0.9369	0.4242	0.5386	0.8528
Oct	0.9139	0.4638	0.5422	0.8319
Nov	1.0986	0.3333	0.6293	1
Dec	1.0934	0.3367	0.7578	0.9952
Jan	1.0671	0.3554	0.8341	0.9713
Feb	0.9701	0.4133	0.7385	0.883
Mar	0.9619	0.4224	0.5317	0.8756
Apr	1.0599	0.3604	0.4632	0.9648
May	1.0517	0.3619	0.4372	0.9573

TABLE 1.21a
Relative abundance and distribution of species in station 1(2008-2009)

Sr No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	1935	0.103	10.327	A
2	*Anchovilla indica*	1569	0.084	8.374	C
3	*Catla catla*	28	0.001	0.149	U
4	*Macrones keleticus*	74	0.004	0.395	U
5	*Hemirhamphus limbatus*	112	0.006	0.598	U
6	*Aplocheilus panchax*	70	0.004	0.374	U
7	*Sphyraena obtuse*	175	0.009	0.934	U
8	*Mugil cephalus*	778	0.042	4.152	C
9	*Mugil dussumeri*	505	0.027	2.695	C
10	*Polynemius plebius*	185	0.010	0.987	U
11	*Polynemius sextarius*	171	0.009	0.913	U
12	*Ambassis urotaenia*	73	0.004	0.390	U
13	*Epinepheles fario*	61	0.003	0.326	U
14	*Therapon jarbua*	202	0.011	1.078	C
15	*Sillago sihama*	818	0.044	4.366	C
16	*Caranx carangus*	253	0.014	1.350	C
17	*Lactarius delicatulus*	278	0.015	1.484	C
18	*Mene maculata*	308	0.016	1.644	C
19	*Lobotes surinamensis*	97	0.005	0.518	U
20	*Gerres abbreviatus*	206	0.011	1.099	C
21	*Gerres filamentosus*	198	0.011	1.057	C
22	*Equula daura*	537	0.029	2.866	C
23	*Etroplus suratensis*	491	0.026	2.620	C
24	*Etroplus maculatus*	620	0.033	3.309	C
25	*Tilapia mossambica*	257	0.014	1.372	C
26	*Pampus argenteus*	33	0.002	0.176	U
27	*Pampus chinensis*	32	0.002	0.171	U
28	*Anabus testudineus*	171	0.009	0.913	U
29	*Cynoglossus quinquelineatus*	121	0.006	0.646	U
30	*Cynoglossus elongatus*	107	0.006	0.571	U
31	*Arius venosus*	317	0.017	1.692	C
32	*Puntius filamentosus*	41	0.002	0.219	U
33	*Anodontostoma charunda*	33	0.002	0.176	U
34	*Trichiurus savala*	24	0.001	0.128	U
35	*Chanos chanos*	35	0.002	0.187	U
36	*Oxyurichthys microlepis*	716	0.038	3.821	C
37	*Dayella malabarica*	227	0.012	1.212	C
38	*Glossogobius giuris*	119	0.006	0.635	U
39	*Pseudosprominus cupanus*	69	0.004	0.368	U
40	*Parambassis dayi*	276	0.015	1.473	C
41	*Parambassis ranga*	232	0.012	1.238	C
42	*Horabagrus brachysoma*	208	0.011	1.110	C
43	*Heteropneustis fossilis*	194	0.010	1.035	C
44	*Mystus vitatus*	208	0.011	1.110	C
45	*Anguilla bengalensis*	49	0.003	0.262	U
46	*Anguilla bicolor*	60	0.003	0.320	U
47	*Monopterus digressus*	43	0.002	0.229	U
48	*Barbodes sarana*	62	0.003	0.331	U
49	*Pisodonophis boro*	42	0.002	0.224	U
50	*Scatophagus argus*	183	0.010	0.977	U
51	*Pristolepis marginata*	175	0.009	0.934	U
	Shrimps				
52	*Penaeus indicus*	484	0.026	2.583	C
53	*Penaeus monodon*	532	0.028	2.839	C
54	*Penaeus semisulcatus*	126	0.007	0.672	U
55	*Metapenaeus dobsoni*	104	0.006	0.555	U
56	*Metapenaeus monoceros*	120	0.006	0.640	U
57	*Metapenaeus affinis*	129	0.007	0.688	U
58	*Macrobrachium rosenbergii*	35	0.002	0.187	U
	Crabs				
59	*Portunus pelagicus*	323	0.017	1.724	C
60	*Scylla serata*	323	0.017	1.724	C
	Bivalves				
61	*Villorita cyprinoides*	1519	0.081	8.107	C
62	*Katalesia opima*	280	0.015	1.494	C
63	*Paphia malabarica*	220	0.012	1.174	C
64	*Meretrix meretrix*	216	0.012	1.153	C
65	*Meretrix casta*	90	0.005	0.480	U
	Oysters				
66	*Crassostrea madrasensis*	458	0.024	2.444	C

TABLE 1.22a

Relative abundance and distribution of species in station 2(2008-2009)

Sr No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	849	0.063	6.266	C
2	*Anchovilla indica*	1453	0.107	10.724	A
3	*Hemirhamphus limbatus*	103	0.008	0.760	U
4	*Mugil cephalus*	706	0.052	5.211	C
5	*Mugil dussumeri*	773	0.057	5.705	C
6	*Therapon jarbua*	189	0.014	1.395	C
7	*Sillago sihama*	544	0.040	4.015	C
8	*Caranx carangus*	127	0.009	0.937	U
9	*Lactarius delicatulus*	122	0.009	0.900	U
10	*Mene maculata*	291	0.021	2.148	C
11	*Gerres abbreviatus*	122	0.009	0.900	U
12	*Gerres filamentosus*	141	0.010	1.041	C
13	*Equula daura*	426	0.031	3.144	C
14	*Etroplus suratensis*	331	0.024	2.443	C
15	*Etroplus maculatus*	330	0.024	2.436	C
16	*Tilapia mossambica*	184	0.014	1.358	C
17	*Anabus testudineus*	129	0.010	0.952	U
18	*Cynoglossus quinquelineatus*	143	0.011	1.055	C
19	*Cynoglossus elongatus*	136	0.010	1.004	C
20	*Arius venosus*	146	0.011	1.078	C
21	*Trichiurus savala*	17	0.001	0.125	U
22	*Oxyurichthys microlepis*	628	0.046	4.635	C
23	*Dayella malabarica*	226	0.017	1.668	C
24	*Glossogobius giuris*	90	0.007	0.664	U
25	*Pseudosprominus cupanus*	77	0.006	0.568	U
26	*Parambassis dayi*	191	0.014	1.410	C
27	*Parambassis ranga*	231	0.017	1.705	C
28	*Horabagrus brachysoma*	161	0.012	1.188	C
29	*Heteropneustis fossilis*	151	0.011	1.114	C
30	*Mystus vitatus*	188	0.014	1.388	C
31	*Anguilla bengalensis*	45	0.003	0.332	U
32	*Anguilla bicolor*	46	0.003	0.340	U
33	*Monopterus digressus*	33	0.002	0.244	U
34	*Barbodes sarana*	51	0.004	0.376	U
35	*Pisodonophis boro*	36	0.003	0.266	U
36	*Scatophagus argus*	174	0.013	1.284	C
37	*Pristolepis marginata*	165	0.012	1.218	C
	Shrimps				
38	*Penaeus indicus*	706	0.052	5.211	C
39	*Penaeus monodon*	720	0.053	5.314	C
40	*Metapenaeus dobsoni*	95	0.007	0.701	U
41	*Metapenaeus monoceros*	120	0.009	0.886	U
	Crabs				
42	*Portunus pelagicus*	328	0.024	2.421	C
43	*Scylla serata*	277	0.020	2.044	C
	Bivalves				
44	*Villorita cyprinoides*	652	0.048	4.812	C
45	*Katalesia opima*	327	0.024	2.413	C
46	*Paphia malabarica*	174	0.013	1.284	C
	Oysters				
47	*Crassostrea madrasensis*	395	0.029	2.915	C

TABLE 1.23a

Relative abundance and distribution of species in station 3(2008-2009)

Sr No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	136	0.024	2.436	C
2	*Anchovilla indica*	225	0.040	4.031	C
3	*Hemirhamphus limbatus*	91	0.016	1.630	C
4	*Mugil cephalus*	207	0.037	3.708	C
5	*Mugil dussumeri*	214	0.038	3.834	C
6	*Therapon jarbua*	147	0.026	2.633	C
7	*Sillago sihama*	232	0.042	4.156	C
8	*Mene maculata*	151	0.027	2.705	C
9	*Equula daura*	248	0.044	4.443	C
10	*Etroplus suratensis*	206	0.037	3.690	C
11	*Etroplus maculatus*	362	0.065	6.485	C
12	*Tilapia mossambica*	158	0.028	2.831	C
13	*Anabus testudineus*	116	0.021	2.078	C
14	*Arius venosus*	204	0.037	3.655	C
15	*Trichiurus savala*	39	0.007	0.699	U
16	*Oxyurichthys microlepis*	297	0.053	5.321	U
			Shrimps		
17	*Penaeus indicus*	526	0.094	9.423	C
18	*Penaeus monodon*	620	0.111	11.107	C
19	*Metapenaeus dobsoni*	101	0.018	1.809	C
20	*Metapenaeus monoceros*	121	0.022	2.168	C
			Crabs		
21	Portunus pelagicus	293	0.052	5.249	C
22	Scylla serata	312	0.056	5.589	C
			Bivalves		
23	*Villorita cyprinoides*	263	0.047	4.712	C
24	*Katalesia opima*	168	0.030	3.010	C
25	*Paphia malabarica*	145	0.026	2.598	C

TABLE 1.24a

Relative abundance and distribution of species in station 4 (2008-2009)

Sr. No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	138	0.0442	4.420	U
2	*Anchovilla indica*	141	0.0452	4.516	U
3	*Mugil cephalus*	85	0.0272	2.723	U
4	*Mugil dussumeri*	96	0.0307	3.075	U
5	*Sillago sihama*	302	0.0967	9.673	U
6	*Equula daura*	227	0.0727	7.271	U
7	*Etroplus suratensis*	119	0.0381	3.812	U
8	*Etroplus maculatus*	122	0.0391	3.908	U
9	*Anabus testudineus*	99	0.0317	3.171	U
10	*Oxyurichthys microlepis*	119	0.0381	3.812	U
			Shrimps		
11	*Penaeus indicus*	271	0.0868	8.680	U
12	*Penaeus monodon*	248	0.0794	7.944	U
			Crabs		
13	*Portunus pelagicus*	310	0.0993	9.930	U
14	*Scylla serata*	318	0.1019	10.186	C
			Bivalves		
15	*Villorita cyprinoides*	238	0.0762	7.623	U
16	*Katalesia opima*	164	0.0525	5.253	U
17	*Paphia malabarica*	125	0.0400	4.004	U

TABLE 1.21 b

Relative abundance and distribution of species in station 1 (2009-2010)

Sr. No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	1927	0.103	10.347	C
2	*Anchovilla indica*	1892	0.102	10.159	C
3	*Catla catla*	28	0.002	0.150	U
4	*Macrones keleticus*	74	0.004	0.397	U
5	*Hemirhamphus limbatus*	133	0.007	0.714	U
6	*Aplocheilus panchax*	70	0.004	0.376	U
7	*Sphyraena obtusa*	155	0.008	0.832	U
8	*Mugil cephalus*	657	0.035	3.528	C
9	*Mugil dussumeri*	473	0.025	2.540	C
10	*Polynemius plebius*	157	0.008	0.843	U
11	*Polynemius sextarius*	161	0.009	0.864	U
12	*Ambassis urotaenia*	73	0.004	0.392	U
13	*Epinepheles fario*	58	0.003	0.311	U
14	*Therapon jarbua*	194	0.010	1.042	C
15	*Sillago sihama*	751	0.040	4.032	C
16	*Caranx carangus*	198	0.011	1.063	C
17	*Lactarius delicatulus*	203	0.011	1.090	C
18	*Mene maculata*	266	0.014	1.428	C
19	*Lobotes surinamensis*	83	0.004	0.446	U
20	*Gerres abbreviatus*	216	0.012	1.160	C
21	*Gerres filamentosus*	206	0.011	1.106	C
22	*Equula daura*	504	0.027	2.706	C
23	*Etroplus suratensis*	456	0.024	2.448	C
24	*Etroplus maculatus*	617	0.033	3.313	C
25	*Tilapia mossambica*	245	0.013	1.316	C
26	*Pampus argenteus*	33	0.002	0.177	U
27	*Pampus chinensis*	32	0.002	0.172	U
28	*Anabus testudineus*	163	0.009	0.875	U
29	*Cynoglossus quinquelineatus*	121	0.006	0.650	U
30	*Cynoglossus elongatus*	105	0.006	0.564	U
31	*Arius venosus*	311	0.017	1.670	C
32	*Puntius filamentosus*	41	0.002	0.220	U
33	*Anodontostoma charunda*	33	0.002	0.177	U
34	*Trichiurus savala*	24	0.001	0.129	U
35	*Chanos chanos*	35	0.002	0.188	U
36	*Oxyurichthys microlepis*	847	0.045	4.548	C
37	*Dayella malabarica*	234	0.013	1.256	C
38	*Glossogobius giuris*	113	0.006	0.607	U
39	*Pseudosprominus cupanus*	63	0.003	0.338	U
40	*Parambassis dayi*	273	0.015	1.466	C
41	*Parambassis ranga*	220	0.012	1.181	C
42	*Horabagrus brachysoma*	204	0.011	1.095	C
43	*Heteropneustis fossilis*	191	0.010	1.026	C
44	*Mystus vitatus*	202	0.011	1.085	C
45	*Anguilla bengalensis*	49	0.003	0.263	U
46	*Anguilla bicolor*	59	0.003	0.317	U
47	*Monopterus digressus*	43	0.002	0.231	U
48	*Barbodes sarana*	59	0.003	0.317	U
49	*Pisodonophis boro*	42	0.002	0.226	U
50	*Scatophagus argus*	185	0.010	0.993	U
51	*Pristolepis marginata*	168	0.009	0.902	U
			Shrimps		
52	*Penaeus indicus*	516	0.028	2.771	C
53	*Penaeus monodon*	526	0.028	2.824	C
54	*Penaeus semisulcatus*	125	0.007	0.671	U
55	*Metapenaeus dobsoni*	100	0.005	0.537	U
56	*Metapenaeus monoceros*	117	0.006	0.628	U
57	*Metapenaeus affinis*	125	0.007	0.671	U
58	*Macrobrachium rosenbergii*	35	0.002	0.188	U
			Crabs		
59	*Portunus pelagicus*	323	0.017	1.734	C
60	*Scylla serata*	308	0.017	1.654	C
			Bivalves		
61	*Villorita cyprinoides*	1528	0.082	8.204	C
62	*Katalesia opima*	278	0.015	1.493	C
63	*Paphia malabarica*	210	0.011	1.128	C
64	*Meretrix meretrix*	206	0.011	1.106	C
65	*Meretrix casta*	89	0.005	0.478	U
			Oysters		
66	*Crassostrea madrasensis*	491	0.026	2.636	C

TABLE 1.22b

Relative abundance and distribution of species in station 2 (2009-2010)

Sr. No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	881	0.066	6.559	C
2	*Anchovilla indica*	1450	0.108	10.795	A
3	*Hemirhamphus limbatus*	103	0.008	0.767	U
4	*Mugil cephalus*	716	0.053	5.331	C
5	*Mugil dussumeri*	780	0.058	5.807	C
6	*Therapon jarbua*	199	0.015	1.482	C
7	*Sillago sihama*	544	0.041	4.050	C
8	*Caranx carangus*	122	0.009	0.908	U
9	*Lactarius delicatulus*	122	0.009	0.908	U
10	*Mene maculata*	288	0.021	2.144	C
11	*Gerres abbreviatus*	136	0.010	1.013	C
12	*Gerres filamentosus*	142	0.011	1.057	C
13	*Equula daura*	425	0.032	3.164	C
14	*Etroplus suratensis*	323	0.024	2.405	C
15	*Etroplus maculatus*	320	0.024	2.382	C
16	*Tilapia mossambica*	212	0.016	1.578	C
17	*Anabus testudineus*	129	0.010	0.960	U
18	*Cynoglossus quinquelineatus*	137	0.010	1.020	C
19	*Cynoglossus elongatus*	137	0.010	1.020	C
20	*Arius venosus*	150	0.011	1.117	C
21	*Trichiurus savala*	17	0.001	0.127	U
22	*Oxyurichthys microlepis*	587	0.044	4.370	C
23	*Dayella malabarica*	215	0.016	1.601	C
24	*Glossogobius giuris*	90	0.007	0.670	U
25	*Pseudosprominus cupanus*	72	0.005	0.536	U
26	*Parambassis dayi*	191	0.014	1.422	C
27	*Parambassis ranga*	230	0.017	1.712	C
28	*Horabagrus brachysoma*	159	0.012	1.184	C
29	*Heteropneustis fossilis*	151	0.011	1.124	C
30	*Mystus vitatus*	188	0.014	1.400	C
31	*Anguilla bengalensis*	42	0.003	0.313	U
32	*Anguilla bicolor*	46	0.003	0.342	U
33	*Monopterus digressus*	33	0.002	0.246	U
34	*Barbodes sarana*	51	0.004	0.380	U
35	*Pisodonophis boro*	36	0.003	0.268	U
36	*Scatophagus argus*	170	0.013	1.266	C
37	*Pristolepis marginata*	160	0.012	1.191	C
	Shrimps				
38	*Penaeus indicus*	716	0.053	5.331	C
39	*Penaeus monodon*	708	0.053	5.271	C
40	*Metapenaeus dobsoni*	95	0.007	0.707	U
41	*Metapenaeus monoceros*	115	0.009	0.856	U
	Crabs				
42	*Portunus pelagicus*	316	0.024	2.353	C
43	*Scylla serata*	269	0.020	2.003	C
	Bivalves				
44	*Villorita cyprinoides*	636	0.047	4.735	C
45	*Katalesia opima*	304	0.023	2.263	C
46	*Paphia malabarica*	170	0.013	1.266	C
	Oysters				
47	*Crassostrea madrasensis*	349	0.026	2.598	C

TABLE 1.23b
Relative abundance and distribution of species in station 3 (2009-2010)

Sr. No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	136	0.024	2.437	C
2	*Anchovilla indica*	218	0.039	3.906	C
3	*Hemirhamphus limbatus*	91	0.016	1.631	C
4	*Mugil cephalus*	208	0.037	3.727	C
5	*Mugil dussumeri*	216	0.039	3.870	C
6	*Therapon jarbua*	143	0.026	2.562	C
7	*Sillago sihama*	231	0.041	4.139	C
8	*Mene maculata*	158	0.028	2.831	C
9	*Equula daura*	248	0.044	4.444	C
10	*Etroplus suratensis*	211	0.038	3.781	C
11	*Etroplus maculatus*	362	0.065	6.486	C
12	*Tilapia mossambica*	155	0.028	2.777	C
13	*Anabus testudineus*	111	0.020	1.989	C
14	*Arius venosus*	209	0.037	3.745	C
15	*Trichiurus savala*	39	0.007	0.699	U
16	*Oxyurichthys microlepis*	296	0.053	5.304	C
	Shrimps				
17	*Penaeus indicus*	526	0.094	9.425	C
18	*Penaeus monodon*	620	0.111	11.109	C
19	*Metapenaeus dobsoni*	101	0.018	1.810	C
20	*Metapenaeus monoceros*	121	0.022	2.168	C
	Crabs				
21	*Portunus pelagicus*	293	0.052	5.250	C
22	*Scylla serata*	312	0.056	5.590	C
	Bivalves				
23	*Villorita cyprinoides*	263	0.047	4.712	C
24	*Katalesia opima*	168	0.030	3.010	C
25	*Paphia malabarica*	145	0.026	2.598	C

TABLE 1.24b
Relative abundance and distribution of species in station 4 (2009-2010)

Sr. No.	Fishes	Number of species	Relative abundance	Percentage of relative abundance	Species status
1	*Anchovilla commersonii*	129	0.0426	4.257	C
2	*Anchovilla indica*	134	0.0442	4.422	C
3	*Mugil cephalus*	85	0.0281	2.805	C
4	*Mugil dussumeri*	95	0.0314	3.135	C
5	*Sillago sihama*	306	0.1010	10.099	A
6	*Equula daura*	226	0.0746	7.459	C
7	*Etroplus suratensis*	119	0.0393	3.927	C
8	*Etroplus maculatus*	117	0.0386	3.861	C
9	*Anabus testudineus*	92	0.0304	3.036	C
10	*Oxyurichthys microlepis*	115	0.0380	3.795	C
	Shrimps				
11	*Penaeus indicus*	243	0.0802	8.020	C
12	*Penaeus monodon*	236	0.0779	7.789	C
	Crabs				
13	*Portunus pelagicus*	311	0.1026	10.264	A
14	*Scylla serata*	302	0.0997	9.967	C
	Bivalves				
15	*Villorita cyprinoides*	227	0.0749	7.492	C
16	*Katalesia opima*	166	0.0548	5.479	C
17	*Paphia malabarica*	127	0.0419	4.191	C

TABLE 1.25a
Correlation analysis between phytoplankton and diversity indices at station 1 (2008-2009)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	0.132	-0.1439	-0.5084	0.1321
Cyanophyta	-0.0451	0.0394	-0.4444	-0.0449
Dinoflagellates	0.1904	-0.0204	-0.3113	0.1901
Diatom	0.2322	-0.3157	0.8361	0.2324
Total phytoplankton	0.3133	-0.3741	0.6734	0.3137

TABLE 1.25b
Correlation analysis between phytoplankton and diversity indices at station 1(2009-2010)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	-0.0512	-0.0112	-0.3626	-0.0513
Cyanophyta	0.3393	-0.288	-0.2652	0.3393
Dinoflagellates	-0.3051	0.5634	-0.4306	-0.3047
Diatom	0.2617	-0.3965	0.5837	0.2615
Total phytoplankton	0.1363	0.0382	-0.0298	0.1364

TABLE 1.26a
Correlation analysis between phytoplankton and diversity indices at station 2 (2008-2009)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	0.3061	-0.2158	-0.2009	0.3059
Cyanophyta	0.1096	-0.1889	0.3828	0.1094
Dinoflagellates	0.0634	0.0396	-0.2113	0.0633
Diatom	-0.0087	-0.0975	0.7013	-0.0084
Total phyto plankton	0.1919	-0.1657	0.4043	0.1918

TABLE 1.26b
Correlation analysis between phytoplankton and diversity indices at station 2(2009-2010)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	-0.2167	0.1489	-0.3477	-0.2228
Cyanophyta	0.3164	-0.2145	-0.059	0.3127
Dinoflagellates	0.2099	-0.0362	-0.1951	0.2122
Diatom	-0.1211	-0.0395	0.412	-0.1154
Total phytoplankton	-0.03	-0.0448	0.2392	-0.0234

TABLE 1.27a
Correlation analysis between phytoplankton and diversity indices at station 3 (2008-2009)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	0.3736	-0.3069	-0.4119	0.3741
Cyanophyta	0.4256	-0.4412	-0.1545	0.4255
Dinoflagellates	-0.0274	-0.0783	0.0358	-0.0271
Diatom	-0.6633	0.6546	0.7127	-0.6628
Total phytoplankton	-0.4969	0.494	0.7627	-0.4961

TABLE 1.27b
Correlation analysis between phytoplankton and diversity indices at station 3 (2009-2010)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	0.3454	-0.3522	0.2135	0.3402
Cyanophyta	-0.4265	0.4963	-0.3703	-0.4187
Dinoflagellates	0.3749	-0.3877	-0.3464	0.3708
Diatom	-0.022	-0.0482	0.4452	-0.027
Total phytoplankton	-0.0358	0.1008	-0.4853	-0.0337

TABLE 1.28a
Correlation analysis between phytoplankton and diversity indices at station 4 (2008-2009)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	-0.7777	0.846	-0.6864	-0.7775
Cyanophyta	0.0003	-0.0031	0.1532	0.0001
Dinoflagellates	0.3764	-0.335	-0.0603	0.3763
Diatom	0.1728	-0.2279	-0.0468	0.1728
Total phytoplankton	-0.0147	-0.0303	-0.2044	-0.0147

TABLE 1.28b
Correlation analysis between phytoplankton and diversity indices at station 4 (2009-2010)

Parameters	Shannon diversity	Dominance index	Species richness	Evenness index
Chlorophyta	0.063	-0.1061	0.2822	0.0689
Cyanophyta	-0.318	0.268	-0.1058	-0.3064
Dinoflagellates	0.3964	-0.3061	0.0324	0.4028
Diatom	0.0634	-0.0822	-0.0917	0.0264
Total phytoplankton	-0.1163	0.0601	-0.1401	-0.149

TABLE 1.29a
Correlation analysis between zooplankton and diversity indices in station 1 (2008-2009)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	-0.005	-0.0001	-0.3323	-0.0048
Copepoda	-0.2218	0.0486	0.4554	-0.2221
Rotifer	-0.3614	0.594	-0.3033	-0.3613
Crustacean larvae	-0.5712	0.5042	0.5201	-0.5707
Protozoa	0.5124	-0.4556	-0.2926	0.512
Molluscs	0.2194	-0.1931	0.539	0.2195
Bryozoa	0.2191	-0.193	0.5392	0.2192
Ostracod	-0.0926	0.073	-0.2959	-0.0927
Total zooplankton	-0.0296	0.0888	-0.3825	-0.0299

TABLE 1.29b
Correlation analysis between zooplankton and diversity indices in station 1 (2009-2010)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	-0.0045	-0.0454	-0.3172	-0.0045
Copepoda	0.0299	-0.1775	0.2959	0.0297
Rotifer	-0.3148	0.4634	-0.1535	-0.3148
Crustacean larvae	-0.0024	-0.0591	0.2677	-0.0025
Protozoa	0.3818	-0.2828	-0.3195	0.382
Molluscs	-0.2619	0.176	-0.2392	-0.2616
Bryozoa	0.0241	0.0461	-0.0257	0.0241
Ostracod	-0.0032	-0.0469	-0.3197	-0.0032
Total zooplankton	0.0766	-0.137	-0.3099	0.0767

TABLE 1.30a
Correlation analysis between zooplankton and diversity indices in station 2 (2008-2009)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	-0.2538	0.2378	-0.4521	-0.2538
Copepoda	-0.2625	0.3577	-0.2584	-0.2626
Rotifer	0.1452	-0.0872	-0.1981	0.1451
Crustacean larvae	-0.043	0.0002	0.458	-0.0428
Protozoa	0.1283	-0.2174	0.1561	0.1281
Molluscs	-0.1287	0.2116	-0.4469	-0.1286
Bryozoa	0.2181	-0.1857	-0.2438	0.2179
Ostracod	0.1249	-0.206	0.3776	0.1248
Total zooplankton	-0.083	0.1519	-0.2976	-0.0835

TABLE 1.30b
Correlation analysis between zooplankton and diversity indices in station 2 (2009-2010)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	0.1603	-0.1325	-0.2895	0.1611
Copepoda	-0.5203	0.5759	0.0174	-0.5292
Rotifer	-0.065	-0.0153	-0.094	-0.0626
Crustacean larvae	0.2214	-0.2218	0.3307	0.2264
Protozoa	0.2073	-0.3284	0.2221	0.2121
Molluscs	0.2778	-0.3468	0.5023	0.2791
Bryozoa	0.081	-0.0307	-0.1408	0.0741
Ostracod	-0.1742	0.1167	-0.198	-0.1725
Total zooplankton	-0.162	0.0893	0.0392	-0.1638

TABLE 1.31a
Correlation analysis between zooplankton and diversity indices in station 3 (2008-2009)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	0.343	-0.4451	-0.2795	0.3428
Copepoda	0.2733	-0.3176	0.0367	0.2732
Rotifer	0.4148	-0.3527	-0.2339	0.4154
Crustacean larvae	-0.2657	0.1815	-0.6293	-0.2672
Protozoa	0.313	-0.2845	0.3421	0.3132
Molluscs	0.01	-0.1438	-0.4567	0.0089
Bryozoa	-0.2803	0.416	0.3105	-0.2796
Ostracod	0.2722	-0.285	-0.0353	0.2717
Total zooplankton	0.5639	-0.5542	-0.1924	0.5644

TABLE 1.31b
Correlation analysis between zooplankton and diversity indices in station 3 (2009-2010)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	-0.3358	0.2479	-0.4327	-0.3411
Copepoda	0.1004	-0.1673	-0.2365	0.0977
Rotifer	0.2674	-0.2601	-0.1877	0.2635
Crustacean larvae	0.2683	-0.3382	-0.6558	0.265
Protozoa	-0.1575	0.236	0.6577	-0.1511
Molluscs	-0.2238	0.2679	-0.0991	-0.2334
Bryozoa	0.5026	-0.5358	0.212	0.5142
Ostracod	-0.2462	0.1247	-0.4719	-0.2508
Total zooplankton	0.2528	-0.3013	-0.3382	0.2477

TABLE 1.32a
Correlation analysis between zooplankton and diversity indices in station 4 (2008-2009)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	0.2841	-0.2887	0.5455	0.2842
Copepoda	0.1069	-0.1289	0.0196	0.1067
Rotifer	0.3712	-0.2494	-0.1355	0.3712
Crustacean larvae	-0.493	0.4003	-0.2515	-0.493
Protozoa	0.3076	-0.2919	0.0824	0.3076
Molluscs	-0.1292	0.0253	-0.0034	-0.1291
Bryozoa	-0.2572	0.1857	0.2346	-0.2574
Ostracod	-0.3135	0.3404	-0.3007	-0.3135
Total zooplankton	0.4907	-0.4376	0.452	0.4907

TABLE 1.32b
Correlation analysis between zooplankton and diversity indices in station 4 (2009-2010)

Parameter	Shannon diversity	Dominance index	Species richness	Evenness index
Cladocera	0.2657	-0.2631	0.5138	0.2736
Copepoda	0.2444	-0.197	-0.0605	0.2512
Rotifer	0.1047	-0.0416	-0.1443	0.1202
Crustacean larvae	-0.4096	0.4242	-0.4729	-0.4219
Protozoa	0.1513	-0.1489	0.0665	0.1561
Molluscs	-0.1185	0.0249	-0.0618	-0.1158
Bryozoa	-0.8724	0.9374	-0.845	-0.8684
Ostracod	0.0464	-0.0866	-0.0021	0.0383
Total zooplankton	0.389	-0.3605	0.3249	0.4013

IV. Discussion

The south west coast of India is blessed with a series of wetland systems popularly referred to as backwaters covering a total area of 46,128.94 hectares. These backwaters are internationally renowned for their aesthetic and scientific values including being a repository site for several species of fish and shell fishes. This is more significant in that the wetland, Ashtamudi have recently been designated as Ramsar site of International importance. Kerala is a land of water bodies which harbour a rich and diversified fauna characterized by many rare and endemic fish species. The development of fisheries in these resources needs to be increased through scientific development (Bhalerao, 2012). The quality of water should be checked at regular intervals to prevent deterioration of water quality and to maintain aquatic biota. The quality can be described by its physical, chemical and biological parameters. As per the available records no scientific study on the water quality and the commercial fauna availability pertaining to the Thekkumbhagam creek alone has been conducted so far.

Fishes are very important from the biodiversity point of view enjoying different ecosystems, habitats and niches of aquatic environment. Fishes are the keystone species which determine the distribution and abundance of other organisms in the ecosystem and are good indicators of water quality and the health of ecosystem (Bijukumar, 2000). Fishes form the most important aquatic natural product on a global scale providing the primary source of protein for nearly 1 billion people worldwide and food security for many more. India is one of the mega biodiversity hot spots contributing 11.72 % of globe's fish biodiversity (Pramod and Ashwani, 2012). These backwaters are internationally renowned for their aesthetic and scientific values including being a repository site for several species of fish and shell fishes. This is more significant in that the wetland, Ashtamudi have recently been designated as Ramsar site of International importance. Kerala is a land of water bodies which harbour a rich and diversified fauna characterized by many rare and endemic fish species. In view of global deterioration of environment, documentation of fauna from all the ecosystems has become important to know the present status of biodiversity.

Fishes are one of the important elements in the economy of many nations as they have been a stable item in the development of many people (Shinde *et al.*, 2009). Thus, biodiversity is essential for stabilization of ecosystem, protection of overall environmental quality for understanding intrinsic worth of all species on the earth. Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as trophic status and fisheries resource potential. Life in aquatic environment is largely governed by physico-chemical characteristics and their stability .The distribution and abundance of fish in estuarine and coastal environment is dependent on physico-chemical and biotic factors.

The Thekkumbhagam creek is having a high potential for fishery development and are considered as the potential sources for feeding, spawning and nursery ground for most of the shell fishes. It forms the seed collection centre for most of the aquaculture activities. The life in any aquatic system is largely governed by physico-chemical characters and their stability. These characters have enabled biota to develop many adaptations that improve sustained productivity and regulate Lake metabolism. The food chain in it comprised of aquatic vegetation as primary producers, zooplankton as primary consumers, small fishes as secondary consumers and large fishes as tertiary consumers. Planktons are the most sensitive floating community which is being the first target of water pollution. Thus any undesirable change in aquatic system affects diversity as well as biomass of this community. Thus the fluctuations of physico-chemical characteristics in estuarine environment has a 132 profound influence on the seasonal occurrence of the juveniles and fish stocks(Brenda *et al.*, 2010).Further the changes of the aquatic ecosystem will cause fluctuations on the survival, growth and breeding of fishes.

In the present study altogether 51 species of fishes,7 species of shrimps,2 species of crabs,5 species of bivalves and a single species of oyster were encountered from the Thekkumbhagam creek and their diversity indices were calculated.The diversity index is a measure of the relationship between the number of species collected and their evenness of distribution. It measures the stability of an ecosystem which increases with its diversity. Thus, the diversity index is a good tool for measuring the health of an ecosystem.In station 1, about 51 species of fishes were observed throughout the study period. In this station, the Shannon Diversity index and species richness of fishes and shrimps were comparatively higher than other stations. This may be due to the successful breeding patterns of different species. Station wise distribution of fishes revealed that this station was having many species that were not found in other 3 stations.In station 2, only 37 species of fishes, 4 species of shrimps, 3 species of bivalves and a single species of oyster was found. The diversity index and species richness of fishes and shrimps were comparatively lesser than that of station 1.But the evenness index was greater than that of station1.This might be due to that of the effect of municipal waste, eutrophication and the effect of aquatic pollutants. Domestic or community waste is indiscriminately discharged into the lake. Several households near the lake do not have proper sanitation facilities. Local inhabitants in the catchment bathe and wash clothes and domestic animals in the stations using soaps and detergents. The Thekkumbhagam creek is having a high potential for fishery development and are considered as the potential sources for feeding, spawning and nursery ground for most of the shell fishes. It forms the seed collection centre for most of the aquaculture activities.The solution of detergents too contains complex of phosphates; hence it may pose eutrophication process in aquatic bodies (Shrivastava and Patil, 2002).The above incidents showed that, this may be one of the possible reasons for the decline of some fishes in this station.

Station 3, was characterized by 16 species of fishes, 4species of shrimps,2 species of crabs and 3 species of bivalves. The Shannon diversity indices and species richness were much lesser than that of station 1 and station 2. It was approaching to one, showing the evenness in distribution. Fish fauna of an aquatic habitat may disappear for reasons such as habitat alteration, population explosion, over fishing, disturbances, and changes in land use. Removal of sewage runs off into the river causes severe threats to fish diversity. Environmental pollution from human activities is a major challenge of civilization, high input of waste resulted in fluctuating trend in catch rate long with low species diversity.

In station 4, only 10species of fishes, 2 species of shrimps and 3 species of crabs and bivalves were encountered during the period of study. In this station the Shannon diversity index and the species richness were comparatively lesser than other three stations. Dominance index in the station was comparatively higher than other three stations. Evenness index was lesser than station3 but higher than station 1 and station 2.Fishes constitute economically very important group of animals which is directly or indirectly related with human health, industrial activities which lead to the acidification of water bodies. Human faeces in the catchment area make the water highly unfit for human use. Besides all these activities, there was the dumping of slaughter waste, hospital waste, poultry waste, fish processing wastes, retting etc. Automobile washing taking place in this station would form a thick film of oil on the surface of water. This would result in inability of fishes to respire and clog their gill slits. Thus, the dissolved oxygen content seems to be completely lacking in the case of extreme pollution that is detrimental to the life of fishes. Oil pollutants significantly drop the glycogen and oxygen level of the tissues of fishes(Shukla & Pandey, 2005).An understanding of the processes affecting the function of aquatic bodies, including the role of fishing in the broader context of human impacts is necessary to develop restoration and conservation programmes. Another reason for the disappearance of commercially important fish species might be due to the rapid infestation of aquatic weeds, characterised by spontaneous growth and appearing without being sown or cultivated, and they have high reproductive capacity. At present prolific growth of two species of aquatic weeds viz *Eichhornia crassipes* (Water Hyacinth) and *Salvinia molesta* (African Payal) has created various environmental problems in many wetlands of the state.It facilitates rampant mosquito breeding in the aquatic systems and fostering water borne diseases. Mosquito breeding site was noticed in station 4. Aquatic weeds form mats masking the region they spread and prevents the capture of sunlight by the submerged plants for photosynthesis leading to their elimination. Rafts of water hyacinth were noticed during the rainy season floating in water obstructing navigation. During December and subsequent months, the weed density was seen reduced and got fully eliminated due to the increasing salinity.

If Shannon-Weiner Diversity index values are in the range of 1 to 3, they are characteristics of moderately polluted conditions and values less than 1 characterize heavily polluted condition. The range of Shannon Weiner diversity index is from 3 to 4.5, it indicates slightly polluted condition (Dagaonkar and Prakash, 2011). The results indicated that station3 and station4 are comparatively more polluted than station1 and station 2.

Correlation analysis between phytoplankton and diversity indices revealed that a significant positive relationship existed between species richness and diatoms in all stations except station 4. A significant positive correlation between rotifer and dominance index was noted. The rich plankton production resulted in faster reproduction and growth of fishes . Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as trophic status and fisheries resource potential.

The reduced fish diversity eventually decreases the fish production of native species and causes extinction of several species (Thirumala *et al.*, 2011).Conservation measures require afforestation in catchment area and awareness about illegal fishing and killing of brood fishes and juveniles. The rapid decline of fish diversity in the polluted zone eventually creates instability in the socio-economic sector of the study area and increased poverty of local fisherman.

V. Conclusion

The present study revealed that in view of deterioration of the environmental conditions, documentation of fauna from this creek has become important to know the present status of biodiversity. The state of fish community may be seen as a valid integrative indicator of aquatic ecosystem quality and health; and little more distantly may be viewed as a regional quality of life for the human beings. The study highlights the need for the regional aquatic ecosystem approach to fisheries management. Weed menace leads to blockage of recreational, communication facilities in a wetland. Dead plants settle to bottom resulting in shoaling of the water body. As a result of biodegradation of plant debris, anoxic conditions develop that is deleterious to aquatic life. Those fish species, which can withstand below par water quality conditions, can only survive and commercially important fishes disappear. Excessive weed growth leads to high rate of siltation resulting in depth reduction of wetland. Some of the weeds are highly invasive and may be either native or exotic. The invasion of exotic species tends to increase as ecosystems become degraded. Even though the problems created by water hyacinth are many, it is to be noted that they have the ability to absorb toxic substances especially heavy metals from the aquatic system. The existing natural resources of fish are very much limited and for that matter , they are getting depleted at an alarming rate, because of the commercial exploitation of the resources to cater the increasing demand for fish, the world is. Study point out that many species in the study area are being threatened by various human activities such as destructive fishing, introduction of pollutants etc. The Thekkumbhagam creek is thus facing the problem of degradation due to increasing tourist pressure, population explosion, waste water from domestic and industrial effluents, organic and agricultural wastes thus affecting the whole ecological cycle. This creek attracts a number of tourists due to its exotic natural scenic beauty and thus number of house boats facilitates the tourist in enjoying the peace and tranquillity of this creek. The tourist who comes for visiting the lake, they come just to enjoy the scenic beauty of the lake and thus most of them pollute the lake by throwing harmful substances such as polythene bags and food waste in to the lake. The authorities concerned should try to make people aware of harmful effect of their act ant then should make loss prohibiting such things near to lake. Having a regulated fishing net mesh size which will only catch adults and exclude juveniles is recommended. This will ensure the full recruitment of the young to adult stage. Regulation of the fishermen and prevention of overfishing still also enable the species to be conserved. Eutrophication has become a major consequence of anthropogenic disturbances to aquatic ecosystems. Kerala is a land of water bodies which harbour a great diversity of fishes characterized by many rare and endemic ones. Increasing deforestation, intensification of agriculture and agricultural practices had caused negative impacts on some lakes. Thus, conservation of biodiversity requires special attention to include the endemic species of ancient lakes and its diverse fish communities. Prevention now is not only better, but also cheaper than looking for ways of recalling the lost species. Once extinction occurs, it could not be easily recalled. To these fish biologists, aquatic ecologists and conservationists should have a major role to play in creating public awareness and support for the conservation mechanisms for the species that pointed out the need for scientists to generate awareness for the conservation of fish species. Thus, the observations provided in the present study may prove valuable as a reference for assessing the changes due to environmental conditions in this creek.

VI. Acknowledgement

The author is extremely grateful to the PG & Research Department of Sree Narayana College for the facility rendered and Kerala University research fellowship provided during the tenure of the work. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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