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Studies on Species Composition of Plankton in the Great Vedaranyam Swamp of the Point Calimere Wildlife Sanctuary, Tamil Nadu, India

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Abstract: Phytoplankton and zooplankton composition was collected in the Great Vedaranyam Swamp of the Point Calimere Wildlife Sanctuary during 2007-2010. The taxonomic analysis showed that phytoplankton belonged to four major groups called Bacillariophyceae (diatoms), Dinophyceae (dinoflagellates), Cyanophyceae (blue greens) and Chlorophyceae (greens). The dominant group was Bacillariophyceae, which comprised 55 species followed by Dinophyceae (16 species), Cyanophyceae (5 species) and Chlorophyceae (3 species). A total of 69 species of zooplankton were identified. Of these, 31 belonged to Copepoda, 10 were Decapoda, 8 were Rotifera, 7 were Ciliata, 6 were Foraminifera, 5 were Cladocera and 2 were Cumacea.

Key words: Copepoda · Diatoms · Phytoplankton · Point Calimere · Zooplankton

INTRODUCTION

The plankton occurs is all natural waters as well as in artificial impoundment like ponds, tanks, reservoir, irrigation channels, etc. Phytoplankton is representing the microscopic algal communities of open water as a major element (at primary level) in aquatic biota. Phytoplankton is the pioneer of an aquatic food chain. The phytoplankton population in any aquatic system is biological wealth of water for fishes and constitutes a vital link in the food chain. The maintenance of a healthy aquatic ecosystem depends on the abiotic properties of water and the biological diversity of the ecosystem [1]. Zooplankton plays a pivotal role in aquatic food webs because they are important food for fish and invertebrate predators and they graze heavily on algae, bacteria, protozoa and other invertebrates. Zooplankton communities are highly sensitive to environmental variations. The phytoplankton and zooplankton are always inversely proportional in an aquatic environment because the zooplankton feed on the phytoplankton. The planktonic study is very useful tool for the assessment of water quality in a type of water body and also contributes to understanding of the basic nature and general economy of the aquatic ecosystem [2]. Very little information is available on plankton of Point Calimere Wildlife Sanctuary and in order to fill up this lacuna, the present study was undertaken to investigate the plankton composition in the Great Vedaranyam Swamp of the Point Calimere Wildlife Sanctuary through different months during the period of October 2007 to March 2010.

MATERIALS AND METHODS

Study Area: The Great Vedaranyam Swamp of the Point Calimere Wildlife Sanctuary is located along the Palk Strait in the Nagapattinam district of Tamil Nadu, South India. It lies between 79.399° E and 79. 884° E and 10.276° N and 10.826° N covering in area of about 38.500 hectares from Point Calimere in the east to Adirampattinam in the west (10°18'N; 79°51' E and 10 °21'N; 79° 25'E). The Point Calimere Wildlife Sanctuary was declared as a Ramsar site on 19th August 2002. The Great Vedaranyam Swamp stretches for about 48 km from east to west, parallel to

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Palk Strait separated from it by a sand-bank. There is a gradual north-south slope. Five fresh water channels empty into this part of the swamp. The swamp contains water only during the monsoon and in the summer the water gets dried up gradually and in the perk summer a small pool of water can only be seen. The entire swamp belt is about 30 km long and 9 km wide. It is screened from the Bay of Bengal and Palk Strait by narrow strips of sand banks with many opening. The most important openings to the sea from the swamp are "*Manavaykal*" and "*Sellakkani*" mouths. Sea water enters to the eastern half of the swamp mostly through these openings. The swamp and Palk Strait are connected by a small channel near the jetty region. The Kodiakkarai swamp represents a mixed ecosystem, influenced by both fresh water and seawater. Two industrial salt companies Chemplast (Chemical and Plastics Limited) and DCW (Dharangadhra Chemical Works) and a number of small and large salt units that produce edible salt and industrial salt operate in this area.

Phytoplankton: Monthly phytoplankton samples for were collected from the surface water by horizontal towing a conical net (0.35 m mouth diameter), made up of bolting silk (cloth No. 30; mesh size 48 μm) for thirty minutes and the collected samples were preserved in 5% neutralized formalin. The former was screened and phytoplankton taxa were identified following Desikachary [3], Needham and Needham [4], Prescott [5], Islam and Haroon [6], Adoni *et al.* [7], Fritter and Manuel [8], Cox [9], Anand [10] and several individual research papers.

Zooplankton: Monthly zooplankton samples were collected from the surface water by horizontal towing a conical net (0.35 m mouth diameter), made up of bolting silk (cloth No. 10; mesh size 158 μm) for 20 minutes and the collected samples were preserved in 5% neutralized formalin. The zooplankton were identified using the standard study of Kasthurirangan [11] (1963), Newell and Newell [12], Smith [13], Todd and Laverack [14] and Perumal *et al.* [15].

RESULTS AND DISCUSSION

Phytoplankton: The list of phytoplanktonic species recorded in the study area during 2007-2010 is given in table 1. A total of 79 phytoplanktonic species belonging to four diverse group's *viz.* Bacillariophyceae, Dinophyceae, Cyanophyceae and Chlorophyceae were recorded.

Bacillariophyceae (Diatoms): The Bacillariophyceae was the predominant group during the study period. Totally 55 species were recorded and the frequency occurrence of *Asterionellopsis japonica*, *Cerataulina bergonii*, *Cerataulina orientalis*, *Chaetoceros affinis*, *Chaetoceros curvisetus*, *Chaetoceros diversus*, *Chaetoceros peruvianus*, *Coscinodiscus centralis*, *Coscinodiscus gigas*, *Cyclotella striata*, *Nitzschia acuta, Nitzschia closterium, Nitzschia longissima, Odontella heteroceros, Odontella mobiliensis, Pleurosigma angulotum, Pleurosigma elongatum, Rhizosolenia alata, Rhizosolenia robusta, Rhizosolenia cylindrus, Rhizosolenia imbricate, Thalassiosira subtilis, Thalassiothrix frauenfeldii, Guinardia flaccid, Gyrosigma disortum, Bacteriastrum elongatum* and *Bacteriastrum comosum* were more abundant in the study area.

Dinophyceae (Dinoflagellates): A total of 16 species of Dinoflagellates such as *Ceratium breve, Ceratium furca, Ceratium fusus, Ceratium extensum, Ceratium macroceros, Ceratium tripos, Dinophysis caudate, Distephanus speculum, Noctiluca scintillans, Prorocentrum micans, Peridinium excentricum, Protoperidinium conicum, Protoperidinium oceanicum, Protoperidinium pentagonum, Protoperidinium depressum* and *Pyrocystis fusiformis* were recorded during the study period.

Cyanophyceae (Blue-Greens): The *Anabena* sp. *Lyngbya* sp. *Microcystis* sp. *Oscillatoria* sp. and *Trichodesmium* sp. were the blue-green algae that occurred in the study area.

Chlorophyceae (Greens): The green algae were represented by three species namely *Chlorella marina, Chlorella salina* and *Ulothrix* sp.

The predominance of diatoms over the other groups of phytoplankton observe in the present study has also been reported earlier in coastal waters, estuaries, swamps, mangroves, rivers, lakes, ponds and reservoirs in India by Kannan and Vasantha [16], Gopinathan *et al.* [17], Rajasegar *et al.* [18], Gowda *et al.* [19], Sridhar *et al.* [20], Balasingh and Shamal [21], Periyanayagi *et al.* [22], Balasingh *et al.* [23], Laskar and Gupta [24], Perumal *et al.* [25] and Sharma [26].

Table 1: List of phytoplanktonic species recorded in the Point Calimere Wildlife Sanctuary during 2007-2010

	Bacillariophyceae (Diatoms)	43	*Pleurosigma elongatum*
1	*Amphora coffeaeformis*	44	*Raphidonemo* sp.
2	*Asterionellopsis japonica*	45	*Rhizosolenia alata*
3	*Bacteriastrum comosum*	46	*Rhizosolenia robusta*
4	*Bacteriastrum elongatum*	47	*Rhizosolenia cylindrus*
5	*Bacteriastrum hyalinum*	48	*Rhizosolenia imbricate*
6	*Bellerochea malleus*	49	*Schroederlla delicate*
7	*Cerataulina bergonii*	50	*Stephanophyxis palmeriana*
8	*Cerataulina orientalis*	51	*Synedra ulna*
9	*Chaetoceros affinis*	52	*Thalassionema nitzschioides*
10	*Chaetoceros curvisetus*	53	*Thalassiosira subtilis*
11	*Chaetoceros diversus*	54	*Thalassiothrix frauenfeldii*
12	*Chaetoceros peruvianus*	55	*Triceratium favus*
13	*Climacosphenia elongata*		
14	*Coscinodiscus centralis*		**Dinophyceae (Dinoflagellates)**
15	*Coscinodiscus gigas*	56	*Ceratium breve*
16	*Coscinodiscus lineatus*	57	*Ceratium furca*
17	*Coscinodiscus sublineatus*	58	*Ceratium fusus*
18	*Coscinodiscus marginatus*	59	*Ceratium extensum*
19	*Coscinodiscus jonesianus*	60	*Ceratium macroceros*
20	*Cyclotella striata*	61	*Ceratium tripos*
21	*Diploneis bombus*	62	*Dinophysis caudata*
22	*Ditylum brightwellii*	63	*Distephanus speculum*
23	*Eucampia zoodiacus*	64	*Noctiluca scintillans*
24	*Grammatophora marina*	65	*Prorocentrum micans*
25	*Grammatophora sphaerophorum*	66	*Peridinium excentricum*
26	*Guinardia flaccida*	67	*Protoperidinium conicum*
27	*Gyrosigma balticum*	68	*Protoperidinium oceanicum*
28	*Gyrosigma disortum*	69	*Protoperidinium pentagonum*
29	*Hemidiscus hardmannianus*	70	*Protoperidinium depressum*
30	*Leptocylindrus danicus*	71	*Pyrocystis fusiformis*
31	*Navicula granulata*		
32	*Navicula cincta*		**Cyanophyceae (Blue-Greens)**
33	*Nitzschia acuta*	72	*Anabena* sp.
34	*Nitzschia closterium*	73	*Lyngbya* sp.
35	*Nitzschia longissima*	74	*Microcystis* sp.
36	*Nitzschia seriata*	75	*Oscillatoria* sp.
37	*Nitzschia sigmoidea*	76	*Trichodesmium* sp.
38	*Odontella heteroceros*		
39	*Odontella mobiliensis*		**Chlorophyceae (Greens)**
40	*Odontella sinensis*	77	*Chlorella marina*
41	*Planktoniella sol*	78	*Chlorella salina*
42	*Pleurosigma angulotum*	79	*Ulothrix* sp.

In the present investigation, the phytoplankton fluctuates seasonally and its composition was high during post-monsoon (January - March) and low during monsoon (October - December) as evidenced earlier by Rajasekar *et al.* [17], Sridhar *et al.* [19], Perumal *et al.* [24] and Sadguru *et al.* [27]. The phytoplankton composition during post-monsoon season may be attributed to the increased salinity, pH, nutrients, high temperature and high intensity of l ight penetration during the season [28-33]. The composition of phytoplankton was lowest during monsoon month, when the water column is remarkably stratify to a large extent because of heavy rainfall, high turbidity causes by run-off, reduced salinity, decreased temperature and pH, overcast sky and cool conditions [29, 30, 34, 35].

Table 2: List of zooplanktonic species recorded in the Point Calimere Wildlife Sanctuary during 2007-2010

	Copepoda		**Rotifera**
1	*Acartia centrura*	42	*Brachionus angularis*
2	*Acartia clausi*	43	*Brachionus falcatus*
3	*Acartia danae*	44	*Brachionus caudatus*
4	*Acartia erythraea*	45	*Keratella tropica*
5	*Acartia southwelli*	46	*Keratella procurva*
6	*Acartia spinicauda*	47	*Microcodides chlaena*
7	*Acrocalanus gibber*	48	*Polyarthra indica*
8	*Acrocalanus gracilis*	49	*Trichotria* sp.
9	*Calanoid copepod*		**Ciliata**
10	*Calanus finmarchius*	50	*Codenellopsis ostenfeldii*
11	*Corycaeus nana*	51	*Condenllopsis ecaudata*
12	*Eucalanus attenuatus*	52	*Favella brevis*
13	*Eucalanus crassus*	53	*Favella erenbergii*
14	*Euterpina acutifrons*	54	*Tintinnopsis beroidea*
15	*Labidocera acuta*	55	*Tintinnopsis cylindrical*
16	*Labidocera detruncata*	56	*Tintinnopsis directa*
17	*Macrostella gracilis*		
18	*Microcalanus pusillus*		**Foraminifera**
19	*Microstella norvegica*	57	*Amphistegina radiate*
20	*Nonocalanus minor*	58	*Eponides repandus*
21	*Oithoma brevicornis*	59	*Elphidium crispum*
22	*Oithoma linearis*	60	*Rosalina bertheloti*
23	*Oithoma rigida*	61	*Textularia candeiana*
24	*Paracalanus parvus*	62	*Textularia agglutnans*
25	*Parapontella brevicornis*		
26	*Pontella danae*		**Cladocera**
27	*Pseudocalanus elongatus*	63	*Evadna normani*
28	*Temora discaudata*	64	*Evadana tergestina*
29	*Temora stylifera*	65	*Penilia avirostris*
30	*Temora turbinata*	66	*Podon lecarti*
31	*Undinula vulgari*	67	*Podon intermedius*
	Decapoda		**Cumacea**
32	*Bipinaria larvae*	68	*Diastylis turmida*
33	*Bivalve veliger*	69	*Hemilamprops rosea*
34	*Copepod nauplius*		
35	*Decapod zoea*		
36	*Gastropod veliger*		
37	*Lamellibranch larvae*		
38	*Mysis larvae*		
39	*Nereid larvae*		
40	*Penaed nauplius*		
41	*Penaed protozoea*		

Zooplankton: During the present investigation, a total of 69 zooplanktonic species were recorded, which include 31 species of Copepoda, 10 species of Decapoda, 8 species of Rotifera, 7 species of Ciliata, 6 species of Foraminifera, 5 species of Cladocera and 2 species of Cumacea (Table 2).

Copepoda: The Copepoda was the predominant taxa during the study period. *Acartia clause, Acartia danae, Acartia erythraea, Acartia southwelli, Acartia spinicauda, Acrocalanus gibber, Acrocalanus gracilis, Calanoid copepod, Eucalanus crassus, Euterpina acutifrons, Macrostella gracilis, Microcalanus pusillus,*

Microstella norvegica, Nonocalanus minor, Oithoma rigida, Paracalamus parvus, Pontella danae, Pseudocalanus elongates and *Temora discaudata* were most common Copepods in the study area.

Decapoda: The Decapoda species included *Bipinaria* larvae, *Bivalve veliger,Copepod nauplius, Decapod zoea, Gastropod veliger, Lamellibranch* larvae, *Mysis* larvae, *Nereid* larvae, *Penaed nauplius* and *Penaed protozoea.*

Rotifera: The *Brachionus angularis, Brachionus falcatus, Brachionus caudatus,Keratella tropica, Keratella procurva, Microcodides chlaena, Polyarthra indica* and Trichotria sp. were the Rotifers that occurred in the study area.

Ciliata: The Ciliates were represented by seven species namely *Codenellopsis ostenfeldii, Condenllopsis ecaudata, Favella brevis, Favella erenbergii, Tintinnopsis beroidea, Tintinnopsis cylindrical* and *Tintinnopsis directa.*

Foraminifera: The Foraminifera species included *Amphistegina radiate,Eponides repandus, Elphidium crispum, Rosalina bertheloti, Textularia candeiana* and *Textularia agglutnans.*

Cladocera: *Evadna normani, Evadana tergestina, Penilia avirostris, Podon lecarti* and *Podon intermedius* were the Cladocera species that occurred in the study area.

Cumacea: The Cumacea were represented by two species namely *Diastylis turmida* and *Hemilamprops rosea.*

The present study revealed that Copepods was most dominant zooplanktonic taxa in the study area and such types of dominant numerical status of Copepods in various waters were studied by Gajbhiye *et al.* [36], Osore [37], Ambikadevi [38], Gowsami and Padmavathi [39], Choudhary and Singh [40], Calbert *et al.* [41], Sinha and Islam [42], Santhanam and Perumal [43], Robin *et al.* [44] and Damotharan *et al.* [45].

Zooplankton of all major groups was observed in post-monsoon season may be co-related with higher temperature, salinity, pH, dissolved oxygen, lower transparency and a high standing crop of primary producers leading to greater availability of food [46-54]. The low zooplankton composition was observed during monsoon period which may be attributed to heavy rainfall influx, low salinity, dilution effect, high turbidity and less photosynthetic activity by the primary producers [45, 46, 49, 55].

The present information of the phyto and zooplanktonic species composition would form a useful tool for further ecological assessment of the study area. However, future studies will be revealed more aspects such as abundance, diversity, similarity, dominance, evenness and phyto and zooplanktonic dynamics to explain their relations with the physico-chemical parameters of the Great Vedaranyam Swamp.

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