BVG Trust

J. Sci. Trans. Environ. Technov. 2015, 9(2) : 111-114

Scientific Transactions in Environment and Technovation

Assessment of benthic organisms (micro and macro invertebrates) in the selected salt pans of east coast of Tamil Nadu, India

https://doi.org/10.56343/STET.116.009.002.009
http://stetjournals.com

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Abstract

Abundance and diversity of benthic organism are the good ecological indicators. Benthic organisms are vital prey for predators especially shorebirds in the coastal ecosystem. Salt pans are providing suitable habitat for benthic organisms. The present study was carried out at Kodikkarai salt pans, east coast of Tamil Nadu, India from 2012-2015. Five different salt pans of the four different seasons for the entire study period and the assessment of benthic organisms was made and the samples were collected. Totally 11 types of benthic organisms (micro and macroinvertebrates) were identified. The benthic organisms included Chromomid larva, Dipolydoracoeca, *Artemia salina*, Cosmopoliton beetle, *Hasriusa dansoni*, *Amphinomidea*, *Penaeus*, *Epihydridea*, Hemiptera, unidendified Hydrophilidea and Coleoptera. Among the four seasons the monsoon period showed the highest density of benthic species among the eleven species the Chironomid larvae showed the maximum turn over when compared to the other species of benthic organisms recorded in the salt pans. But in summer except *Artemia salina* no species were recorded from the salt pans. The density of benthic organisms varied significantly among the seasons (P<0.001). The overall results of the study showed that the saltpans are supported diversity of benthic organism, which also showed variation seasonally.

Key words: Benthic diversity; coastal wetlands; conservation; saltpans; shorebirds

INTRODUCTION

Shorebirds are long distant migratory birds which predominantly depend on the benthic prey to meet out their energetic demands (Pandiyan et al., 2006). The coastal wetlands tend to be highly productive ecosystem and they are the most important for the shorebirds in terms of energy requirements (Velasquez, 1992; Masero et al., 1999). But in general most of the coastal wetlands are degraded due to various factors (Pandiyan and Asokan, 2015). In addition to that several studies revealed that during the recent decades, many coastal wetlands have been destroyed or transformed, resulting in major impacts on shorebird populations (Goss-Custard et al., 1977a, b; Goss-Custard & Moser, 1988). However, artificial wetlands such as salines can provide as alternate important foraging habitats for shorebirds (Peìrez-Hurtado and Hortas, 1991; Pandiyan et al 2015). The salt production via the circulation of sea water through a system of ponds in salines is one of the important ancient activities in India, in which some of the micro and macro invertebrate species could be form. Aquatic invertebrates in saltpans represent abundant prey for shorebirds (Velasquez, 1992), although there are relatively few invertebrate taxa owing to the extreme salinities in which the chironomid larvae are particularly important for shorebirds as principal prey (Velasquez, 1992; Peìrez-Hurtado et al., 1997). The present article provides the first hand information with regards to the evaluation of benthic species in different seasons of the different saltpans of Tamil Nadu, India.

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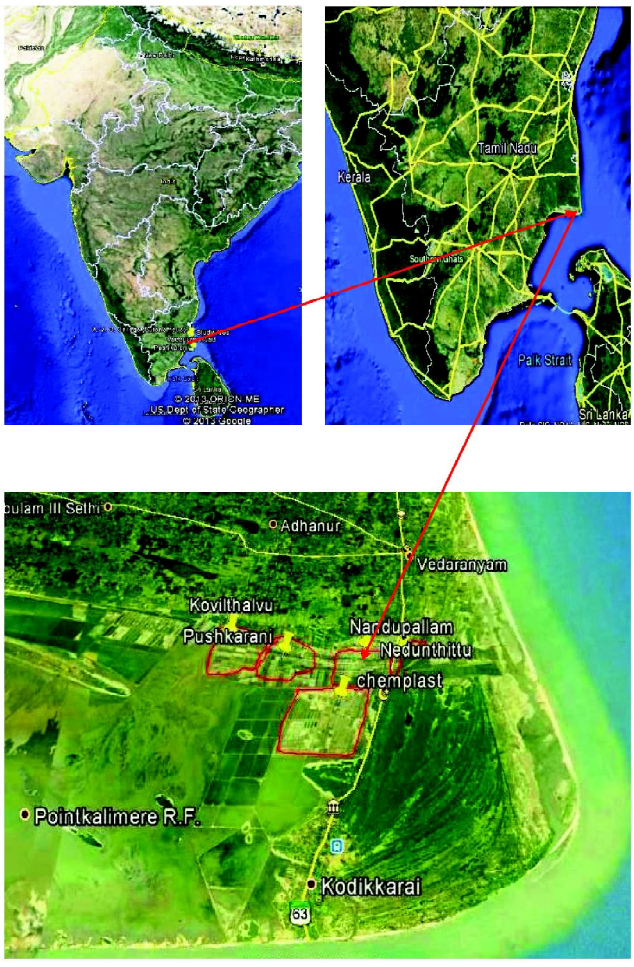
STUDY AREA

The study was carried out in the Kodikkarai saltpans of the east coast of Tamilnadu, southern India. The saltpans in the study area comprised 930 ha. and divided into five different saltpan areas viz., Chemplast (250 ha. 10º 019.678'N, 79º 49.809'E), Kovilthalvu (190 ha. 10º 20.793'N, 79º 048.163'E), Nandupallam (170 ha. 10 º 20. 394'N, 79º 50.714'E), Nedunthittu (160 ha. 10º 20.520'N, 79º 50.203'E) and Pushkarani (160 ha. 10º 20.444'N, 79º 48.989'E). These saltpans are located on the east coast of India near an important water bird wintering area: Point Calimere Wildlife Sanctuary, which is the only RAMSAR site located in Tamilnadu (Figure 1). Annually more than 3 lakhs of migratory and resident migratory birds are using this sanctuary as a vital feeding and breeding site. The saltpans primarily comprise of reservoir ponds, which are mainly used to store sea water, evaporation ponds (which mainly used for increasing the salinity of the water and crystallization ponds, these are true saltpans in which the sea water crystallizes into salt particles; which differ mainly in their salinity, vegetation and water levels. The salinity of the first (reservoir) pond type is very similar to that of the marine environment (35-38%), whereas the last pond type (crystallization ponds) reaches more than 250% of salinity. This region is subjected to the Northeast monsoon with most of the rainfall occurring during October–December. The salt pans receive water from the adjacent sea through neretic inlets during the southwest monsoon especially during May. High winds blowing from the sea to land facilitate the flow of sea water into the saltpans during this season. Also these pans receive

rain water during the northeast monsoon in October to December. Many salt pans have been constructed in a vast area for the purpose of extracting salt from the highly saturated waters of the hyper saline ponds (Sampath and Krishnamoorthy, 1989). However during the past decade rainfall declined remarkably and, in the recent years, most of the rainfalls were over a period of 2–3 weeks except 2015. In fact, these study areas are important and are acting as stopover sites for the migratory birds during their migratory periods (Sampath and Krishnamoorthy, 1989; Pandiyan et al., 2010, 2014)

Fig.1 Map showing the saltpan areas of Kodikkarai, Tamilnadu.



MATERIALS AND METHODS

Collection of benthic organism

The benthic prey species were recorded from the mud samples, samples collected at least three random points from the saltpans twice in a month within the depth range accessible to shorebirds (0–20 cm Masero *et al*.1999). Prey availability in the mud samples of the saltpans were determined. Selection of three random points for collection of benthic prey from each saltpan was purely based on the aggregation of shorebirds used sites. At each point, three core samples were taken at a depth of 10-cm diameter (78.5 cm^2) and upto a depth of 20 cm, which is the greatest accessible depth for the most of the shorebirds (Masero *et al*.1999) except for two curlew species. In the laboratory, the core sample was filtered through 0.5 sieves. The benthic organisms (micro and macroinvertebrates) were collected from the sample and preserved in 70% ethanol and 4% neutral formalin solution. The soil samples were collected and sieved through 0.5mm sieve in the field. The benthic prey items were stored in a sample bottles using 4% formalin. In the laboratory the benthic prey items were separated and were counted. The excess of water on the prey items were removed by using filter paper.

RESULTS

Totally 11 types of benthic organisms were identified in the five different salt pans over the four different seasons. The benthic organisms included Chromomid larva, Dipolydoracoeca, *Artemia salina*, Cosmopoliton beetle, *Hasriusa dansoni*, *Amphinomidea*, *Penaeus*, *Epihydridea*, Hemiptera, Unidendified Hydrophilidea and Coleoptera and (Table 1). Among the four seasons the monsoon season showed higher density of benthic species than other seasons. Among the eleven species the Chironomid larvae showed the maximum turn over when compared to the other species of benthic organisms recorded in the salt pans. The density of chironomid larvae was 18.1 ± 2.3, 178.7 ± 15.79 and 85.5 ± 10.54 No./m^2 pre monsoon, monsoon and post monsoon respectively. But in summer *Artemia salina* only was recorded from the saltpans. The Hasriusadansoni was not recorded during post monsoon and summer. The density of benthic organisms varied significantly among the seasons ($P<0.001$). The overall results of the study showed that the Chironomid showed the high density followed by species of *Artemia salina* and other species recorded.

DISCUSSION

The population dynamics of organisms vary depending on the species and the varying spatial and temporal parameters. In the present study it was found that among the eleven species of benthic organisms the Chironomid showed the highest density and the second highest species was *Artemia salina* recorded when compared to the other species (Table 1). But *Artemia salina* showed highest and no species was recorded during summer. Since the habitat is basically saline water habitat and the salinity was not stable over the seasons (unpublished data). Sampath and Krishnamoorthy (1989) reported that *Artemia* was higher during the summer in the saltpans due to high salinity (170 ppt). It is informed that Artemia enriched their volume during summer, but during the monsoon the salinity is decreased to less than 50 ppt, and the chironomid larvae get enriched rather than Artemia (Sampath and

Table.1. Density of benthic prey (No./m^2)present in the Kodikkarai saltpans, in different season from August 2012 to June 2015.

S.No	Species	Seasons				
		Pre Monsoon	Monsoon	Post Monsoon	Summer	Overall
1	Chromomid larva	18.1 ± 2.3	178.7 ± 15.79	85.5 ± 10.54	0	82.9 ± 7
2	Dipolydoracoeca	0.5 ± 0.11	0.3 ± 0.06	0.02 ± 0.01	0	0.2 ± 0.03
3	Artemia salina	6.52 ± 1.04	31.3 ± 4.91	40.3 ± 7.86	28.2 ± 13.06	28.4 ± 3.86
4	Cosmopoliton beetle	0.4 ± 0.09	0.6 ± 0.1	0.1 ± 0.04	0	0.3 ± 0.04
5	Hasriusadansoni	0.4 ± 0.09	0.2 ± 0.06	0	0	0.1 ± 0.03
6	amphinomidea	0.7 ± 0.13	2.3 ± 0.53	1.8 ± 0.43	0	1.3 ± 0.21
7	Penaeus	0.9 ± 0.2	2.7 ± 0.79	1.9 ± 0.62	0	1.6 ± 0.31
8	Epihydridea	0.3 ± 0.08	0.5 ± 0.08	0.3 ± 0.07	0	0.3 ± 0.03
9	Unidendified Hydrophilidea	0.4 ± 0.08	0.4 ± 0.08	0.2 ± 0.06	0	0.3 ± 0.03
10	Unidendified Coleoptera	0.3 ± 0.07	0.3 ± 0.06	0.2 ± 0.05	0	0.2 ± 0.03
11	Hemiptera	0.4 ± 0.09	0.4 ± 0.07	0.2 ± 0.05	0	0.3 ± 0.03

Krishnamoorthy, 1989). On the other hand, It has also been shown that the chironomid species could tolerate the high salinity (Armitage et al., 1995), but in contrary it was found that during the summer season the chironomid species was not found in the salt pans because the water level in the study site was very low (<10 cm), which was not favourable for chironomid larvae. Some of the studies showed that the salinity as a whole, a marked seasonality with the abundance of larvae of chironomid species, with peaks in May and November in tropical regions. This pattern contraries the report made from the temperate regions, where abundance of invertebrates peaks in monsoon season (Service and Feller, 1992). The current study strongly suggests that the nature of local climatical condition of a given habitat could regulate the density and diversities of taxa across the species.

Besides, it was found that the density of insects namely Cosmopoliton beetle, *Hasriusa dansoni*, Hemiptera, unidendified Hydrophilidea and Coleoptera showed major diversities of macroinvertebrates in the salt pans. The saltpans are seems to function as a reservoir for diversity of species especially insects (Davis, 2000). He also suggested that there are several groups of taxa are quite adapted to salt concentrations in a changing environment and show a quite large range of tolerance to. Despite these saltpans being part of coastal environments and they could provide suitable type of environment for the variety of fauna including micro and macroinvertebrates Davis (2000). In general salinity is one of the important factors which would favours or unfavour certain species in their survival depending on the range and species. Salinity gradients have been related to diversity and abundance of macroinvertebrate communities in other inland ecosystems, for example, rivers. Rising salinities affected the number of species but not other diversity, evenness, or abundance values (Piscart et al 2005); and also found that the species composition of the community was influenced by the salinity for a small group of species, mainly crustaceans. But in the present study the Peneus (shrimp forms) showed the least density when compared to the other species recorded. However, the results of the Saltpans also differ between each other as assessed through results of the saltpans and also in comparison with other studies (Amaral and Costa, 1999; Serrano et al 1983).

CONSERVATION IMPLICATIONS

The supratidal habitats are degraded by anthropogenic pressures by converting the coastal ecosystem into aquafarms, saltpans, mining, hydroelectric power plant projects and establishment of other industries for the benefit of human kind. These activities are directly or indirectly influencing the density, diversity and richness of the faunal and flora of coastal ecosystem. Many studies describes that lot of species are extinct and many are under sever stress because of alteration of coastal ecoystem (Pandiyan *et al*., 2015). Since the coastal wetlands are degraded, the man made wetlands in and around the coastal ecosystem like the salt pans are supporting variety of faunal diversity seasonally. In this point of view the salt industries may be strengthened through standard regulations and policies by the state and central government. Because the salt extraction industries are functioning in India in a large scale and they are expanding the land upto their requirements. By better management of slat industries we could also provide a alternate habitat for wildlife. However, we have to still initiate some guidelines regarding the operation of salt industries and it should reach to the owners of the salt industries for better management.

ACKNOWLEDGEMENT

We thank to University Grants Commission, Govt. of India, New Delhi, for the financial assistance to for funding as a Major Research Project (MRP 41-115/2012 (SR). Our sincere thanks to Dr. R. Saravanamuthu, Director, R & D cell, STET Women's College, Sundarakkottai, Tamil Nadu, India for his critical analysis of the manuscript. We are also express our thanks to the AVC College Management, faculty members of Zoology and Wildlife Biology for their constant support.

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