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Occurrence of different types of eggs and the physio-chemical parameters of Vellar estuary, Parangipettai, South East Coast of India

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ABSTRACT

A surveywas made for a period of one year (January - December 2010) to find out the avaliability of different types of eggs and also the physio-chemical parametres such as atmospheric and water temperature, suspended solid concentration, pH, salinity, dissolved oxygen, biological oxygen demand, nitrate, nitrite, ammonia, total nitrogen, inorganic phosphate, total phosphorus, silicate, petroleum hydrocarbon, chlorophyll. A total of 39 different eggs were recorded in the present study, among which 10 eggs belongs at clupeidae family, 11 belonging to engraulide family, 3 eggs belongs to each mugilidae, carangidae and synodonyidae family, 2 of cynoglossidae and 1 egg for each ambassidae, chirocentridae, ophichthidae, gerridae, atherinidae, leiognathidae and teraponidae families.

Key words: Vellar estuary, eggs, physico-chemical parametres, Parangipettai.

INTRODUCTION

Evaluation of fishery seed resources may prove to be more convenient and reliable for an appraisal of prospective commercial fishery [1]. Studies on the early stages of fishes are useful to understand the biology of the species besides determining their spawning seasons [2]. Information about the distribution and abundance of fish eggs of an area will help in a great deal in capture fisheries management and also useful in locating shoals of fish and their breeding grounds of the ecosystem [3]. In the life history of fishes, the different stages or phrases are not only varying from adult but also the degree of variation vary considerably in different groups [4]. Vertical distributions of different developmental stages and species are strongly affected fluctuating hydrographic conditions [5]. Knowledge of spawning seasons of fishes, temperature, habitats and behaviour are also useful in delimiting the possibilities [4]. In this case the present study was designed to find out the different types of eggs present in this study area and also the physio-chemical parameters for the whole year.

Study area

Parangipettai (Lat. 11°29'25.55"N, Long. 79°45'38.62"E)situated on the Southeast coast of India is towed with a variety of biotopes and with rich biodiversity (Fig. I). The river Velar originates in Servarayan hills of Salem (Tamil Nadu, South India) and flows east for about 480 km before joining Bay of Bengal at Parangipettai. The Velar estuary is a positive estuary as it has connection with the adjoining sea throughout the year. It is also subjected to semidiurnal tides. This estuary is in a state of constant flux. It is a dynamic estuarine environment influenced by the tidal ebb and flow, and biotic and abiotic exchanges that constantly occur between the estuarine and the adjoining neritic realms of the Bay of Bengal. It is also subjected to variations in salinity and other typical estuarine hydrographical processes resulting from seasonal variations in the amount of fresh water flow or monsoonal rainfall. This estuarine environment serves as a good nursery area for many commercially important marine organisms and also supports a rich fish and shell fish fishery.

Fig.I. Study area

MATERIALS AND METHODS

Sampling were made for the period of one year at different seasons to record the physico-chemical characteristics of the Parangipettai coast. The study period is divided in to four season viz. post-monsoon (January to March), summer (April to June) and pre-monsoon (July to September) and monsoon (October to December) based on the northeast monsoon which is prevalent in the study area. Finfish eggs were collected every month in the early hours of the day during high tide, with the help of plankton net of diameter 0.5 m made of bolting silk (No: 10 mesh size, 158µm). Volume of water filtered was quantified with the help of a calibrated flow meter (General Oceanics, INC model) attached to it. The net was towed horizontally along the surface water at a constant speed of 1.0 km/hr for about 15 - 20 minutes, adopting the methods of [6] and [7]. Samples were preserved in 5% buffered formalin-seawater and sorted in the laboratory [8]. Fin fish eggs were sorted out from this sample and their abundance was expressed as number of eggs/100m³.

Field data like temperature, salinity, dissolved oxygen, pH and other nutrients were collected during morning to noon. Atmospheric and surface water temperature were measured using standard mercury filled centigrade thermometer and pH was measured using Elico pH meter (Model LC-120). Dissolved oxygen was estimated by the modified Winkler's method, described by the [9]. For the analysis of nutrients, surface water samples were collected and transported immediately to the laboratory. The water samples were filtered using a millipore filtering system (MFS) and analzed for dissolved inorganic phosphate, nitrate, nitrite, reactive silicate and chlorophyll by adopting the standard methods described by [9].

Table.I. Seasonal distribution of eggs

S.No	Name of the Species	Post-monsoon	Summer	Pre-monsoon	Monsoon
	Clupeidae				
1	*Anadontostomachacunda*	+	+	+	+
2	*Sardinellafimbriata*	+	+	+	+
3	*Sardinellagibbosa*	+	+	+	+
4	*Sardinellaleiogaster*	+	+	+	+
5	*Sardinellalongiceps*	+	+	+	-
6	*Sardinella*clupeoids	+	+	+	+
7	*Nematalosanasus*	+	+	+	+
8	*Opisthopterustardoore*	-	+	-	+
9	*Pellonaditchella*	+	+	+	-
10	*Escualosathoracata*	+	+	+	+
	Engraulidae				
1	*Engraulisencrasicholas*	+	+	+	-
2	*Stolephorusheterolobus*	+	+	+	+
3	*Stolephorus indicus*	+	+	+	-
4	*Stolephorusmacrops*	+	+	+	+
5	*Stolephoruspunctifer*	+	+	+	+
6	*Stolephorus* tri	+	+	+	+
7	*Setipinnataty*	+	+	+	+
8	*Setipinnabreviceps*	+	+	+	+
9	*Thryssadussumieri*	+	+	+	+
10	*Thryssahamiltonii*	+	+	+	+
11	*Thryssamystax*	+	+	+	+
	Mugilidae				
1	*Mugilcephalus*	+	+	+	+
2	*Liza dussumieri*	+	+	+	+
3	*Liza tade*	+	+	+	+
	Carangidae				
1	*Carangoidesmalabaricus*	+	+	+	+
2	Caranxmelampygus	+	+	+	+
3	Caranx sp.	+	+	+	+
	Synodontidae				
1	*Sauridagracilis*	+	+	+	+
2	*Sauridatumbil*	+	+	+	+
3	Saurus sp.	+	+	+	+
	Cynoglossidae				
1	*Cynoglossusarel*	+	+	+	+
2	*Cynoglossuspuncticeps*	+	+	+	+
	Ambassidae				
1	*Ambassiscommersoni*	+	+	+	+
	Chirocentridae				
1	*Chirocentrusdorab*	+	+	+	+
	Ophichthidae				
1	*Ophichthys*sp.	+	+	+	+
	Gerridae				
1	*Gerresoblongus*	+	+	+	+
	Atherinidae				
1	*Pranesuspinguis*	+	+	+	+
	Leiognathidae				
1	*Secutorruconius*	+	+	+	+
	Teraponidae				
1	*Teraponjarbua*	+	+	+	+

RESULTS

A total of 39 different types of eggs belonging to 13 different families were recorded in the present study, among which 10 type of eggs belonging to family clupeidae, 11 type belonging to family engraulide, 3 eggs of mugilidae, carangidae and synodonyidae families, 2 eggs of cynoglossidae family and 1 egg for each ambassidae, chirocentridae, ophichthidae, gerridae, atherinidae, leiognathidae and teraponidae families (Table.I.).

The maximum density of eggs were observed during summer followed by post-monsoon, pre-monsoon and monsoon (Fig. II).

Fig.II. Season wise eggs density

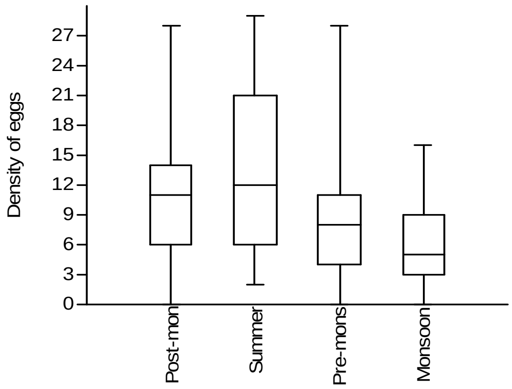


Fig.III. Seasonal va riation of atmospheric temperature temperature

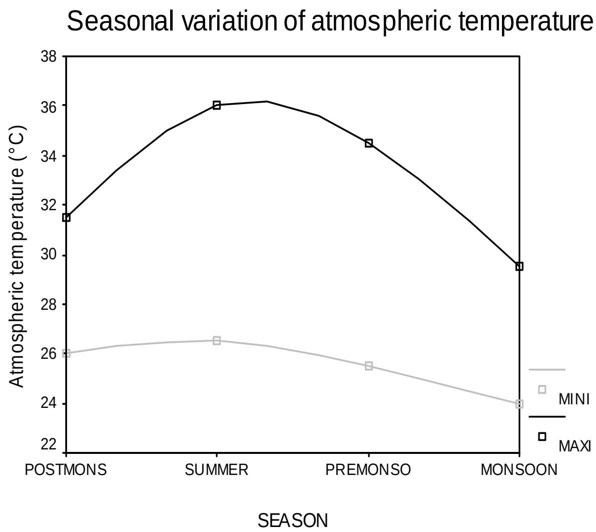
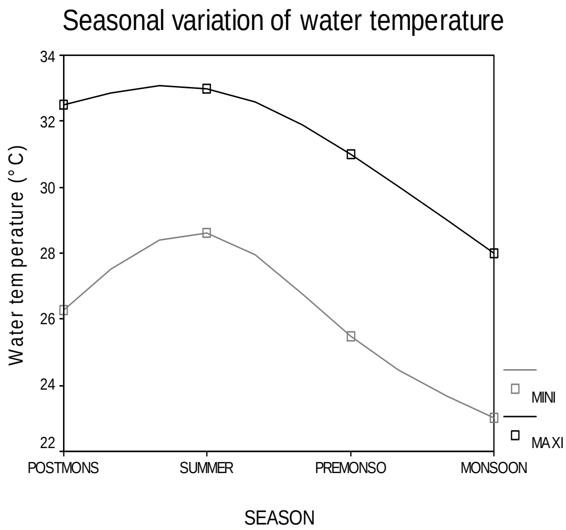


Fig.IV. Seasonal va riation of surface water



The atmospheric temperature was ranged from 25 ° C to 36° C (Fig.III) and surface water temperature from 23 °C to 33°C (Fig.IV). The suspended solids concentration (SSC) ranged from 4 mg/l to 94 mg/l (Fig.V). The pH fluctuation was ranged from 8 to 8.4 (Fig.VI) and salinity was varied from 18% to 40% (Fig.VII). The dissolved oxygen concentration (DO) ranged from 3.27 mg/l to 5.96 mg/l (Fig.VIII) and biological oxygen demand (BOD) ranged from 0.12 mg/l to 4.0 mg/l (Fig.IX). The nitrite (no2) was ranged from 0.11 µmol/l to 1.68 µmol/l (Fig.9) and nitrate (no3) from 1.55 µmol/l to 4.68 µmol/l (Fig.XI). The ammonia fluctuation was ranged from 0.01 µmol/l to 0.83 µmol/l (Fig.XII) and total nitrogen was varied from 11.34 µmol/l to 18.41 µmol/l (Fig.XIII). The inorganic phosphate (IP) ranged from .04 µmol/l to 1.89 µmol/l (Fig.XIV) and total phosphate (TP) ranged from 1 µmol/l to 3.37 µmol/l (Fig.XV). The silicate ranged from 2.71 µmol/l to 139.14 µmol/l (Fig.XVI) and petroleum hydro carbon (PHC) ranged from 0.13 µg/l to 5.51 µg/l (Fig.XVII). Chlorophyll was varied between 1.12mg/$m^3$to 4.21 mg/m^3 (Fig.XVIII).

Fig.V. Seasonal va riation of SSC

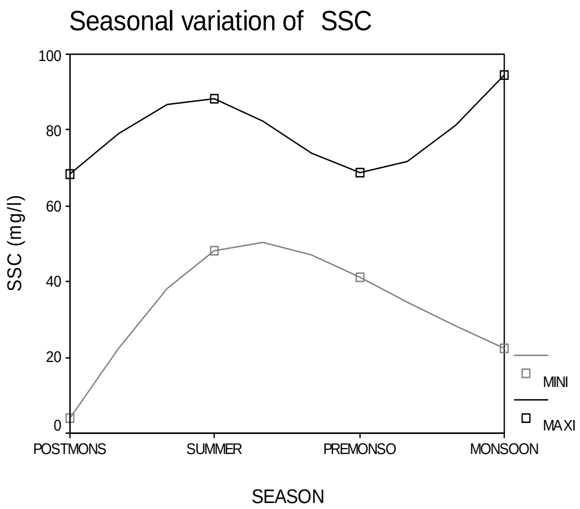


Fig.VI. Seasonal va riation of PH

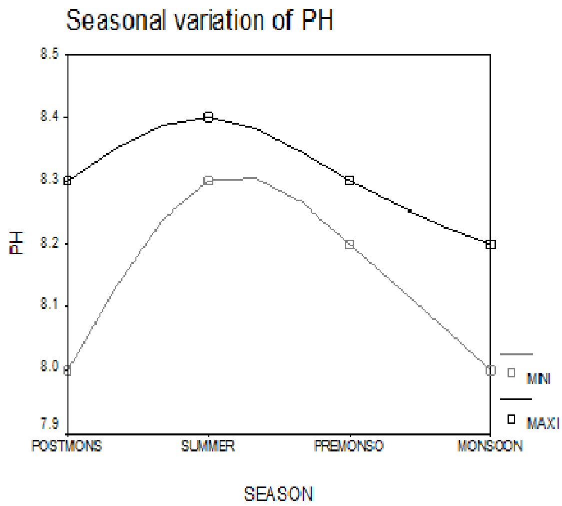


Fig.VII. Seasonal va riation of salinity

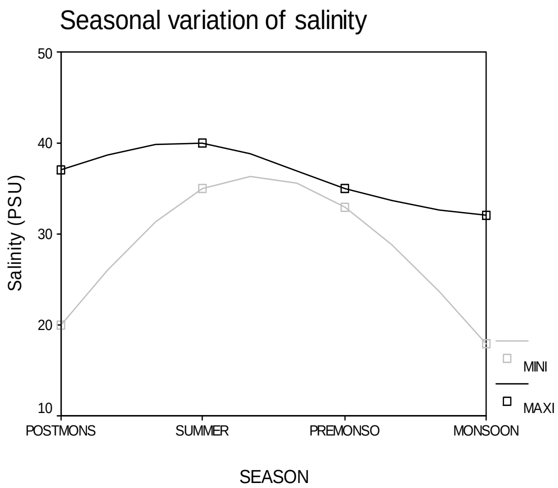


Fig.VIII. Seasonal va riation of DO

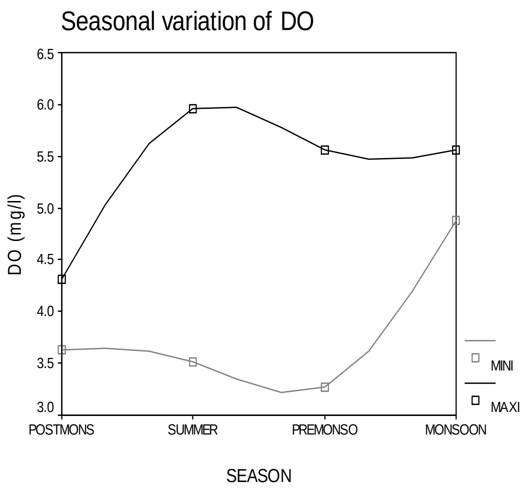


Fig.IX. Seasonal va riation of BOD

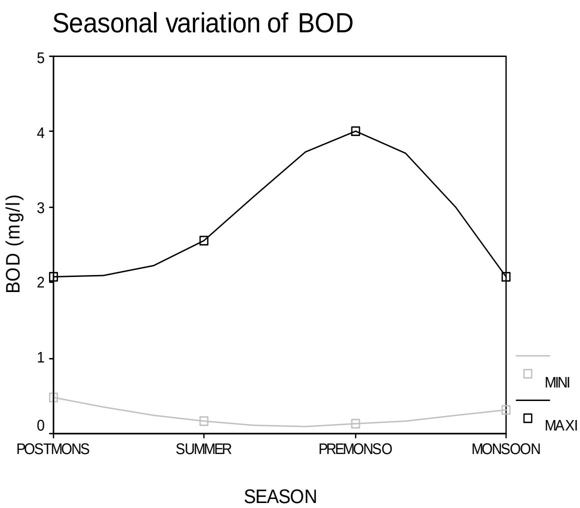


Fig.X. Seasonal va riation of nitrite

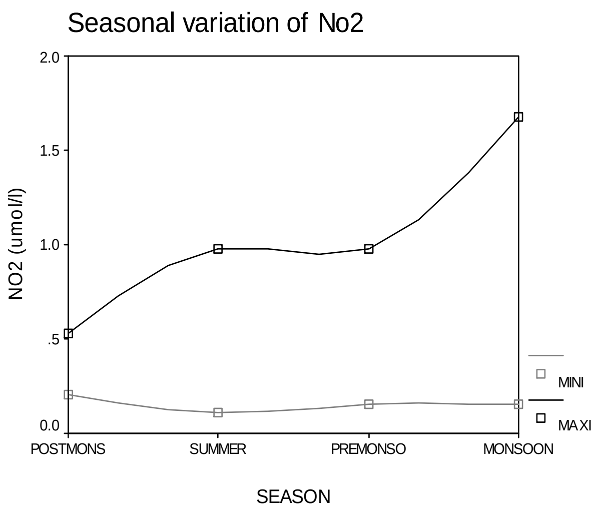


Fig.XI. Seasonal va riation of nitrate

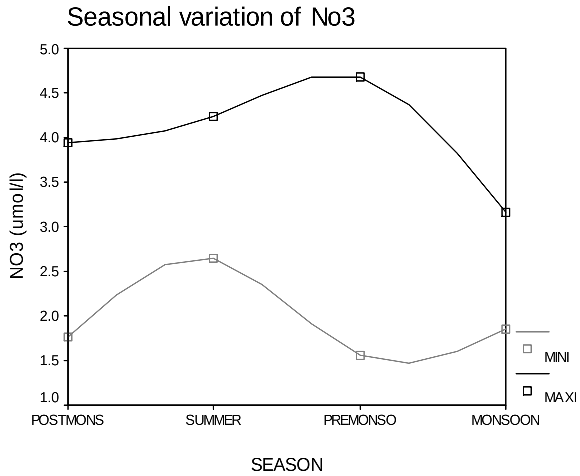


Fig.XII. Seasonal va riation of ammonia

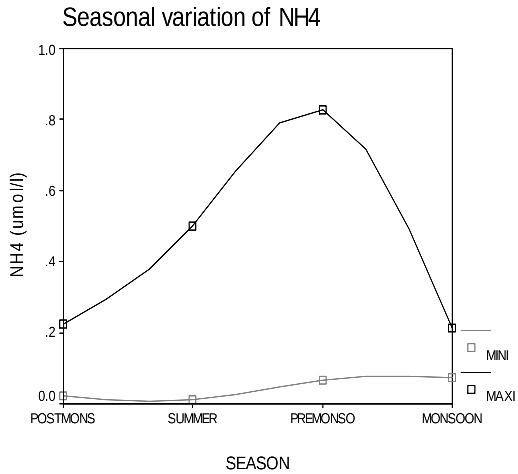
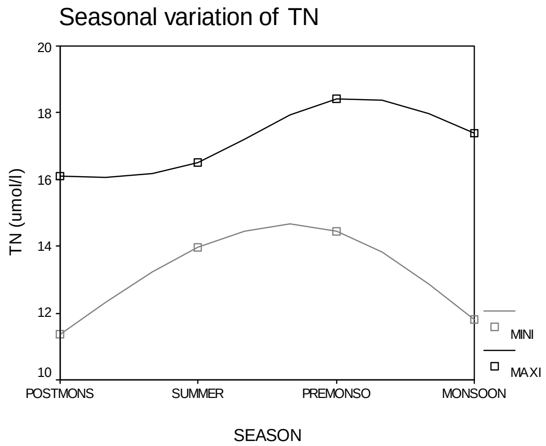


Fig.XIII. Seasonal va riation of total nitrogen

Fig.XIV. Seasonal va riation of inorganic

phosphate



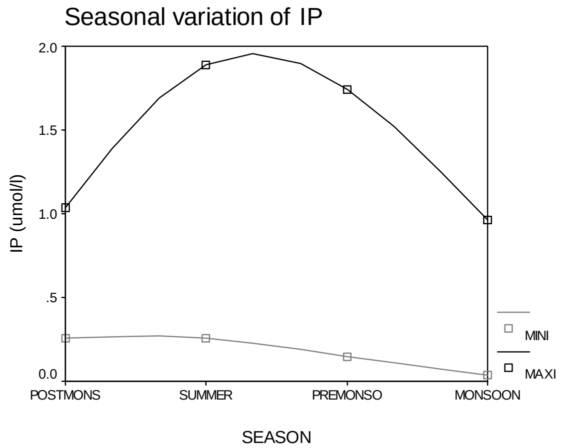


Fig.XV. Seasonal va riation of total phosphate

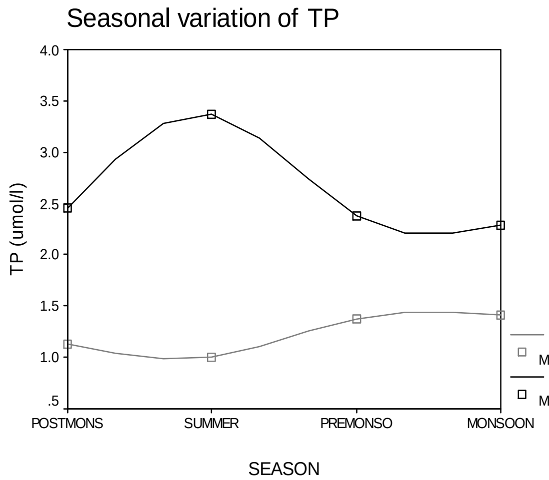


Fig.XVI. Seasonal va riation of silicate

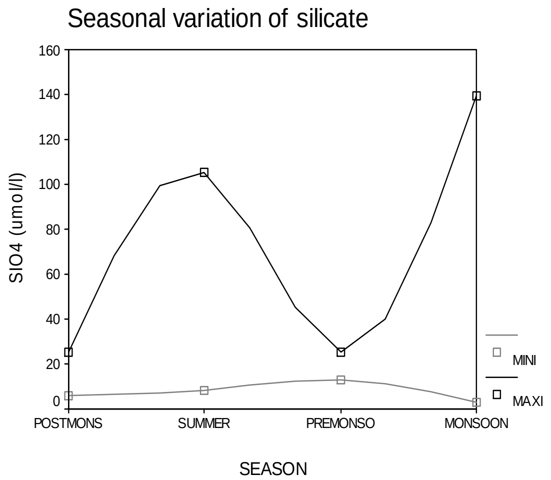


Fig.XVII. Seasonal va riation of PHC

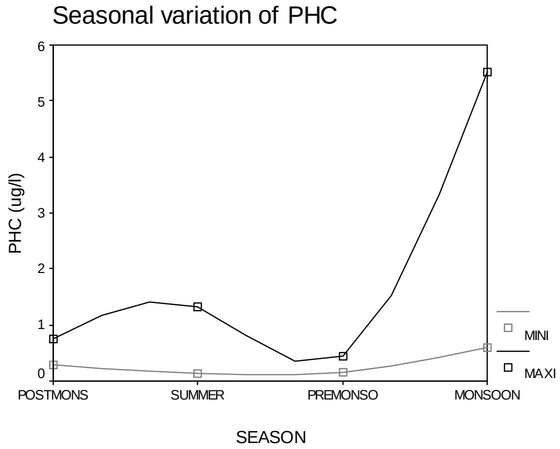
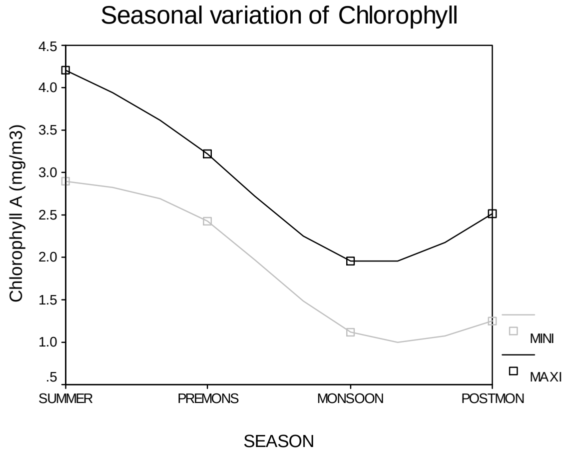


Fig.XVIII. Seasonal va riation of chlorophyll



DISCUSSION

Atmospheric and water temperature was minimum during monsoon season and maximum during summer. Generally, surface water temperature is influenced by the intensity of solar radiation. Similar observation was made by [10]. According to him, water temperature was increased by solar radiation, evaporation, freshwater influx and cooling and mix up with ebb and flow from adjoining neritic waters. The water temperature during monsoon was low because of strong land sea breeze and precipitation and the recorded high value during summer could be attributed to high solar radiation [11-14]. Minimum SSC was found during post-monsoon season and maximum during monsoon in the present study. In the present study, the minimum chlorophyll content increased the SSC. According to [15] incresed primary productivity reduced the SSC at Golden Horn estuary.

Hydrogen ion concentration (pH) in surface water remained alkaline throughout the study period with minimum during monsoon season and maximum during summer. Similarly, [10] recorded maximum pH during summer season at Pichavaram waters. According to him, this might be due to the presence of high photosynthetic activity. Fluctuations in pH values during different seasons of the year is attributed to factors like removal of CO2 by photosynthesis through bicarbonate degradation, dilution of sea water by fresh water influx, low primary productivity, reduction of salinity and temperature and decomposition of organic materials as stated by [12,16].
In the present study, salinity was maximum during summer season and minimum during the monsoon season; similar observation was made by [10]. According to him, the rainfall and the fresh water inflow from the land in turn moderately reduced the salinity. The salinity acts as a limiting factor in the distribution of living organisms, and its variation caused by dilution and evaporation is most likely to influence the fauna in the intertidal zone [17]. Changes in the salinity in coastal waters are due to the influx of fresh water from land run off, caused by monsoon or by tidal variation [10].

In the present study, minimum dissolved oxygen (DO) was observed during pre-monsoon season and maximum during summer. The minimum and maximum biological oxygen demand (BOD) was observed during pre-monsoon season in the present study.

In the present study, minimum nitrites was observed during summer season and maximum during monsoon. The recorded maximum nitrite value during monsoon season could be mainly due to the the organic materials received from the catchment area during ebb tide [11]. The increased nitrites level was due to fresh water inflow, mangrove leaves littre fall decomposition and terrestrial run-off during the monsoon season [12]. Another possible way of nitrites entry is due to the increased phytoplankton excretion, oxidation of ammonia and reduction of nitrate and by the recycling of nitrogen and bacterial decomposition planktonic detritus present in the environment [18]. The minimum values recorded during summer period may be due to less fresh water inflow and high salinity [19]. In the present study, the minimum and maximum nitrate was recorded during pre-monsoon season.

In the present study, minimum ammonia (NH4) was observed during summer season and maximum during pre-monsoon. Minimum total nitrogen (TN) was observed during post-monsoon season and maximum during pre-monsoon in the present study. In the present study, minimum inorganic phosphte (IP) was observed during monsoon season and maximum during summer.

In the present study, minimum and maximum silicate was observed during monsoon season. The silicate content was higher than that of the other nutrients and the recorded high monsoon values may be due to heavy inflow of monsoonal freshwater derived from land drainage carrying silicate leached out from rocks. Besides this, the dissolution of particulate silicon carried by the river, the removal of silicates by adsorption and co-precipitation of soluble silicate silicon with humic compounds and iron [16].
In the present study, minimum petroleum hydrocarbon (PHC) was observed during summer season and maximum during monsoon. This is due to the rain, the fresh water mixing increase the PHC concentration. In the present study, the maximum total phosphorus (TP) and chlorophyll were observed during summer season. Total phosphorus acts a proxy for potential system productivity and express as chlorophyll resources efficiency [20]. Phytoplankton succession and community composition reflect the environmental conditions of the ecosystem, among which the availability of nutrients play a significant role [21].In many coastal waters, phosphate was an important resources regulating phytoplankton growth [22].

In the present study, maximum density of eggs were observed during summer, because it is a breeding season for many fishes.Tamilnadu government was declared a 45 day's fishing ban between 15th April and 30th May to prevent catch of brooders. [23] stated that the maximum diversity of ichthyoplankton was observed during summer season at Karaikkal waters. In the present study, temperature, pH, salinity and DO were observed maximum during summer season. According to [2], in the marine ecosystem, the temperature influences the distribution and abundance of flora and fauna. Environmental parameters such as salinity and temperature have been shown to play an important role in the occurrence, density and growth of the larval stages of fishes [24].

Hence, it is widely accepted that diversity increase with an increase of the environmental stability in aquatic biotopes [25]. From this study concluded that physicochemical parameters plays a significant role in distribution of ichthyoplankton.

CONCLUSION

This study shows the different types of eggs present in the Vellar estuary. A total of 39 different types of eggs belonging to 13 different families are present in this estuary. The diversity of eggs shows high in the month of summer. It may be due to the maintenance of salinity and temperature. And the diversity of the eggs is low in the months of monsoon, it may be due to the flow of fresh water because of rainfall.

The survey of the physio-chemical parameters for the four seasons about the estuary shows us the suitable parameters for these fishes and it would help us to maintain these fishes in the laboratory condition in the tanks for the studies

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