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# Distribution of Finfish in Karaikkal, Tamilnadu, South East Coast of India

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**Abstract:** In the present study distribution of finfish eggs was made in Karaikkal, south east coast of India. Seasonal sampling of finfish eggs were made for during one year (2008), covering an area depth was (0.5, 1, 3, 5, 10) km away from the sea shore. The composition of fish eggs are belonging to the families of Ambassidae, Clupeidae, Engraulidae, Teraponidae, Atherinidae, Chirocentridae, Cynoglossidae, Leiognathidae, Mugilidae, Ophichthidae and Synodontidae. The family Engraulidae was common and predominant among them. The maximum density of fish eggs are observed during summer, followed by pre-monsoon, post monsoon and minimum diversity was observed during monsoon. *Engraulis* sp. (102/10m$^3$) was the maximum density observed during summer season. However, the minimum (1/10m$^3$) density of eggs of *Opisthopterus tardoore* and *Pranesus pinguis*, *Engraulis* sp, *Mugil* sp. and *Ophichthys* sp were observed during the summer season.

**Key words:** Fin fish · Eggs · Distribution · Engraulidae · Karaikkal Coast

## INTRODUCTION

The term "Icthioplankton" is generally referred to the developmental stage of fin fishes collected by plankton net. Such studies could receive considerable attention in recent years. A study of the distribution patterns of fish eggs contributes to an understanding of the interrelationships among fish species during their early life stages, as well as an understanding of adult spawning patterns. In addition, information can be obtained on the reproductive strategies adopted by these fish in response to the physical and biological processes of the region. Icthioplankton surveys are widely useful in fishery investigations of commercially important fishes, biology of the species, of breeding grounds and migration, understanding their spawning seasons and spawning biomass.

Distribution patterns of fish eggs in any region of the ocean are related to the reproductive activity of the adult population and to topographic and hydrographic features that affect the dispersal of the eggs. The work of Delsman *et al.* [1] on the eggs and larvae of fishes collected from the Java Sea is probably the only standard work dealing with the developmental stages of fishes of Indo-pacific region. Ahlstrom *et al.* [2] described the eggs and larvae of Jack mackerel (*Trachurus symmetricus*); Bensam [3] a synopsis of the early developmental stages of fishes of the genus *Sardinella* Valenccies; Venkataraman *et al.* [4] observed by surveying a limited area were abundant spawning takes place, it should be possible to determine by a quantitative sampling of eggs and larvae, the spawning time and the rate of mortality during the planktotrophic life of fishes.

The present study was concentrating on survey availability of finfish and juveniles, related to season as an attempt to provide baseline information on the juvenile fishes Karaikkal. The objective of the present study was to describe the seasonal variation in species diversity as well as species abundance for the fish eggs assemblage on along 4 consecutive annual cycles.

## MATERIALS AND METHODS

**Study Area:** The present study was carried out in Karaikkal (10°55'46.56"N 79°50'11.40"E) coastal waters which is situated in the east coast of India an enclave Pondicherry state and 25 km north of Nagapattinam (Map.1). Karaikkal has a distributor of river Kavery it is opens in to the Bay of Bengal at Karaikkal called as Arasalar estuary. It has tidal amplitude of 1 meter the tidal influence extends to about some 10 km.

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**Sample Collection:** During this study fish eggs are collected from four seasons from Karaikkal coastal waters over a period of one year from January 2008 to December 2008. Eggs of fin fishes are normally collected during the early hours of the day preferably during high tide with the help of plankton net made of bolting silk (No. 10 mesh size 158 μm) with a mouth diameter of 0.5 m. The volume of water filtered may be quantified by attaching a calibrated flow meter (General Oceanic's INC model). For the collection of eggs and larvae, the net is towed horizontally along the surface water (Oblique haul) at a constant speed of 1.5 km/hr for about 10 to 15 minutes and the sample is emptied to a plastic bucket and preserved in 5% buffered sea water–formalin and the eggs and larvae are sorted out in the laboratory. All fish eggs and larvae were removed from the plankton samples and identified. Numeric data were transformed standard units, numbers per 10 $m^3$ of sea surface.

## RESULT AND DISCUSSION

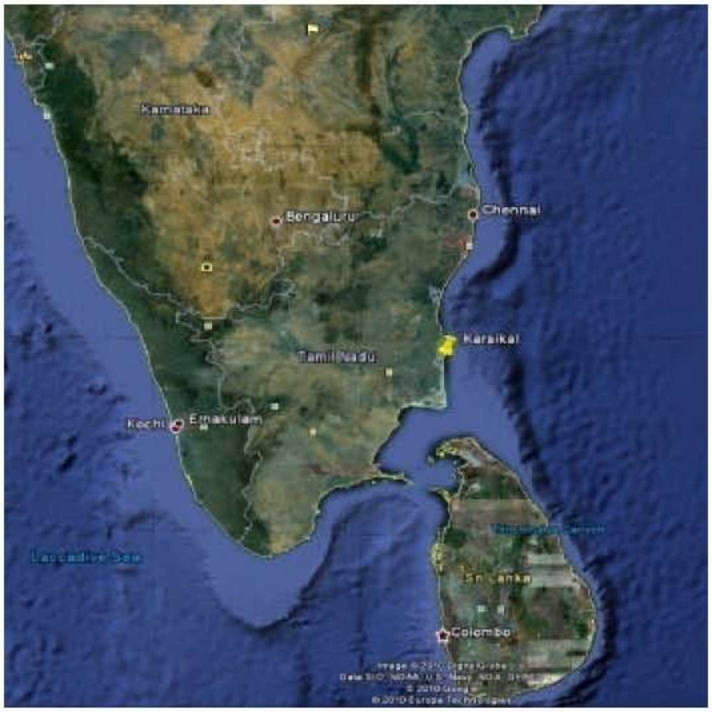
The seasonal occurrence of fish eggs suggest that the spawning of fishes may be associated with physico-chemical factors. In the present study, atmospheric temperature varied between 24.5 to 37°C. The water temperature varied between 23.5 to 32°C. The minimum temperature was observed during monsoon season and the maximum temperature was observed during summer season (Fig.1). pH varied between 8.0 to 8.4, the minimum pH was observed during monsoon season and the maximum pH was observed during summer season (Fig.2). Salinity varied between 4 to 35‰, the minimum salinity was observed during monsoon season and the maximum salinity was observed during summer season (Fig.3).

Dissolved oxygen (DO) varied between 3.18 to 5.45 mg/l, the minimum DO was observed during pre-monsoon season and the maximum DO was observed during monsoon season (Fig.4). Biological oxygen demand (BOD) varied between 0.16 to 5.28 mg/l, the minimum BOD was observed during all seasons and the maximum BOD was observed during post monsoon season (Fig.5). Nitrite ($NO_2$) varied between 0.132 to 1.301 μmol/l, the minimum Nitrite ($NO_2$) was observed during summer season and the maximum Nitrite ($NO_2$) was observed during monsoon season (Fig.6). Nitrate ($NO_3$) varied between 1.808 to 7.572 μmol/l, the minimum $NO_3$ was observed during post monsoon season and the maximum $NO_3$ was observed during pre-monsoon season (Fig.7). Ammonia ($NH_4$) varied between 0.010 to 0.816 μmol/l, the minimum $NH_4$ was observed during post monsoon season and the maximum $NH_4$ was observed during summer season (Fig.8). Total nitrogen (TN) varied between 11.068 to 19.723 μmol/l, the minimum TN was observed during post monsoon season and the maximum TN was observed during summer season (Fig. 9).

Inorganic phosphate (IP) varied between 0.037 to 1.815 μmol/l, the minimum IP was observed during monsoon season and the maximum IP was observed during pre-monsoon season (Fig.10). Total phosphorous (TP) varied between 1.083 to 4.041 μmol/l, the minimum TP was observed during post monsoon season and the maximum TP was observed during summer season (Fig.11). Silicate ($SiO_3$) varied between 2.210 to 159.717 μmol/l, the minimum $SiO_3$ was observed during monsoon season and the maximum $SiO_3$ was observed during post monsoon season (Fig.12). Petroleum hydrocarbon (PHC) varied between 0.035 to 1.650 μg/l, the minimum PHC was observed during summer season and the maximum PHC was observed during monsoon season (Fig.13). During the study period, a total of 858 fish eggs collected, were belonged to 12 families of 21 genuses, which could be assigned to 42 species.

The maximum density (453/10$m^3$) of eggs was recorded during summer followed by pre-monsoon (200/10$m^3$), post monsoon (189/10$m^3$) and monsoon (16/10$m^3$). The maximum species diversity was observed during summer (27 species) followed by post monsoon (24 species), summer (15 species) and monsoon (8 species). During the present study *Caranx* sp eggs are observed in pre-monsoon, post monsoon, summer and monsoon seasons. *Anodontostomus chacunda* eggs are collected during post monsoon, summer and pre-monsoon seasons.

During post monsoon season, a total of 8 families and 16 genus were observed. The dominant egg was *Stolephorus tri* (35/10$m^3$), followed by *Stolephorus heterolobus* (24/10$m^3$), *Stolephorus macrops* (20/10$m^3$), *Sardinella gibbosa* (15/10$m^3$), *Caranx* sp. (14/10$m^3$), *Ophichthys* sp. (11/10$m^3$), *Liza tade* (9/10$m^3$), *Saurus* sp. (8/10$m^3$), *Stolephorus punctifer* (7/10$m^3$), *Terapon jarbua* (6/10$m^3$), *Engraulis grayi* and *Thryssa dussumieri* (5/10$m^3$), *Liza dussumieri* and *Sardinella fimbriata* (4/10$m^3$), *Anadontostomus chacunda*, *Mugil cephalus*, *Pellona ditchella*, *Secutor ruconius*, *Setipinna breviceps* (3/10$m^3$), *Pellona* sp. and *Sardinella leiogaster* (2/10$m^3$), *Chirocentrus dorab*, *Saurida gracilis*, *Stolephorus* sp. (1/10$m^3$) (Fig.14).




Map 1: Study area

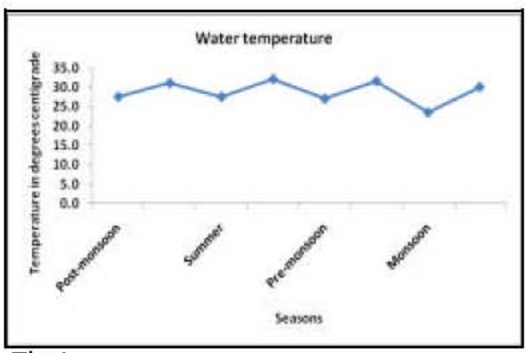



Fig. 1

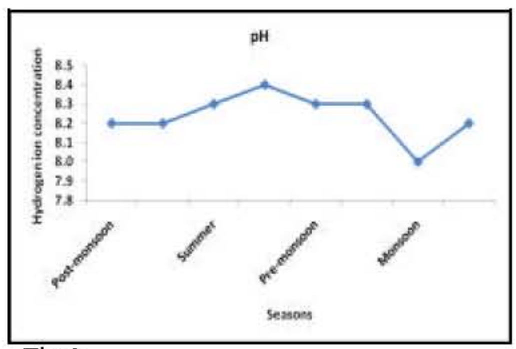



Fig. 2

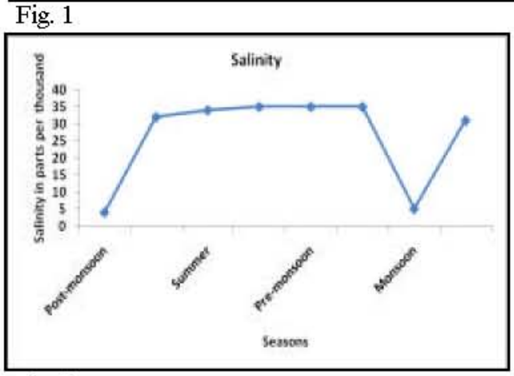



Fig. 3

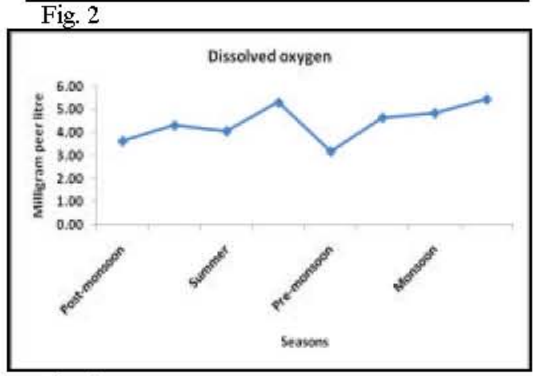



Fig. 4

Fig. 1: Seasonal variations of water temperature recorded during 2008
Fig. 2: Seasonal variations of hydrogen ion concentration recorded during 2008
Fig. 3: Seasonal variations of salinity recorded during 2008
Fig. 4: Seasonal variations of dissolved oxygen recorded during 2008

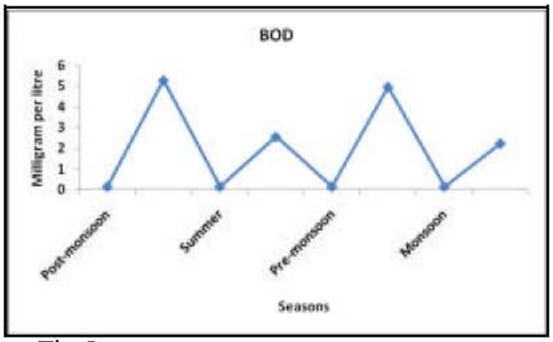



Fig. 5

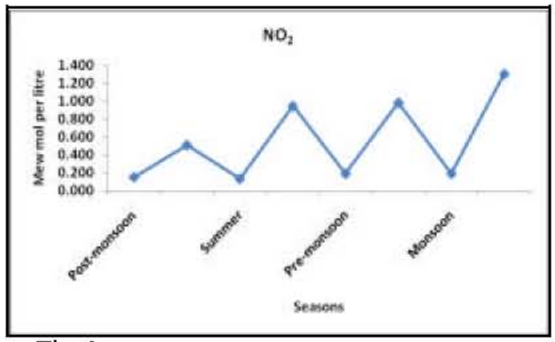



Fig. 6

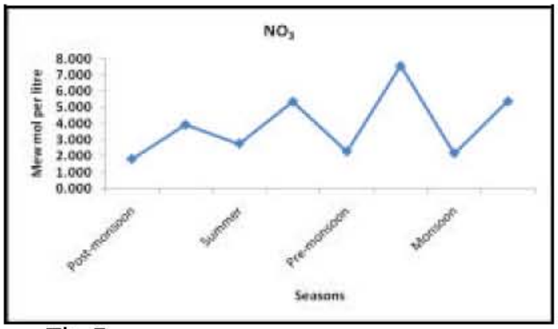



Fig. 7

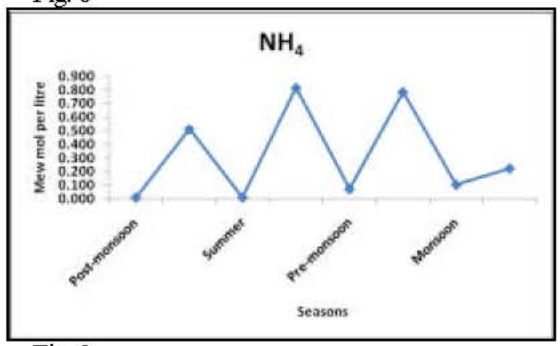



Fig. 8

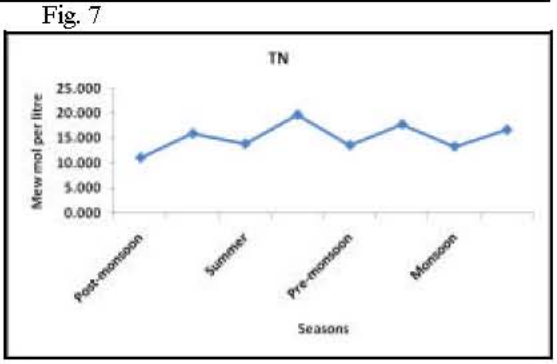



Fig. 9

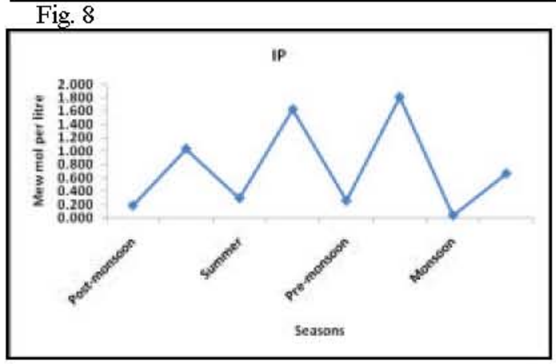



Fig.10

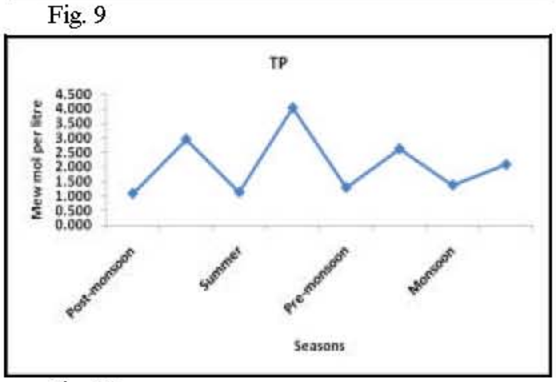



Fig. 11

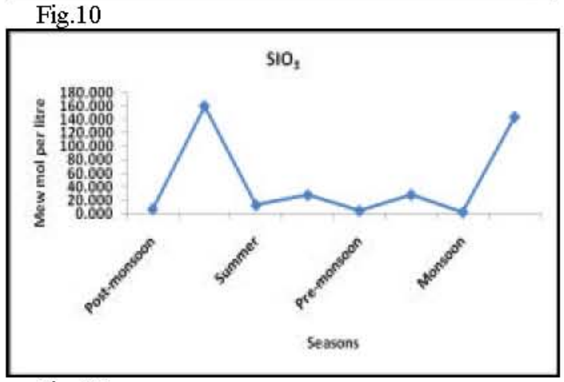



Fig. 12

Fig. 5: Seasonal variations of biological oxygen demand recorded during 2008

Fig. 6: Seasonal variations of nitrite recorded during 2008

Fig. 7: Seasonal variations of nitrate recorded during 2008

Fig. 8: Seasonal variations of ammonia recorded during 2008

Fig. 9: Seasonal variations of total nitrogen recorded during 2008

Fig. 10: Seasonal variations of inorganic phosphate recorded during 2008

Fig. 11: Seasonal variations of total phosphorous recorded during 2008

Fig. 12: Seasonal variations of Silicate recorded during 2008

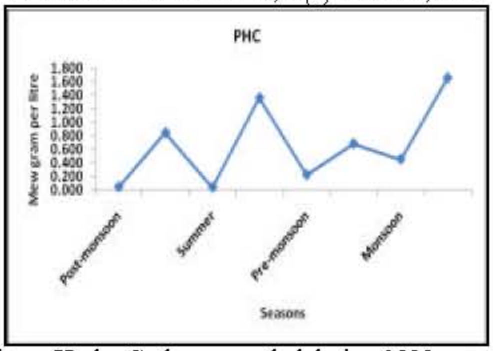



Fig.13: Seasonal variations of Petroleum Hydro Carbon recorded during 2008

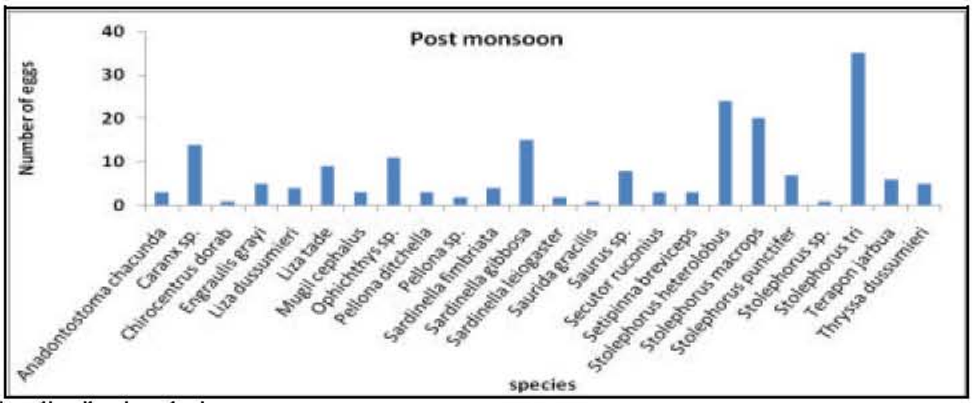



Fig.14: Species distribution during post monsoon

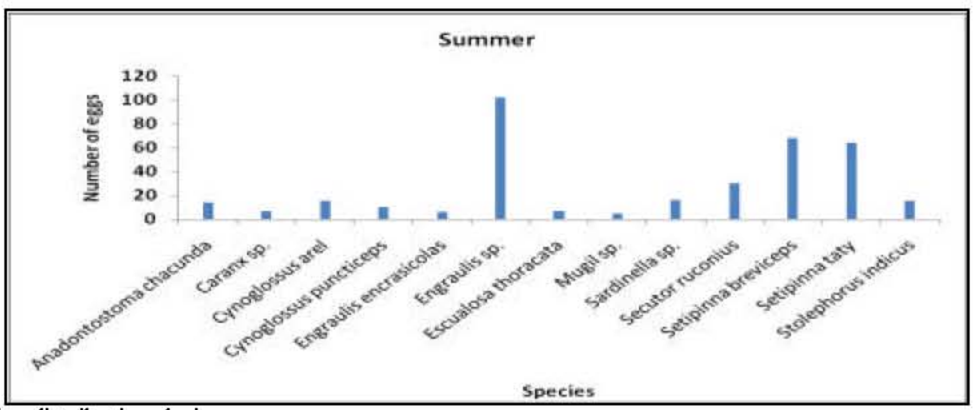



Fig.15: Species distribution during summer

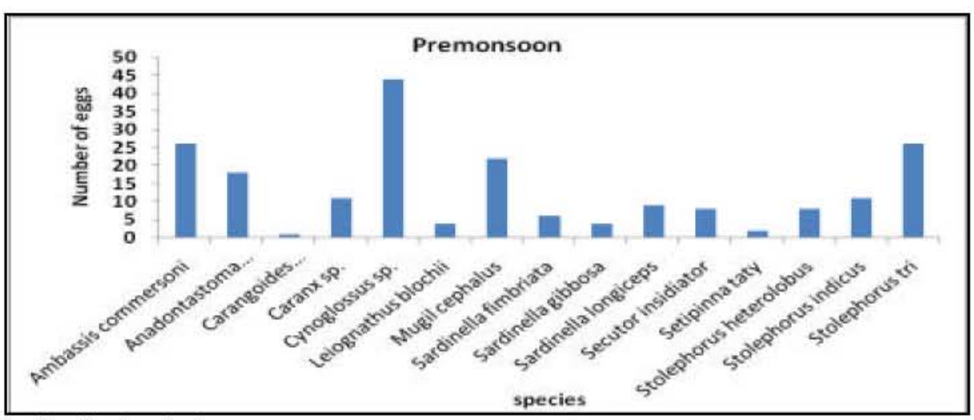



Fig.16: Species distribution during pre-monsoon

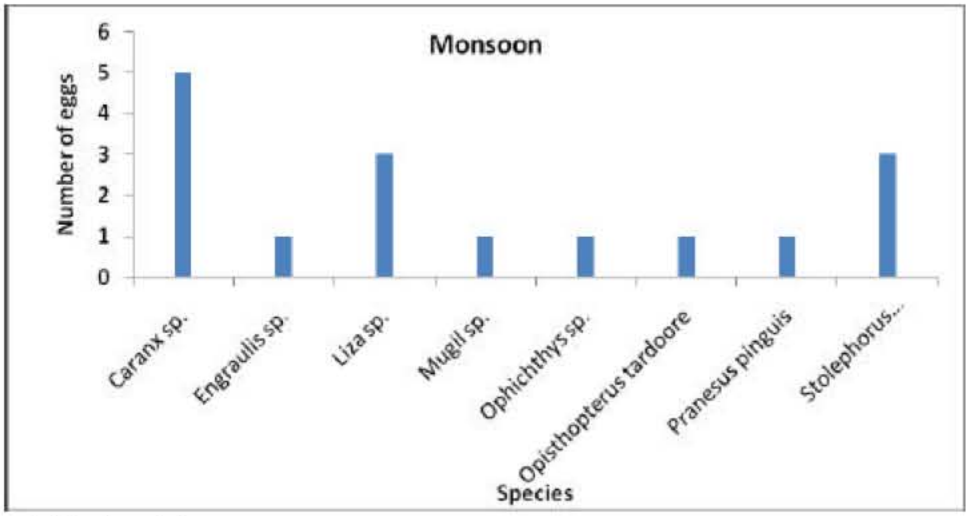



Fig. 17: Species distribution during monsoon

During summer, a total of 9 families and 19 genuses were observed. The *Engraulis* sp. ($102/10m^3$) was abundantly observed, followed by *Setipinna breviceps* ($68/10m^3$), *Setipinna taty* ($64/10m^3$), *Secutor ruconius* ($30/10m^3$), *Sardinella* sp. and *Stolephorus punctifer* ($16/10m^3$), *Cynoglossus arel* and *Stolephorus indicus* ($15/10m^3$), *Anadontostoma chacunda* ($14/10m^3$), *Saurida gracilis* ($12/10m^3$), *Stolephorus macrops* ($11/10m^3$), *Cynoglossus puncticeps* ($10/10m^3$), *Saurida tumbil* ($8/10m^3$), *Caranx* sp. and *Escualosa thoracata* and *Terapon jarbua* ($7/10m^3$), *Enraulis encrasicolus, Thryssa hamiltonii* and *Liza dussumieri* ($6/10m^3$), *Mugil* sp., *Mugil cephalus, Saurus* sp. and *Chirocentrus dorab* ($5/10m^3$), *Thryssa dussumieri* ($4/10m^3$), *Liza tade, Stolephorus heterolobus* and *Thryssa mystax* ($3/10m^3$) (Fig.15).

During premonsoon, a total of 9 families and 11 genus are observed. *Cynoglossus* sp. ($44/10m^3$) was maximum observed, followed by *Ambassis commersonii* and *Stolephorus tri* ($26/10m^3$), *Mugil cephalus* ($22/10m^3$), *Anadontostomus chacunda* ($18/10m^3$), *Caranx* sp and *Stolephorus indicus* ($11/10m^3$), *Sardinella longiceps* ($9/10m^3$), *Secutor insidiator* and *Stolephorus heterolobus* ($8/10m^3$), *Sardinella fimbriata* ($6/10m^3$), *Leiognathus blochii* and *Sardinella gibbosa* ($4/10m^3$), *Setipinna taty* ($2/10m^3$), *Carangoides malabaricus* ($1/10m^3$) (Fig.16).

During monsoon, eggs distribution was found to be low, a total of 6 families and 8 genuses are observed. *Caranx* sp. ($5/10m^3$) was maximum observed, followed by *Stolephorus heterolobus* and *Liza* sp. ($3/10m^3$), *Engraulis* sp., *Mugil* sp., *Ophichthys* sp., *Opisthopterus tardoore* and *Pranesus pinguis* ($1/10m^3$) (Fig.17).

*Chirocentrus dorab, Engraulis grayi, Liza dussumieri Liza tade, Sardinella leiogaster, Saurida gracilis, Saurus* sp., *Stolephorus macrops*, *Stolephorus punctifer, Terapon jarbua, Thryssa dussumieri, Pellona ditchella* and *Pellona* are observed only postmonsoon. *Cynoglossus arel*, *Cynoglossus puncticeps*, *Sardinella* sp, *Escualosa thoracata*, *Engraulis encrasicolus* and *Secutor ruconius* are observed only during summer season. Eggs of *Leiognathus blochii, Sardinella longiceps, Ambassis commersoni, Secutor insidiator, Cynoglossus* sp. and *Carangoides malabaricus* are observed only during premonsoon season.

*Mugil cephalus*, *Sardinella fimbriata, Stolephorus tri* and *Sardinella gibbosa* are collected during postmonsoon and premonsoon. *Ophichthys* sp, collected during postmonsoon and monsoon. *Secutor ruconius* and *Setipinna breviceps* eggs are observed during postmonsoon and summer. *Stolephorus heterolobus* collected postmonsoon, premonsoon and monsoon. *Engraulis* sp and *Mugil* sp are observed during summer and monsoon, *Stolephorus indicus* and *Setipinna taty* eggs are observed during summer and premonsoon. *Opisthopterus tardoore*, *Pranesus pinguis* and *Liza* sp.eggs observed only during monsoon season.

The population of fish can be divided roughly among those that spawn in the monsoon, post monsoon, summer, pre-monsoon and year rounding spawning. Yet, maximum density and diversity of finfish eggs were observed during summer season which corresponding to the relative high temperature; pH and salinity may stimulate the coastal species to spawn during the present study. Water temperature did not seem to have any direct effect on the distribution of fish eggs although each species of fish prefers to have optimal temperature and time for spawning. Normally eggs are collected in large numbers in increasing temperature and salinity. Each species has a certain salinity range. Perhaps high salinity and temperature conditions may stimulate spawning activity in some coastal fishes as observed. The physico-chemical features of the estuarine environment were subjected to widely temporal variations Brinda *et al.* [5]. In addition, information can be obtained on the reproductive strategies adopted by these fish in response to the physical and biological processes of the region.

Distribution patterns among the eggs and larvae species arise from the synchronous reproductive activities of different species that are developed during evolutionary adaptation to geo-graphic and oceanographic conditions. The formation of fish eggs and larval assemblages are mainly influenced by the reproductive cycles of the adult fish populations. In addition, it is not unusual that several organisms may show variations from year to year on the magnitude of their population and also in the time of occurrence of maximum and minimum which is slightly earlier or later. Finfish eggs are collected throughout the year, Elbee *et al.* [6] concluded that the spawning period occurred over the whole year. The spawning period is extended from one season to another season Quasim *et al.*[7]. Regarding the distribution and abundance of fish eggs in the present study area, the families that appear most abundantly are Engraulidae, followed by Clupeidae, Cynoglossidae, Mugilidae, Carangidae, Ambassidae, Ophichthidae, Synodontidae, Teraponidae and Atherinidae and Chirocentridae.

The physico-chemical parameter of marine ecosystem plays a crucial role in the distribution and abundance of ichthyoplankton. Besides the influence of reproductive seasonality, aggregations of estuarine associated ichthyoplankton in the inshore zone have been allied to a number of physical and environmental factors Cowley *et al.* [8]. This may indicate spawning in previous seasons and therefore long pelagic life, or early spawning and rapid larval development Crossley *et al.* [9].

The spatial and temporal distribution patterns of ichthyoplankton are influenced by different physical factors Sanvicente *et al.* [10]. Cross-shelf differences in fish egg abundance were also expected as every neritic pelagic spawner has its own spawning location over the shelf or shelf break and found a strong correlation between mesozooplankton biomass and larval diversity support a relationship of larval diversity with mesozooplankton biomass Rodriguez *et al.* [11].

The maximum density of eggs was recorded during summer followed by pre-monsoon. The fishing holidays of east coast was declared during the summer season because, to avoid the catching of brooders and reduce disturbances during breeding. This may be good reason for a peak observation of fish eggs during summer. Pattern of distribution and abundance of fish eggs and larvae is associated with environmental factors and the environment may act either as a favorable factor for successful spawning by fish and survival during eggs and larval stages. The suitability of developmental stages in a spatial feature is a main characteristic of the life cycle of fish. For pelagic species the stability is related to hydrographic features.

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