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Seasonal abundance and composition of finfish and shellfish seeds inmangroves of Gangolli estuary, off south-west coast of India

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Abstract

The composition and seasonal abundance of the fin and shellfish seeds in mangrove areas of Gangoli estuary were studied for one year from January to December, 2013. Monthly day time sampling was conducted with a rectangular dragnet of 75 m^2 length having 5 mm mesh size. The mean monthly density was highest in January (Avg. of 12,996/haul) and lowest during May (Avg. of 859/haul). Thirty species of fish, four species of shrimps and two species of crabs belonging to 26 families were recorded during the study. *Ambasis sp.*, *Feneropenaeus indicus, Etroplus suratensis,Leognathus sp., Liza sp., Stolephorus vaganensis, Hemiramphus sp., Terapon sp.* and *Gerres sp.* were the most abundant species/taxa. A total of 10 commercially important species comprising *F. indicus, Etroplus suratensis, Liza sp., Gerres sp.,Siganus sp., Lutjanus russeli, Macrobrachium rosenbergii, Lutjanus argentimaculatus, Sillago sp. and Penaeus monodon* constituted 8.5 % (April, 2013) to 93.7% (October, 2013) with an average of 37.2% of the total fish and shellfish seeds. Higher Species diversity (H') and Species richness (D) was recorded during January.The result of the present investigation gives an insight of the abundance and seasonality of commercially important fish and shellfish seeds, which may facilitate the brackishwater fish farmers to exploit the seeds more pragmatically for their culture practice.

Key words

Estuary, Fish and shellfish seed, Mangrove, Seasonal abundance.

Introduction

Estuaries are among the most productive natural systems and are important nursery areas that provide food, protect from predation and valuable habit for many fish and shellfish species. The coastal areas in India which includes the deltaic mangroves and number of rivers and hundreds of coastal streams, yield valuable fin and shellfishes (Pushparajan *et al.,* 2012). It is well known that estuaries and brackishwater impoundments form nursery grounds for several economically important species of finfish and shellfish (Naik *et al.,*2009). Estuaries are important seed collection centres for most of the coastal aquaculture activities (Brinda *et al.,* 2010). These resources constitute fisheries of high magnitude in addition to supplying abundant seed for brackishwater aquaculture. Adequate availability of quality seeds in space and time is one of the prerequisites for proper management of their culture. The demands for fin and shellfish seed have increased considerably with growing utilization of coastal areas for brackishwater aquaculture. The seed requirement for existing brackishwater aquaculture practices in India is now being met from the seed produced at hatchery, as well as, from natural collections (Uptal and Mitra, 2013).

The brackish water finfish cage culture along Karnataka was initiated at Uppunda Village, Bhatkal, by Mangalore Research Centre of Central Marine Fisheries Research Institute (CMFRI) during 2008-09. After successful implementation of the technology, the culture practice is wide spread all along the coastal areas of Karnataka (Dineshbabu *et al.,* 2012). As there are no major hatcheries situated to produce brackishwater seeds along the west coast of India, the farmers are mainly dependent on the seeds produced from the hatcheries of East coast. Collection of fish seeds from wild become vital as the hatchery

produced seeds of few varieties will not be sufficient to meet the growing demand of brackishwater fish culture. Little information is available on distribution and abundance of commercially important fish and shellfish seed in the estuaries along the Karnataka coast. In this backdrop, the present study was planned as an initial step to study the seasonal abundance and composition of finfish and shellfish seeds in the mangroves of Gangolli estuary off west coast of India.

Materials and Methods

Gangolli estuaruary is located in Gangolli village, Kundapur taluk, Karnataka having an area of 30,700 m^2. The estuary is more dynamic in nature, become almost fresh during south-west monsoon (June-September) period due to influx of copious amount of freshwater through riverine flow. During post-monsoon (October - January) period, estuarine water is moderately saline while in the pre-monsoon season (February - May), it is almost similar to seawater due to reduced freshwater influx.

The present study was conducted for one year from January to December, 2013. Three stations were selected in estuary for collection of fish seeds (Fig. 1). Collection was done during low tide employing a drag net of 75 m length and 5mm mesh size having floats and sinkers respectively at the top and bottom of the net. Net was hauled through the bottom covering an area of 24 m^2. The sample collected was cleaned, sorted and segregated. Seeds were identified to species level (Fischer and Bianchi, 1984; Froese and Pauly, 2014), but in some cases it was confined to genus/family level. The temperature of surface water was recorded using standard mercury in glass thermometer. pH was measured using WTW Multi-parameter (Multi 350i) water analyser (Merck, Germany).Water sample was collected from all the stations for estimation of dissolved oxygen and salinity

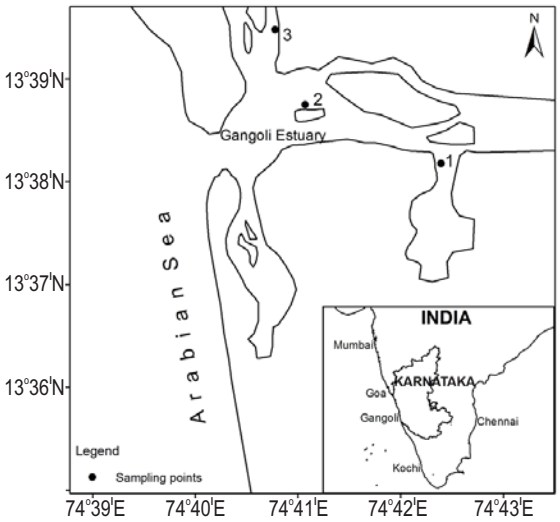

Fig.1.: Study area of Gangolli estuary, Karnataka and location of the sampling stations.

following standard method of APHA, (2012). Sampling was not done during the monsoon season (June-September), since the estuary was fully flooded with fresh water from the riverine run off. Statistical analysis such as species diversity, evenness and richness was carried out using PRIMER 6 package. Bray-curtis analysis of similarity was done to compare the seasonal similarity index (Field *et al.,* 1982).

Results and Discussion

During the one year study, a total of 54,509 individuals of fin and shellfish seeds were collected. Since there was not much difference in the abundance and composition of fin and shellfish seeds collected from different stations, the data was pooled and mean value was taken for seasonal variations. The mean monthly density was highest in January (Average of 12,996/haul) and lowest during May (Avg. of 859/haul). The sample collected constituted thirty representative species of finfish, four species of shrimps and two species of crabs from 26 families. The fish species diversity found in subtropical estuaries was lower than those found in tropical estuaries (Hoq and Islam, 2007). At par with the present study, 37 species/taxa were recorded from 27 families in the Sundarbans mangrove waters of Bangladesh (Hoq and Islam, 2007)

In the present study, peak abundance was found during late post-monsoon (November to December) and early pre-monsoon period (January to March). Many fish species spawn during south-west monsoon (June- September), which coincides with the arrival of postlarvae and juveniles into estuarine areas during late postmonsoon (November to December)/early premonsoon (January to March) after their planktonic phase. The seasonal variation of fish and shellfish seeds with high value during premonsoon has been reported from both western (Selvaraj *et al.,* 2005; Naik *et al*., 2009) and east coast (Hoq and Islam, 2007; Azhgar *et al*., 2009).

Individuals of 5 most abundant species/taxa group (*Ambasis sp., Fennropenaeus indicus, Etroplus suratensis, Leiognathus sp., and Liza sp.)* comprised almost 31.35 (April,) – 95.44% (February), with an average of 78.07% of the total number of specimens (Table 1). According to catch composition, contribution of *Ambasis sp.,* was maximum ranging from 2.49 to 70.31% with overall mean value of 39.33%. *Ambasis sp.,* a small weed fish are important prey species for higher consumers. Similar dominance of *Ambasis sp.,* in the surf zone and back waters of Cochin off South-west coast has been reported by Selvaraj *et al.*(2005).A total of ten commercially important species comprising *F. indicus, E.suratensis, Liza sp., Gerres sp., Siganus sp., Lutjanus russeli, Macrobrachium rosenbergii, Lutjanus ar gentimaculatus, Sillago sp. and Penaeus monodon* constituted 8.5% (April, 2013) to 93.7% (October, 2013), with an average of 37.2% of the total fish and shellfish seeds (Table 1). Although the sub tropical mangrove of estuarine system supports fewer species, it yields a higher proportion of species of commercial

Table 1.: Percentage (%) composition of fin and shellfish seeds collected in Gangolli estuary.

Species \ Months	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Overall average
Fish seeds									
Ambassis sp.	68.27	44.66	70.31	2.03	22.47	69.23	35.16	2.49	39.33
*Etroplus suratensis**	7.28	0.99	0.26	0.63	-	3.46	26.31	13.15	6.51
*Lutjanus russelli**	4.46	0.28	-	-	0.35	-	0.08	1.28	0.81
*Siganus sp.**	2.25	1.52	0.32	0.80	0.70	-	-	1.68	0.91
*Liza sp.**	1.60	0.70	1.47	2.20	32.95	4.23	3.23	0.56	5.87
Scomberoides sp.	1.60	0.07	-	-	-	-	0.63	-	0.29
Secutor insidiator	1.45	0.04	-	-	-	-	-	-	0.19
Platycephalus indicus	1.38	0.11	-	0.31	5.47	0.38	0.87	0.08	1.07
Terapon sp.	1.38	0.32	-	0.11	6.29	0.19	-	0.56	1.11
Platex sp.	1.32	-	-	-	-	-	-	-	0.17
Leiognathus sp.	0.92	1.13	1.62	26.30	2.68	5.96	7.64	1.04	5.88
*Lutjanus argentimaculatus**	0.37	0.18	-	0.29	1.28	0.10	0.24	0.88	0.42
Sphyraena sp.	0.18	0.25	0.21	0.06	0.81	-	-	0.08	0.20
Saurida sp.	0.15	-	0.08	-	-	-	1.50	0.32	0.26
Caranx sp.	0.12	0.29	0.48	4.27	1.51	-	-		0.83
Gobids	0.12	-	0.27	2.01	1.51	-	0.95	0.96	0.73
Stolephorus vaganensis	0.12	0.57	-	30.18	-	2.69	-	0.16	4.22
*Sillago sp.**	0.09	0.04	0.51	0.29	-	1.15	0.24	0.08	0.30
Batrichthys sp.	0.06	-	-	-	-	-	0.16	-	0.03
Apogon sp.	0.06	-	-	-	-	-	-	-	0.01
Lagocephalus sp.	0.03	-	-	-	0.23	-	-	0.08	0.04
Psettodes sp.	0.03	-	-	-	-	-	-	-	0.004
Scatophagus sp.	0.03	-	-	-	-	-	-	-	0.004
Hemiramhus sp.	-	0.39	1.42	0.06	14.90	0.48	0.24	-	2.19
Clupeids	-	0.32	0.16	-	-	-	-	-	0.06
*Gerres sp.**	-	0.04	0.52	1.63	0.35	3.56	1.97	0.64	1.09
Esculosa thoracata		-	-	2.90	-	-	3.94	-	-0.86
Hilsa sp.	-	-	2.18	25.55	4.70	-	-	-	3.95
Stolephorus waiti	-	-	0.32	-	0.58	-	-	-	0.11
Arius sp.	0.03	-	-	-	2.56	0.38	1.73	-	0.59
Shrimp seeds									
*Fenneropenaeus indicus**	5.82	47.96	16.52	0.46	-	0.19	17.57	75.38	20.49
*Macrobrachium sp.**	0.18	0.14	0.19	2.15	-	2.98	0.16	-	0.73
Metapenaeus monoceros	-	-	0.24	0.88	-	-	0.16	-	0.16
*Penaeus monodon**	-	-	-	-	-	0.10	-	-	0.06
Crab seeds									
Scylla sp.	0.09	-	-	-	1.28	0.58	0.63	0.08	0.33
Portunus pelagicus	0.61	-	0.21	0.06	-	-	0.55	0.48	0.24

* Commercially important fin and shellfish seeds.

importance (Morton, 1990). This is evident from the present study, where about 37.2% of the abundant species were of commercial importance. Similar abundance of about 25% of commercially important fish species was reported from Sundarbans mangrove area (Hoq and Islam, 2007).

The species diversity (H') values ranged from 0.99 to 1.22 (Table 2). Minimum value was recorded during February and maximum during January. The values in the present study was found to be lower than the values (2.07 to 3.21) reported for finfish seeds from Point Calimere and Muthupettai, South east Coast of India (Srilatha *et al.,* 2013) and for shrimp seeds (2.49 to 2.71) in Pichavaram mangroves south east Coast of India (Pushparajan *et al.,* 2012). Species richness (D) varied from 3.25 to 4.81 (Table 2). Minimum was observed during March and maximum during January. The values were found to be higher than the values (0.72 to 0.836) reported by Srilatha *et al.,* (2013) for fish seeds from Point Calimere and Muthupettai, South east Coast of India and Pushparajan *et al.,* (2012) for shrimp seeds (0.78 to 0.81) from Pichavaram mangroves south-east coast of India. Species evenness (J') values ranged from 0.75 to 0.91 (Table 2). Minimum value was recorded during February and maximum during May. Similar species evenness values were reported by Srilatha *et al.,* 2013 (0.86 to 0.96) for fish seeds from Point Calimere and Muthupettai, South East Coast of India and Pushparajan *et al.,* (2012) (0.80 to 0.89) for shrimp seeds from Pichavaram

Table 2.: Diversity indices

Months	Species (S)	Species richness (Margalef) (d)	Pielou's evenness (J)	Shannon Weiner H'(log10)
Jan	30	4.81	0.82	1.22
Feb	21	3.61	0.75	0.99
Mar	19	3.25	0.81	1.04
April	20	3.52	0.85	1.11
May	18	3.71	0.91	1.14
Oct	18	3.28	0.85	1.07
Nov	22	3.87	0.86	1.15
Dec	20	3.67	0.80	1.04

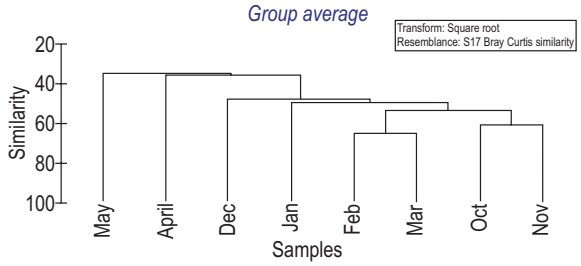

Fig.2.: Bray Curtis similarity index.

mangroves, south-east coast of India. No significant seasonal variation in abundance was shown by most of the fish and shell fish species in the Gangolli estuary. *Ambasis sp., Liza sp., and Leiognathus sp.,* were presented during all the months; whereas *F. indicus, E. suratensis, Platycephalus indicus, L. argentimaculatus* and *Gerres sp*., were present during seven months out of eight months study period. *Scombroides sp., Secutor insidiator, Platex sp*., *Batrichthys sp., Apogon sp., Lagocephalus sp., Psettodes sp*. and *Scatophagus sp*. were present only during one or two months and most of their abundance were restricted to January/February.

Seasonal similarity index was noticed during February/March and October/November (Fig. 2), when Bray-Curtis similarity analysis performed. Similarity of species composition and abundance during different months ranged from 26.14 to 65.22%. Maximum similarity of more than 60% was observed between Feb-Mar and Oct –Nov. These months formed two clusters to which the other months got linked. Similarity coefficient is extensively used to find the degree of relationship (in species composition and abundance) on spatio-temporal scale (Clarke, 1999). Cluster analysis (or classification) is helpful in finding natural groupings of samples, such that samples within a group are more similar to each other than samples in different groups. In the present study, it was used to delineate seasonal similarity in seed abundance in the study area.

Water temperature, pH, dissolved oxygen and salinity ranged between 28.8 (January) and 32.7 °C (May); 7.24 (October) and 7.78 (May); 3.75 (May) and 5.24 mgl^{-1} (February) and 1.77 (October) and 31.13ppt (May), respectively. Except dissolved oxygen (r=0.71, p 0.05), all the hydrographical parameters failed to show any correlation with the seasonal abundance of fish and shellfish seed. However, higher abundance and species diversity of the fish and shellfish seeds coincided with the low temperature and moderate salinity recorded during January.

Fish and shellfish seeds are one of the essential requirements for culture system. The result of the present investigation, carried out in the mangrove areas of Gangolli estuary off south-wast coast of India, gives an insight of the abundance and seasonality of commercially important fish and shellfish seeds. This may facilitate brackishwater fish farmers to exploit the seeds more pragmatically for culture practice.

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