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Diversity and seasonal variation of fish assemblages associated with trawl catches from southeast coast of India

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HIGHLIGHTS

- Points out the finfish assemblages of trawl catch in Cuddalore and Parangipettai.
- Indicates the seasonal variation in fish abundance.
- Increased number of reef associated fishes indicates the presence of reef patches.
- Fish ban period increasing the fish production by spawning.

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ABSTRACT

In the present study, the fish assemblage data of trawl catches were recorded from January 2009 to December 2010 in Cuddalore and Parangipettai, southeast coast of India. The main objective of the present study was to describe and compare the species assemblages, seasonal variation in the diversity of fin fish populations from two adjacent coastal regions. Totally 123 species of fishes belonging to 13 orders, 49 families and 82 genera were recorded from 44 hauling of otter trawls. In both the regions, family wise contribution of fish assemblages revealed that the family Leiognathidae were found to be dominant followed by Engraulidae, Clupeidae and Carangidae with maximum species ranging 7 to 10 species followed by Sciaenidae, Lutjanidae, Mullidae, Synodontidae, Terapontidae, Gerreidae, Siganidae, Bothidae and Cynoglossidae with 3 to 6 species. In the present study various diversity indices were calculated, the minimum diversity values were recorded during summer and monsoon seasons and the maximum values were recorded during premonsoon season in both the regions during the study period. This data clearly indicates that the seasonal variation in fish abundance with a noticeable decrease in the catch during the summer season.

1. Introduction

The trawl fishery resources in tropical coastal areas of Asia consist of highly diverse and multi-species complexes (Longhurst and Pauly, 1987). These fisheries cannot be managed on the assumption of single target species. Therefore, managing the fisheries requires a thorough understanding of the biological assemblage structure. An assemblage is operationally defined as the species available in the same place at the same time (Fauth et al., 1996). Ecological analysis of assemblage structure, since its early application based on the vegetation ecology, has become increasingly important in the management of marine resources (McManus, 1997).

Assemblage analyses can assist in defining "Assemblage Production Units" (Tyler et al., 1982), which can be used as the basis for assigning particular parts of the fishery to specific groups of fishers, gear types and harvest pressures (McManus, 1997). In addition, these analyses can provide a better understanding of the fundamental patterns of species abundances within harvested ecosystems, also assist in identifying the effects of fishing and contribute to developing models to understand the structure of ecosystems (Suvavepun, 1991; McManus, 1997). Catches in commercial fisheries landings have been in decline since 1980s (Watson and Pauly, 2001; FAO, 2002; Worm et al., 2005), leading to growing global concerns about the state of fish resources. According to the FAO, 75% of fisheries are fully exploited, over exploited, severely depleted, or in recovery (FAO, 2002). The effect of such overexploitation on the marine ecosystem has come under increasing scrutiny in recent years.

In India, trawl fishery have contributed foremost part of the total marine fish production (Srinath, 2003). Trawl fisheries sector

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account for more than 50% of the marine fisheries production of India. The annual average fish landing from trawlers was recorded as 17,21,000 t (2008–2011), which formed around 51% of the marine fish landing of the coast. Of which about 51% of the catch was contributed by the west coast and remaining 49% by the east coast of India (Dineshbabu et al., 2013). Most of studies regarding the trawl fisheries are carried out in the west coast of India (Bijukumar and Deepthi, 2009; Sajeevan and Nair, 2006; Sajeevan and Somvanshi, 2013; Sirajudheen and Biju Kumar, 2014). In the east coast only a few studies are available (Ajmal Khan et al., 2008; Murugesan and Purusothaman, 2011; Murugesan et al., 2012; Yedukondala Rao et al., 2013; Ramu et al., 2015). Hence, the present study mainly focussing the diversity and seasonal variation of fish assemblages associated with the trawl catches along Cuddalore and Parangipettai coast.

2. Materials and methods

Fishes were collected once in a month by an otter trawl with a mouth width of 8.5 m and cod end mesh size of 20 mm during January 2009–December 2010 along Cuddalore (Lat. 11° 43′N; Long. 79° 49′E) and Parangipettai (Lat. 11° 24′N; Long. 79° 46′E) (Fig. 1) coast. On each sampling occasion, the net was towed at an estimated speed of 2.78 km h^{-1} (1.5 knots) for 1 h at depth level ranging between 5 and 35 m, thus covering a swept area of 0.0243 km^2 for 75 min tow. Although this method has a disadvantage of underestimating the true fish biomass since many larger and adult fin fishes are less susceptible to otter trawls, this method of sampling yielded a fairly consistent results in terms of species occurrence, abundance and diversity. Each area was sampled once in a month and altogether 44 trawl samples (22 samples in 11 months at each transect) were taken. As the fishing ban was imposed during the month of May, samples were not collected in that month. Stratified multi-stage random sampling of bycatch (Bijukumar and Deepthi, 2009) was followed from each of the trawl catch per month. After washing, each fish species was sorted, counted and measured for standard length and total length to the nearest 0.1 cm using a fish measuring board and total weight was recorded to the nearest 1 g using electronic balance. Fish samples were brought to the laboratory in ice boxes and preserved in 10% neutralized formalin. All the diversity indices and multivariate analyses were performed using PRIMER (Version 6.1.5) statistical software (Clarke and Warwick, 2001). For the sake of convenience, a calendar year was divided into four seasons namely monsoon (October–December), post-monsoon (January–March), summer (April–June) and pre-monsoon (July–September).

3. Results and discussion

3.1. Fish assemblages

Totally 123 species of fishes were collected from Cuddalore and Parangipettai during January 2009–December 2010 in the 44 hauling of otter trawls carried out (Table 1). This constitute 32,412 nos. of fishes belongs to 13 orders, 49 families and 82 genera. Of this, 60 species were commonly found in both the regions which accounted for more than 50% of the total catch in these areas. Almost similar result was reported by Sirajudheen and Biju Kumar (2014), they recorded 138 species belonging to 14 orders 67 families and 108 genera in trawl catch of the Neendakara fishing harbour of Kerala. But Yedukondala Rao et al. (2013) recorded 67 species of finfish belonging to 51 genera in Visakhapatnam. And Ramu et al. (2015) recorded 95 species belonging to 42 families and 59 genera along the coastal line of Nagapattinam. Hence the present study indicates that these two study areas are rich in biodiversity of finfishes.

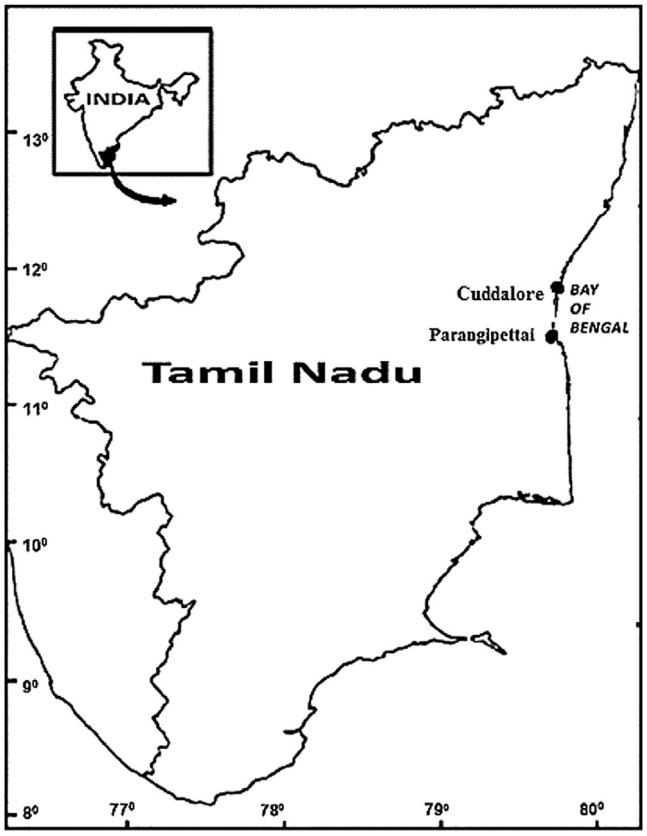

Fig. 1. Map showing study areas of Cuddalore and Parangipettai.

During January–December 2009, in Cuddalore a total of 7557 nos. of fishes which constitute 84 species, 60 genera and 37 families were collected from 11 trawl samples. And in Parangipettai, a total of 7763 numbers of fishes belonging to 78 species, 60 genera and 40 families were collected from 11 trawl samples. The finfish assemblages in Cuddalore was dominated by members of the family Leiognathidae (34.6%) followed by Engraulidae (17%), Clupeidae (6.6%) and Carangidae (5.2%). Whereas in Parangipettai it was dominated by the family Leiognathidae (34%) followed by Engraulidae (10.4%), Clupeidae (9.7%) and Carangidae (9.4%). Other families like Arridae, Trichiuridae, Sciaenidae, Sillanginidae, Lutjanidae, Haemulidae, Terapontidae, Mullidae, Gerreidae and Synodontidae contributed less than 5% to the total abundance in both the regions.

During January–December 2010, in Cuddalore a total of 8853 nos. of fishes belonging to 93 species, 66 genera and 38 families were collected. In Parangipettai, a total of 8244 numbers of fishes belonging to 74 species, 56 genera and 39 families were collected. In Cuddalore, among the family, Leiognathidae was found to be dominant (23.8%) followed by Engraulidae (15.7%), Clupeidae (8.2%) and Carangidae (7.8%). Whereas in Parangipettai, the finfish assemblages was dominated by members of the family Leiognathidae (31.2%) followed by Engraulidae (11.4%), Clupeidae (8.4%) and Carangidae (7.5%). But the families like Arridae, Trichiuridae, Sciaenidae, Terapontidae, Sillanginidae, Haemulidae, Gerreidae, Mullidae, Cynoglossidae and Synodontidae contributed less than 5% to the total abundance in both the areas.

Family wise contribution of fish assemblage in both the regions revealed that the family Leiognathidae was the dominant group followed by Engraulidae, Clupeidae and Carangidae with 7–10