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DIVERSITY OF REEF FISHES IN HOOK AND LINE FISHERY AT MANDAPAM, GULF OF MANNAR, SOUTH-EAST COAST OF INDIA

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Introduction

The coral reef ecosystem of Gulf of Mannar supports a wide spectrum of flora and fauna of taxonomic and economic importance. Among the fauna, finfishes form a dominant component and different types of fishing practices are going on in this ecosystem. Hook and line landings at Mandapam fish landing centre is seasonal which took place from October-November to April-May as Gulf of Mannar remains rough during the other months. Eventhough some studies have been carried out on hook and line fishery in south-east coast of India (Menon *et al.*,1993; Radhakrishnan *et al.*, 2016; Durai *et al.*, 2011), a systematic study on this fishery on reef fishes alone from Mandapam was not reported earlier. Hence, an attempt is made here to study the diversity of reef fishes landed by hooks and lines at Mandapam from Gulf of Mannar.

Material and methods

Fortnightly samples were collected from Mandapam fish landing centre (Long.79° 8'; Lat 9°15') landed by hooks and lines from Gulf of Mannar (GOM), for a period of four years from October, 2008 to May, 2012. For sampling, stratified multistage random sampling developed by Central Marine Fisheries Research Institute was followed. The area of the GOM under the Indian EEZ is about 15000 sq. km., where commercial fishing takes place in about 5500 sq. km. The fishes landed were identified up to species level using standard books. The weight as well as numbers of each species landed was estimated. Specieswise, familywise, monthwise and yearwise catch data was generated and analysed. Conventional diversity indices like Shannon diversity index (H' loge), Margalef's richness index (d), Pielous evenness index (J'), and Simpson index (1-Lambda') were derived to understand the fish diversity in different years. To compare the diversity between the years, dominance plot was drawn. The data were fourth root transformed before the computation of diversity indices, similarity and cluster analysis. The similarity in species composition was studied by calculating the Bray-Curtis coefficient. The similarity matrices were constructed and the similarity is 100% if the two samples are totally similar while it is 0 if the two samples are totally dissimilar. In the cluster analysis, hierarchical agglomerative clustering, the Bray-Curtis similarity was used to construct the map. New diversity indices have statistical support to compare the biodiversity within different years and it was derived by using taxonomic diversity index (Δ), average taxonomic distinctness index (Δ^+), and variation in taxonomic distinctness (λ^+) as per Clarke and Warwick, 2001. To find out the deviation from the normal distribution and to test the variance between the samples Δ^+ and λ^+values were used for plotting the 95% funnel plots. All the univariate and multivariate analyses for the diversity profile were done using the PRIMER (v.6) software (Clarke and Gorley, 2006).

Results

Qualitative and quantitative abundance

32 species of reef fishes belonging to 17 genera under 14 families were recorded during the study period. Among the families, Sphyraenidae formed the maximum with a share of 46% followed by Carangidae with 32% (Fig. 1).

Specieswise composition indicated the dominance of *Sphyraena barracuda* (42%) followed by *Caranx heberi* (15%), *Scomberoides tol* (13%), *Lethrinus nebulosus* (9%) and rest of the species contributed only less than 5% each (Fig. 2).

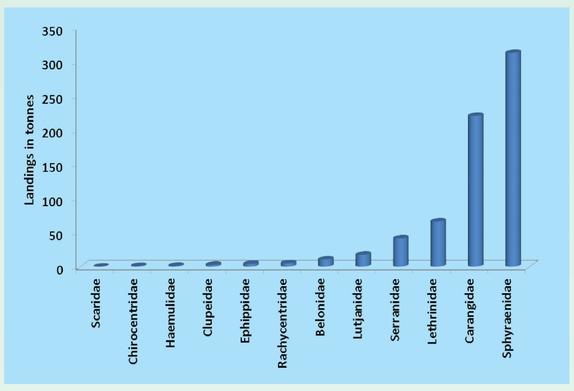

Fig. 1. Familywise reef fish landings during the study period

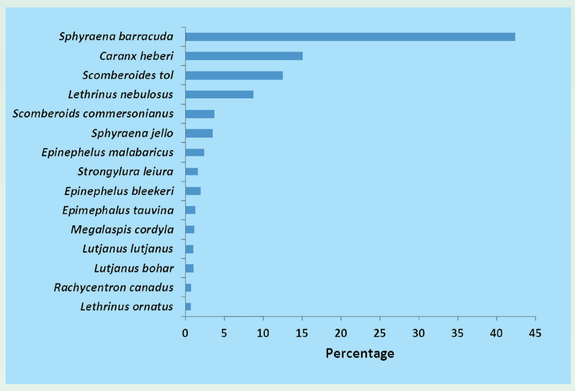

Fig. 2. Specieswise composition of reef fishes during the study period

Yearwise landings indicated an average of 171 tonnes per year during the study period with a maximum of 295 t. during 2008-09. Afterwards it showed a decline and remained almost steady during the rest of the study period (Fig. 3).

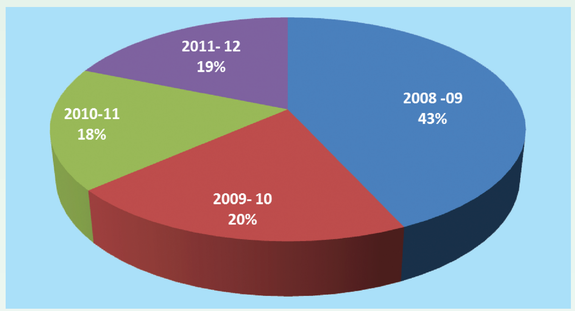

Fig. 3. Yearwise landings of reef fishes during the study period

Biodiversity

The diversity indices along with some attributes of community structure of reef fishes in different years are given in Table 1.

Table 1. Diversity indices and taxonomic attributes during the study period

	S	N	d	J'	H'(loge)	1-Lambda'	Delta	Delta+	Lambda+
2008-09	25	183.86	4.60	0.94	3.04	0.95	48.20	51.56	132.77
2009-10	17	130.39	3.29	0.98	2.77	0.94	43.73	46.32	104.95
2010-11	18	120.38	3.55	0.95	2.74	0.93	48.16	50.65	144.82
2011-12	21	155.79	3.96	0.97	2.94	0.95	47.61	51.03	116.66

The Shannon- Wiener's diversity index (H') which is the most commonly used diversity measure showed slightly higher value during 2008-09 which indicate that species composition was slightly different in this year than the rest of the years. The Margalef's Richness index (d) which incorporates the number of individuals (N) and species number (S) also showed higher value during 2008-09. The equitability or Evenness index (J') which expresses the evenness of distribution of individuals among the different species did not show much variation and the values ranged from 0.94 to 0.98.

In the dominance plot, the curve for 2008-09, which lies on the lower side, extends further and rises slowly due to the presence of more number of species when compared to rest of the years (Fig. 4). Since the percentage contribution of each species is added, the curve extends horizontally along with species numbers in the x-axis before reaching the cumulative 100%.

The similarity in species composition and abundance among different years as derived from Bray-Curtis similarity matrix (Table 2) indicated that the maximum similarity of 75% was between 2009-10 and 2011-12 and the similarity was found to be the minimum (65%) between 2009-10 and 2010-11.

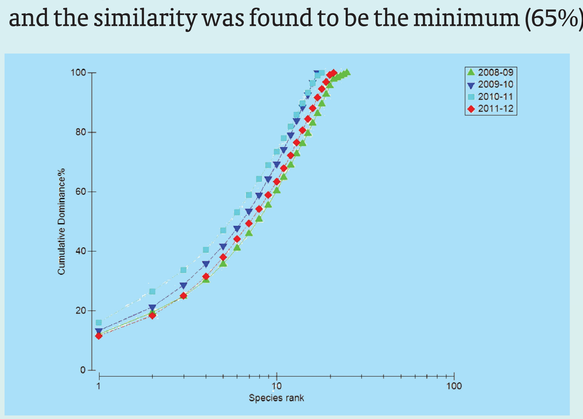

Fig. 4. Dominance plot of reef fishes landed during the study period

Table 2. Bray-Curtis similarity of reef fishes landed in different years

	2008-09	2009-10	2010-11	2011-12
2008-09				
2009-10	71.47			
2010-11	69.38	64.77		
2011-12	71.41	75.44	71.88	

The dendrogram (Fig. 5) revealed the separate grouping similarity in species composition and abundance of different years. The years 2009-10 and 2011-12 formed a group with the maximum similarity percentage of 75 and other years got linked to them at different levels of similarity percentages.

The degree to which species in a sample are taxonomically related to each other can be measured using the newly introduced biodiversity indices namely, average taxonomic distinctness (Δ^+) and variation in taxonomic distinctness (λ^+). The average taxonomic distinctness was found to be the minimum during 2009-10 and maximum during 2008-09. This indicates that more closely related species are available during 2009-10 while the taxonomic distance between species was the highest during 2008-09.

In the funnel plot of Δ^+ against number of species (Fig. 6), only 2009-10 falls outside the confidence funnel but very near to the funnel and majority of the points are within the expected limits which indicate that the fish diversity between the years is not statistically significant.

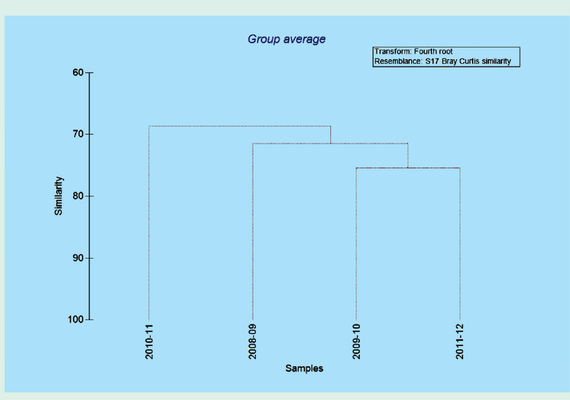

Fig. 5. Dendrogram of reef fishes landed in different years

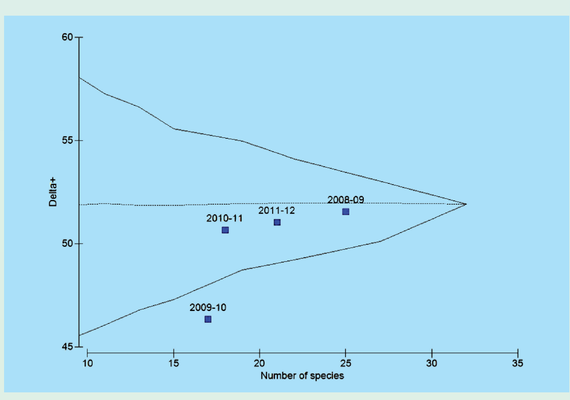

Fig. 6. Funnel plot for average taxonomic distinctness (Δ^+) showing the diversity of fishes in different years and its deviation from the normal distribution

The variation in taxonomic distinctness (λ^+) ranged between 104.95 in 2009-10 and 144.82 in 2010-11 which indicate the divergent range in taxonomic distances between pairs of species in different years (Fig. 7). Hence, the unevenness of the taxonomic tree structure was greater during 2010-11 when compared to that of other three years. As all the values of λ^+ lies inside the funnel plot, it is assumed that they are within the expected limit.

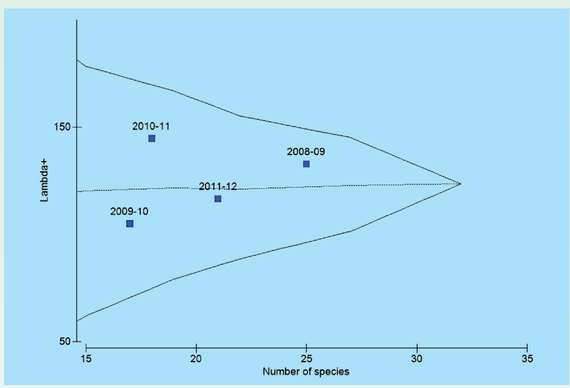

Fig. 7. Funnel plot for variation in taxonomic distinctness (λ^+) in different years

Conclusion

The hook and line fishery at Mandapam indicated that 50% of the fishes landed were reef fishes. 32 species of reef fishes belonging to 14 families were landed and among them *Sphyraena barracuda* contributed the maximum (42%). The diversity index (H') was the highest during 2008-09 and the evenness of distribution of individuals among the different species did not show much variation in different years. The maximum similarity in species composition and abundance was between 2009-10 and 2011-12. The funnel plots of average taxonomic distinctness (Δ^+) and variation in taxonomic distinctness (λ^+) indicated that the values in most of the years are within the expected limits.

References

Clarke K. R. and R. N. Gorley. 2006. *PRIMER v6. User Manual*. 1st edition. PRIMER-E Ltd., Plymouth, UK.

Clarke K. R. and R. M. Warwick. 2001. *Changes in marine communities: An approach to statistical analysis and interpretation*, 2nd edition, PRIMER – E Ltd., Plymouth, 112 p.

Durai V., N. Neethiselvan, B. Chrisolite and B. Sundaramoorthy. 2011. Longline selectivity and fishing pressure on the fishery of *Lethrinus elongatus* off Thoothukudi coast. T*amilnadu J. Veterinary & Animal Sciences* 7 (3): 137-143.

Menon Gopinatha N., P. Bensam and K. Balachandran. 1993. Hooks and line fishery resources of India. In: National Workshop on low energy fishing, CIFT, p. 30-38.

Radhakrishnan K., M. Kalaiarasan, M. S. Madan, P. N. Ananth, T. Umamaheswari and R.Velmurugan. 2016. Economic analysis of the Hook and Line fishery in Kombuthurai coast, Tamil Nadu. *Current World Environment*, 11 (3): 926 - 933.