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Trophic Level of Fishes Associated in the Trawl Bycatch from Parangipettai and Cuddalore, Southeast Coast of India

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ABSTRACT

Usage of trawl nets has been perceived as one of the major threats to marine biodiversity and to the sustainability of marine fisheries. In the present study, trophic level of fishes associated with bycatch of bottom trawling off Parangipettai and Cuddalore were studied. Stratified random sampling method was followed from each trawl and fish species collected were identified to species level. As many as 46 species in Parangipettai and 51 in Cuddalore waters were recorded. Among them, demersal and reef associated species were found to be dominant groups in both the regions. As regards trophic level (Trl), species accounting for 37% (17 species) in Parangipettai and 40% (20 species) in Cuddalore waters belonged to the trophic level 3.0-3.49 followed by 23.9% (Parangipettai) and 31.3% (Cuddalore) to 4.0-4.5. The number of species recorded in other trophic was less in both the coasts. Diversity indices paralleled the trend of maximum percentage of species recorded in the trophic levels. In all the trophic levels, juveniles (below 15 cm) were landed in large proportions in the trawl bycatch. Reduction of fishing pressure and use of bycatch reduction devices are suggested for the conservation and better management of marine fisheries in the Southeast coast of India.

Key words: Trophic level, diversity, bycatch, demersal fishes, length class distribution, southeast coast of India

INTRODUCTION

Trophic Level (TrL) expresses the position of an organism within the food web that largely determines the state of an ecosystem (Pauly and Palomeres, 2000). This is particularly relevant in the context of rapid climate change which resulted in changes in the distribution of marine organisms in general and top predators such as fishes in particular (Perry *et al*., 2005). The structure and function of marine ecosystem respond drastically to inter-annual changes and inter-decadal climatic variations (McGowan *et al*., 1998). The trophic level for marine organisms ranged between 2 (for herbivores/detritivores) and 5 (for predators of marine mammals) which explains the relative position of an animal in the food web that nourish them (Pauly *et al*., 2002).

The sensitivity of different Trophic levels (TrL) of anthropogenic stress and climatic variations has important implication in the smooth functioning of pelagic ecosystems and may propagate the ecological interactions through the food web (Edwards and Richardson, 2004; Litzow and Ciannelli, 2007). The quality and quantity of food are directly affecting the growth and indirectly the maturation and mortality in fishes (Wootton, 1990). The estimation of trophic level is also very

useful in quantifying the effects of fishing on marine ecosystems because it allows development of new approaches to the analysis of marine food webs. Escobar-Sanchez *et al.* (2011) studied that the nitrogen isotope values showed no differences in the trophic level. Gradual decline in the fish landings is significant in the eastern north and central Atlantic, Southeast Pacific, Mediterranean Sea and Black Sea (Caddy and Garibaldi, 2000). Yen *et al.* (2008) studied the spatial distribution of fish species catches in relation to catchment and habitat features in the floodplain lot fisheries of Tonle Sap Lake, Cambodia.

Due to the unprecedented expansion of fishing along the Indian coast, fish landings were increased by more than five times (Srinath, 2003). In the wake of above, changes in trophic level are widely used in monitoring the sustainability of marine fish catches and in realizing the impact of fishing on marine ecosystems. Though many works have been undertaken in foreign waters, only a minimum number of studies have been done in Indian waters. Very recently Vivekanandan *et al.* (2009) studied on the trophic level of fishes occurring along the Indian coast. Bijukumar and Deepthi (2009) studied the mean trophic index of fish fauna of Southwest coast of India. There is pressure of indiscriminate catch of all varieties of fish throughout the year resulting in decline in fish biodiversity and annual yield of fish from the floodplain lakes of Eastern India (Mondal and Kaviraj, 2009). Considering the above, in the present study an extensive survey was made to study the trophic level of fishes occurring in the trawl bycatch collected off Parangipettai and Cuddalore.

MATERIALS AND METHODS

Fishes were collected at monthly intervals from the trawl by-catch landed in Parangipettai (Lat. 11°24' N; Long. 79°46' E) and Cuddalore coastal waters (Lat. 11°43' N; Long. 79°49' E) (Fig. 1) during February 2009 to January 2010. Stratified random sampling from each of the trawl catch was followed. In the present study, each fish species collected in the trawl bycatch was identified up to species level following the keys available in FISH BASE (Froese and Pauly, 2007), FAO species identification sheets (Fischer and Bianchi, 1984) besides standard books (Talwar and

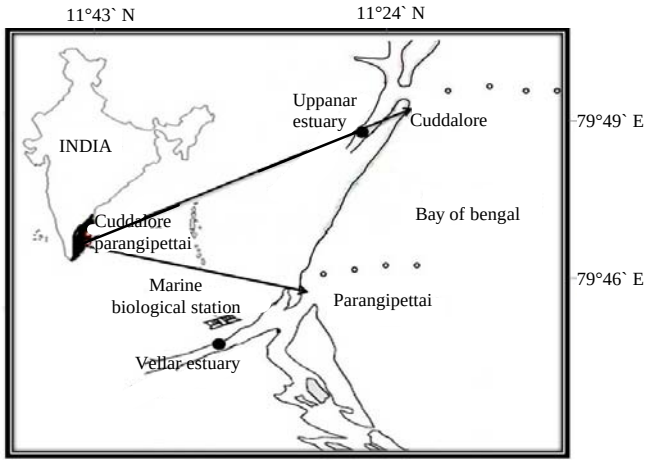

Fig. 1: Map showing the study area

Kacker, 1984). Further, the specimen was measured for standard length and total length to the nearest 0.1 cm using measuring board and weighed individually to the nearest 0.01 g using electronic balance. Diversity indices namely species diversity, richness and evenness for the fishes at each trophic level were calculated using PRIMER Ver. 6 Software (Clarke and Warwick, 2001).

For trophic level study, data on adult fishes alone were taken into account for analysis and the data on trophic level were collected by using Fish Base software (www.fishbase.org) (Nieto-Navarro *et al.*, 2010). The primary producers (i.e., plants) and detritus are assigned as fundamental trophic level 1. Data on trophic levels given in Fish Base are based on the estimation on diet composition data by following the equation proposed by Christensen and Pauly (1992):

$$TL_i = 1 + (DC_{ij} TL_i)$$

where, Tl_i is the trophic level of species i, Dc_{ij} is the proportion of prey species j is the diet of species i and TL_j is the trophic level of prey species j.

RESULTS

The list of fishes and their trophic levels including size range and habitat recorded at Parangipettai and Cuddalore coasts. Altogether 62 species of fishes were recorded in Parangipettai and Cuddalore coasts. In Parangipettai, as many as 46 species of finfishes belonging to 12 orders, 29 families and 40 genera were recorded in the trawl bycatch. Of this, 15 species were demersal, 14 were reef associated, 10 were pelagic and 7 were bathypelagic. In Cuddalore, 51 species belonging to 10 orders, 26 families and 37 genera were recorded. Of 51, 18 belonged to demersal, 17 to reef associated, 9 to pelagic and 7 to bathypelagic (Table 1).

In Parangipettai, the trophic level 3.5-3.99 was represented by maximum species (17 species) accounting for 37% of the total and the level 2.00-2.49 by the minimum species (2 species) while in Cuddalore waters, as an oddity, the trophic level 3.0-3.49 constituted the maximum species with 20 species (40%) and the levels 2.0-2.49 and 2.5-2.99 by the minimum with 2 species each. This indicates that 68%, represented by 30 species and 70% by 36 species, showed dominant in the trophic level of 3.0-3.99 (midlevel carnivores) in Parangipettai and Cuddalore water, respectively. The result of length-class distribution of fishes in each revealed that, among the trophic levels, 3.5 and above registered more number of species with the size 15 cm and below in both the waters. Minimum number of species recorded in trophic level 3.49 and below. Similarly, the length class 20 cm and its above registered less species (Table 2).

List of frequently occurring species recorded at each trophic level in the trawl bycatch is presented in Table 3. In Parangipettai, *Sardinella longiceps* (97.3%) and *Siganus javus* (2.6%) were found to be the most frequent species in the trophic level 2.0-2.49; *Secutor insidiator* was found to be dominant with 95.5% and *Anodontostoma chacunda* with 4.4% in 2.5-2.99; out of 13 species recorded in trophic level 3.0-3.49, *Leiognathus brevirostris* (32.3%), *Leiognathus bindus* (18.0%), were the most abundant species. Of 17 species recorded in trophic level 3.5-3.99, *Stolephorus indicus* (41.0%), *Upeneus vittatus (*15.6%) were found to be the most frequenters. Of 11 species in the trophic level 4.0-4.5, *Caranx ignobilis* (28.3%), *Trachinocephalus myops* (20.6%) were the most abundant species.

In Cuddalore, *Sardinella longiceps* (89.5%) and *Siganus javus* (10.4) were found to be the most frequent species in the trophic level 2.0-2.49; *Secutor insidiator* with 95.4% and *Sardinella gibbosa* with 4.5% came in 2.5-2.99; out of 20 species in trophic level 3.0-3.49, *Stolephorus insularis*

Table 1: List of fishes and their trophic levels, size range and habitat recorded in the trawl bycatch in Parangipettai and Cuddalore coastal waters

Name of the species	Size range recorded (cm) Parangipettai	Size range recorded (cm) Cuddalore	Max size (cm)*	Habitat*	Trophic level*
Class: Elasmobranchii					
Order: Torpediniformes					
Family: Narcinidae (Electric rays)					
Narcine brunnea	7.1-8.5	6.8-7.5	22	D	3.1
Order: Rajiformes					
Family: Dasyatidae (Sting rays)					
Himantura imbricata	16.5-17.3	-	140	D	3.6
Class: Actinopterygii					
Order: Anguilliformes					
Family: Congridae (Conger eels)					
Anguilla bengalensis	12.4-37.5	13.5-35.6	120	BP	3.6
Conger cinereus	15.4-40.3	-	103	RA	4.4
Order: Clupeiformes					
Family: Engraulidae (Anchovies)					
Stolephorus indicus	3.5-11.2	2.1-9.7	15	P	3.6
S. insularis	3.8-7.8	3.4-9.8	10	RA	3.2
Thryssa mystax	8.0-12.3	7.2-11.1	15	P	3.6
T. setirostris	-	9.5-10.4	18	P	3.3
Encrasicholina punctifer	-	5.4-9.3	13	RA	3.3
E. heteroloba	-	4.8-10.2	14	RA	3.3
Family: Clupeidae (Sardines, Shads)					
Anodontostoma chacunda	7.0-9.5	-	26	P	2.8
Dussumieria acuta	12.3-17.5	6.8-12.5	20	P	3.4
Escualosa thoracata	7.2-8.8	7.5-9.1	10	P	3.2
Ilisha megaloptera	3.1-9.7	4.5-8.3	28	P	3
Sardinella fimbriata	4.7-12.1	-	13	P	2.7
S. gibbosa	-	5.2-16.7	20	RA	2.8
S. longiceps	7.6-18.4	6.4-15.7	23	P	2.4
Order: Siluriformes					
Family: Ariidae (Sea catfishes)					
Arius arius	12.4-28.1	9.8-18.6	40	D	3.4
Order: Aulopiformes					
Family: Synodidae (Lizard fishes)					
Saurida tumbil	4.5-18.0	5.6-15.5	60	RA	4.4
Trachinocephalus myops	7.2-17.7	6.5-14.3	40	RA	4.4
Order: Gadiformes					
Family: Bregmacerotidae (Codlets)					
Bregmaceros mcclellandii	5.7-7.5	-	11	P	3.3
Order: Gasterosteiformes					
Family: Syngnathidae (Seahorse)					
Hippocampus kuda	7.8-9.1	-	30	RA	3.7
Family: Fistulariidae (Pipe fishes)					
Fistularia commersonii	6.2-13.4	5.9-14.2	160	RA	4.3
Order: Scorpaeniformes					
Family: Platycephalidae (Flat heads)					

Table 1: Continued

Name of the species	Size range recorded (cm) Parangipettai	Size range recorded (cm) Cuddalore	Max size (cm)*	Habitat*	Trophic level*
Grammopolites suppositus	-	6.1-16.4	25	D	3.8
Platycephalus indicus	5.7-14.9	-	100	RA	3.6
Order: Perciformes					
Family: Sillaginidae (Whitings)					
Sillago sihama	-	7.5-14.5	30	RA	3.4
Family: Carangidae (Jacks, Kingfishes)					
Alectis ciliaris	-	5.6-8.9	150	RA	4.1
Caranx ignobilis	6.2-10.1	-	170	RA	4.2
Decapterus macrosoma	4.3-14.3	5.6-14.7	35	RA	3.4
Family: Leiognathidae (Pony fishes)					
Leiognathus bindus	2.2-5.5	2.8-6.4	11	D	3
L. blochii	-	2.8-10.5	13	D	3
L. brevirostris	3.1-8.2	3.5-9.1	11	D	3
L. daura	-	5.3-11.2	14	D	3.2
L. dussumieri	-	6.2-10.5	28	D	3.2
L. fasciatus	-	3.5-8.3	21	D	3.3
Secutor insidiator	2.1-7.6	1.6-5.8	11	D	2.8
Gazza minuta	1.5-6.8	-	170	RA	4.2
Family: Lutjanidae (Snappers)					
Lutjanus argentimaculatus	6.4-9.7	5.3-8.5	110	RA	4.1
Apharus rutilans	-	5.7-11.8	150	RA	3.6
Family: Gerreidae (Mojarras)					
Gerres filamentosus	4.3-8.9	-	35	D	3.3
Family: Pomadasyidae (Grunts)					
Pomadasys maculates	4.3-8.5	5.3-9.2	59	RA	4
Family: Sciaenidae (Crokers)					
Otolithes ruber	7.5-18.6	4.3-16.1	90	BP	3.6
Family: Mullidae (Goatfishes)					
Upeneus moluccensis	7.1-14.6	4.8-12.7	20	RA	3.6
U. vittatus	6.7-14.8	6.5-16.3	28	RA	3.5
Family: Teraponidae (Grunters)					
Terapon jarbua	9.2-20.1	7.6-16.7	36	D	3.9
T. puta	-	8.5-16	16	BP	3.1
Family: Scombridae (Mackerels, Tunas)					
Scomberomorus guttatus	-	9.2-20.5	84.5	P	4.3
Family: Siganidae (Rabbit-fishes)					
Siganus javus	7.6-16.2	9.0-20.1	16	BP	2.4
Family: Sphyraenidae (Barracudas)					
Sphyraena jello	9.5-14.9	7.1-16.6	150	RA	4.5
S. obtusata	-	6.5-13.7	55	RA	4.5
Family: Trichiuridae (Ribbon fishes)					
Lepturacanthus savala	14.3-33.1	17.3-36.4	100	BP	4.3
Trichiurus lepturus	10.7-43.6	12.2-37.6	234	BP	4.4
Family: Stromateidae (Pomfrets)					
Pampus argenteus	7.5-35.1	-	60	BP	3.1
Order: Pleuronectiformes					

Table 1: Continued

Name of the species	Size range recorded (cm) Parangipettai	Size range recorded (cm) Cuddalore	Max size (cm)*	Habitat*	Trophic level*
Family: Bothidae (Lefteye flounders)					
Pseudorhombus elevatus	6.7-15.1	7.5-17.6	20	D	3.5
P. javanicus	-	6.8-16.7	42	D	3.5
P. triocellatus	8.1-13.6	7.9-14.4	15	D	3.5
Family: Psettodidae (Indian-halibuts)					
Psettodes erumei	6.1-10.5	-	164	D	4.4
Family: Soleidae (Soles)					
Zebrias quagga	4.2-8.9	5.6-9.1	15	D	3.5
Family: Cynoglossidae(Tongue soles)					
Cynoglossus arel	5.9-17.0	3.8-14.6	40	D	3.3
C. macrostomus	4.3-14.1	4.5-14.2	17.3	BP	3.3
Order: Tetraodontiformes					
Family: Lagocephalidae					
Lagocephalus lunaris	4.5-8.7	5.1-11.4	55	D	3.7
Family: Diodontidae (Puffer fish)					
Diodon hystrix	3.8-8.7	5.6-14.8	91	P	4.3

*Data from FishBase (Froese and Pauly, 2007). BP: Bathypelagic; D: Demersal; P: Pelagic; RA: Reef associated

Table 2: Length class distribution of fishes in the trawl bycatch in the study area

Trophic level	Parangipettai Length class (cm)	No. of species	No. of individuals	Cuddalore No. of species	No. of individuals
2.0-2.49	10-15	1	12	-	-
	15-20	1	445	2	172
2.5-2.99	5-10	2	337	1	359
	10-15	1	17	-	-
	15-20	-	-	1	17
3.0-3.49	5-10	9	437	8	1543
	10-15	1	4	10	320
	15-20	1	45	2	34
	25-30	1	49	-	-
	above30	1	19	-	-
3.5-3.99	5-10	4	40	3	659
	10-15	7	296	6	242
	15-20	4	47	6	477
	20-25	1	74	-	-
	above 30	1	19	1	15
4.0-4.5	5-10	2	51	2	64
	10-15	4	256	4	78
	15-20	2	227	2	83
	20-25	-	-	1	17
	above 30	3	174	2	177

(41.2%), *Leiognathus bindus* (26.1%) were found to be the most frequent species; of 16 species in trophic level 3.5-3.99, *Stolephorus indicus* (45.9%), *Pseudorhombus javanicus* (15.0%) occurred

Table 3: List of frequent species recorded in each trophic level in the trawl bycatch

	Parangipettai			Cuddalore		
Trophic level	Species	Abundance	%	Species	Abundance	%
2.0-2.49	*Sardinella longiceps*	445	97.3	*Sardinella longiceps*	154	89.5
	Siganus javus	12	2.6	*Siganus javus*	18	10.4
2.5-2.99	*Secutor insidiator*	322	95.5	*Secutor insidiator*	359	95.4
	Anodontostoma chacunda	15	4.4	*Sardinella gibossa*	17	4.5
3.0-3.49	*Leiognathus brevirostris*	179	32.3	*Stolephorus insularis*	785	41.2
	L. bindus	100	18.0	*Leiognathus bindus*	498	26.1
	Arius arius	49	8.8	*L. dussumiers*	125	6.5
	Dussumieria acuta	45	8.1	*Gerres filamentosus*	101	5.3
	Gerres filamentosus	43	7.7	*L. fasciatus*	98	5.1
3.5-3.99	*Stolephorus indicus*	376	41.0	*Stolephorus indicus*	639	45.9
	Upeneus vittatus	143	15.6	*Pseudorhombus javanicus*	209	15.0
	Thryssa mystax	76	8.2	*Thryssa mystax*	183	13.1
	Terapon jarbua	74	8.0	*Otolithes ruber*	179	12.8
	Lutjanus argentimaculatus	71	7.7	*Terapon jarbua*	36	2.5
4.0-4.5	*Caranx ignobilis*	201	28.3	*Trichiurus lepturus*	102	26.7
	Trachinocephalus myops	146	20.6	*Saurida tumbil*	71	16.9
	Trichiurus lepturus	102	14.4	*Lepturacanthus savala*	65	15.5
	Saurida tumbil	81	11.4	*Pomadasys maculatus*	49	11.6
	Lepturacanthus savala	66	9.3	*Fistularia commersoni*	28	6.6

Table 4: Diversity indices calculated for the fishes in various trophic levels in trawl bycatch

	2.0-2.49		2.5-2.99		3.0-3.49		3.5-3.99		4.0-4.5	
Diversity indices	P	C	P	C	P	C	P	C	P	C
H'	0.17	0.48	0.52	0.26	3.05	2.69	2.93	2.50	2.70	3.02
D	0.16	0.19	0.34	0.16	0.89	2.51	2.34	2.07	1.38	1.65
J	0.17	0.48	0.33	0.26	0.82	0.62	0.71	0.62	0.81	0.87

P: Parangipettai; C: Cuddalore; H': Shannon-weiner index; D: Margalef richness index; J: Pielou's evenness index

frequently; In 4.0-4.5, *Trichiurus lepturus* (26.7%), *Saurida tumbil* (16.9%) were found to be the frequenters.

Comparing regions, *Sardinella longiceps*, *Siganaus javus* in trophic level 2.0-2.49; *Secutor insidiator* in trophic level 2.0-2.99; *Leiognathus bindus, Gerres filamentosus* in trophic level 3.0-3.49; *Stolephorus indicus*, *Thryssa mystax* in trophic level 3.5-3.99 and *Trichiurus lepturus, Saurida tumbil* in trophic level 4.0-4.5 were found to occur in both the regions.

Diversity indices were calculated for the fishes recorded in various trophic levels of both the coasts (Table 4). In Parangipettai, Shannon diversity ranged from 0.17 to 3.05 with minimum in trophic level 2.0-2.49 and maximum in 3.0-3.49; Margalef richness index varied from 0.16 to 2.34 with minimum in 2.0-2.49 and maximum in 3.5-3.99 and Pielou's evenness index ranged from 0.17 to 0.82 with minimum in trophic level 2.0-2.49 and maximum in 3.0-3.49. In Cuddalore, Shannon diversity ranged from 0.26 to 3.02 with minimum in 2.5-2.99 and maximum in 4.0-4.5; Margalef richness index varied from 0.16 to 2.51 with minimum in 2.5-2.99 and maximum in 3.0-3.49 and Pielou's index ranged from 0.26 to 0.87 with minimum in trophic level 2.5-2.99 and maximum in 4.0-4.5.

DISCUSSION

In the present study, altogether 62 species of fishes were recorded in Parangipettai and Cuddalore water. Of this, 21 species each belonged to reef associated and demersal; 11 to pelagic and 9 to bathypelagic. Comparing coasts, in Parangipettai, demersal group topped the list with 15 species followed by reef associated with 14, pelagic with 10 and bathypelagic with 7 species. As in Parangipettai, in Cuddalore too, demersal group showed dominant with 18 species, reef-associated with 17, pelagic with 9 and bathypelagic with 7 species. Similar dominance of demersal and reef-associated groups was reported by Bijukumar and Deepthi (2009) and Vivekanandan *et al.* (2009). This might be due to the presence of large number of mid level carnivores in the study area. The results of Trl of fishes indicates that a maximum of 37% of fishes represented by 17 species namely *Thryssa mystax, Anguilla bengalensis, Stolephorus indicus, Platycephalus indicus, Grammoplite suppositus, Hippocampus kuda, Terapon jarbua, Upeneus vittatus, U. moluccencis, Otolithes ruber, Lutjanus argentimaculatus, Pseudorhombus elevates, P. javanicus, P. triocellatus, Zebrias quagga, Cynoglossus arel, C. macrostomus, Lagocephalus lunaris* and *Himantura imbricata* belonged to 3.5-3.99 (mid level carnivores) in Parangipettai while 40% represented by 20 species such as *Narcine brunnea, Stolephorus insularis, Ilisha megaloptera, Escualosa thoracata, Dussumieria acuta, Encrasicholina heterologa, E. punctifer, Thryssa setirostris, Arius arius, Bregmaceros maclellandii Leiognathus bindus, L. blochii, L. brevirostris, L. daura, L. dussumieri, L. fasciatus, Decapterus macrosoma, Sillago sihama, Terapon puta, Gerres filamentosus, Pampus argenteus* and *Diodon hystrix*, to 3.0-3.49 (mid level carnivores) in Cuddalore waters.

The above findings are in harmony with Bijukumar and Deepthi (2009), who too, reported the maximum number of species in the Trl of 3.5-3.99. Presence of a large number of mid level carnivores in the trawl bycatch landings signals the large scale removal of top level predators as evidenced by Vivekanandan *et al.* (2005). Since, predators are eliminated from the oceans, the trawl must depend on species in the lower trophic level. This is true in the present study as the bycatch is dominated by mid-level carnivores particularly the demersal groups. Remaining groups were recorded in other trophic levels. Spatial variation in abundance of local populations of marine fishes results from the combination of many physical and biological factors that affect fish distribution and diversity (Alwany and Stachowitsch, 2007).

As regards length class distribution, fishes with <15 cm length showed dominant in all the trophic levels. In contrast, fishes with 30 cm length and above were recorded only in the trophic level of above 3.0 which are mostly carnivores. Similarly, Olukolajo and Oluwaseun (2008) have reported that greater species richness was found in the lagoons, due to the greater exchange of fingerlings and juveniles of marine species which use the lagoons as nursery grounds. Campos and Fonseca (2007) have found that the length distributions for all the species were approximately same.

Among the trophic levels, maximum number of species were frequented at Trl 3.0-3.49 followed by 3.5-3.99, 4.0-4.5, 2.5-2.99 and 2.0-2.49. This is in corroboration with the works of Bijukumar and Deepthi (2009). With respect to diversity indices, the values paralleled the trend of maximum percentage of species and frequenters in the Trl of 3.0 and above. True to this, the maximum diversity and richness values were recorded in the Trl 3.0-3.49 and minimum in 2.0-2.49 in both the regions. Similarly, the trend was evident in evenness index also.

According to Bhathal and Pauly (2008), even though the deployment of mechanized fleets increased the catches, there has been a negative repercussion on the mean trophic level of marine fisheries in India. The relative abundance of various species in the ecosystem is also affected by

fishing. After a few years, consequent of this, community structure, biodiversity and functioning of the ecosystem may gets affected (Jackson *et al*., 2001). The trophic levels of fish are conservative attributes and they cannot change much over time, even when ecosystem structure changes (Pauly *et al*., 1998). Fisheries production of an ecosystem depends significantly on food web dynamics (Link, 2002). Commercial fishing can decrease the average body size and age of stock, causing the truncated population to track environmental fluctuations directly (Anderson *et al*., 2008). Shareet *et al*. (2009) reported that the trophic composition of the different species slightly differed with respect to seasons.

CONCLUSION

In the present study, a clear trend of higher diversity of mid level carnivores was recorded in both the coasts. This indicates absence of sustainability of trawl fishing and the need for interventions and regulations to reduce the magnitude of bycatch. In all the trophic levels, fishes with smaller length groups dominated the landings indicating that juveniles are landed in larger proportions in the trawl bycatch. Therefore, current features of trophic levels of trawl bycatch warrants policy interventions to reduce fishing pressure and to implement bycatch reduction devices along the east coast of India for conservation and judicious management.

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