doi:10.21077/ijf.2026.73.2.176533-04

Available online at: epubs.icar.org.in/index.php/IJF

Food and feeding dynamics of the checkered snapper *Lutjanus decussatus* (Cuvier, 1828) in the reef ecosystems of Andaman Islands, India

S. M. Ajina[1,2], Y. Gladston[1,2], R. Kiruba Sankar[2], A. Pavan-Kumar[3], S. Dam Roy[4] and A. K. Jaiswar[3]

[1]Vizhinjam Regional Centre of ICAR-Central Marine Fisheries Research Institute, Vizhinjam, Thiruvananthapuram-695 521, Kerala, India
[2]ICAR-Central Island Agricultural Research Institute, Port Blair-744 101, Andaman and Nicobar Islands, India
[3]ICAR-Central Institute of Fisheries Education, Mumbai-400 061, Maharashtra, India
[4]ICAR-Central Inland Fisheries Research Institute, Kolkata-700 064, West Bengal, India

Abstract

The food and feeding dynamics of the checkered snapper *Lutjanus decussatus* (Cuvier, 1828), inhabiting the reef ecosystem of the Andaman Archipelago in the Bay of Bengal, were studied from September 2019 to August 2021. Gut contents of 692 specimens in the length range of 15.70 to 29.80 cm were examined, where 338 stomachs were empty and 354 stomachs were found in different degrees of fullness. Each prey was identified to the lowest possible taxon and quantified based on numeric and gravimetric abundance. The diet composition, diet breadth and diet shift between the male, female and sexually undifferentiated fishes were analysed seasonally. The species fed dominantly on crustaceans [dietary coefficient (QI) of 94.98% and index of relative importance (IRI) of 93.01%] followed by teleosts (QI of 4.88% and IRI of 6.84%). The seasonal diversity indices, vacuity index, most preferred prey items and the fullness index of each sex were calculated. The findings of the present study will form baseline information on the feeding dynamics of the checkered snapper that would be helpful for fishery managers in formulating management strategies.

*Correspondence e-mail:
ajinamary6@gmail.com

Keywords:
Fisheries management; Gut content, Prey, Trophic levels

Received : 26.02.2026
Accepted : 17.06.2026

Introduction

The information on the gut content of fish provides key insights to understand the dietary requirement of the fish and prey-predator relationship in the ecosystem (Windell and Bowen, 1978; Manko, 2016). Research on the food and feeding biology of fish reveals the preference for food in different seasons and life stages (MacArthur and Pianka, 1966; Saikia, 2015). Based on their physiological requirements, fish select the most suitable prey item from the ecosystem (Gerking, 2014), and accordingly, the jaw morphology, dentition, and the gastrointestinal tract evolve (Meyer, 1989; Helfman and Winkelman, 1997; Svanbäck and Eklöv, 2003; Westneat 2004; Kammerer *et al*., 2006; Nanami and Shimose, 2013). However, the objectives of dietary studies varied from the documentation of preferred food items to probing the community structure and complex feeding physiology (Hyslop 1980; Norton *et al*., 1995). This knowledge assists fisheries managers in developing and formulating policy for the conservation of species *in situ* (ecosystem-based management) or *ex-situ* (specific and captivity) systems (Saikia, 2015).

Snappers (Family: Lutjanidae), inhabiting rocky and coral reef ecosystems, exhibit benthic carnivorous feeding behaviour with a diurnal rhythm of foraging (Grimes, 1979; Rooker, 1995; Duarte and García, 1999). The checkered snapper, *Lutjanus decussatus* (Cuvier, 1828), is one of the most encountered Lutjanid species in the coral reef systems of the Andaman Islands (Rajan and Sreeraj, 2012). It is a commercially important food fish in the domestic market and has potential in the marine aquarium trade. In the Andaman Islands, *L. decussatus* forms a minor fishery and is reported along with other perch landings, as there is no target-specific fishing gear. Locally, the fish is consumed fresh, and fillets are also transported to mainland markets. Considering the natural and anthropogenic threats to the reef ecosystems of the Andaman Islands (Krishnan *et al*., 2011; Majumdar *et al.,* 2018), understanding the trophodynamics of reef-associated fishes, particularly *L. decussatus*, is essential. However, studies on the fishery and biology of reef-associated perches in the Andaman waters are limited, with only a few investigations on some groupers and snappers reported from the region (Kiruba Sankar *et al*., 2013a, b). Information on food and feeding biology is crucial for understanding the ecological role of a species and forms the basis for its conservation and management. Nevertheless, studies addressing the food and feeding dynamics of *L. decussatus* are lacking. Therefore, the present study was undertaken to generate baseline information on the food and feeding biology of *L. decussatus* in the Andaman Islands.

Materials and methods

Sampling methodology

A total of 692 specimens of *L. decussatus* were collected from Wandoor fish landing centre (n=298) (11° 35' 37" N; 92° 36' 33"E), Junglighat fish market (n=336) (11° 39' 26" N; 92° 43' 28"E), Dignabad landing centre (11° 40' 31" N; 92° 44' 38" E) and also by experimental fishing in the reef areas off Ross Island (11° 40' 53" N; 92° 45' 26" E) (n=58) (Fig. 1) from September 2019 to August 2021. In the experimental fishing, fish were captured using a hand line with a barbed hook (no. 7-9). The specimens of *L. decussatus* were identified using the standard taxonomic key of Anderson and Allen (2001). Identification was based on diagnostic morphologic characterestics, including a whitish body with a distinctive red checkered pattern on the dorsal surface and a prominent black spot on the caudal peduncle as described by Anderson and Allen (2001). The morphometric traits of the fish specimens were measured to the nearest 1.0 cm using a measuring board and Vernier calliper and weighed to the nearest grams (g) using a digital electronic weighing balance. Later, based on the gonadal examination, the specimens were categorised into male, female and undifferentiated for different seasons, Pre-monsoon (February to May), Monsoon (June to September) and Post-monsoon (October to January) (Attri and Tyagi, 2010).

The guts were dissected from the peritoneal cavity of the fish and the food items were identified to the lowest taxa using various identification keys (Fischer and Whitehead, 1974; De Grave, 2016; Ng, 2016ab). The identification of microscopic food items was carried out by examining the external morphology using a stereo-zoom microscope at 4x magnification (Olympus Corporation, Japan). The prey items were differentiated into major taxonomic groups *viz*., crustaceans, teleosts, molluscs and annelids for the comparative study. The prey items were counted numerically under each taxon and weighed to the nearest grams. The excessive digested portion of the food was classified as unidentified crustaceans/unidentified fishes (based on the hard part of the digested material).

Diet composition

The prey items of the diet of *L. decussatus* were assessed by using two conventional indices, Index of relative importance (IRI) (Hyslop, 1980) and dietary coefficient (QI) (Salgado *et al*., 2004). Other sub-

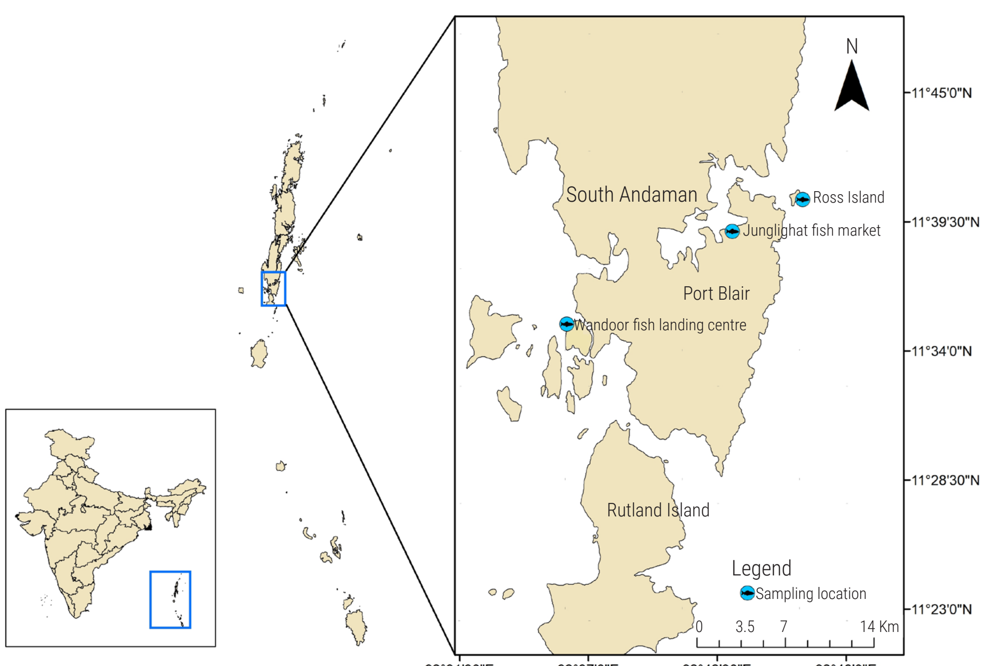

Fig. 1. Map showing the sampling locations

indices namely Numerical index (NI), Occurrence index (OI) and Gravimetric index (GI) were also calculated for each prey item and prey group (NI: Percentage of each prey to the total prey items; OI: The percentage of stomachs with a specific prey type × the number of all non-empty stomachs dissected and GI: the percentage weight each prey to the total wet weight of all food items). These sub-indices are used to derive the conventional indices *viz*., IRI and QI.

Index of relative importance (IRI) was calculated as:

IRI = (NI + GI) x OI

For the comparison of prey type, the obtained IRI value of each prey type was used to estimate the percentage of IRI (%IRI) using the following formula:

$$\%IRI_i = 100IRI_i \sum_{I=i}^{n} IRI$$

If the percentage of IRI of a prey constitutes more than 50%, it is considered as preferential food item, 25% as secondary food and the remaining 25% as accessory food (da Silveira *et al*., 2020).

The dietary coefficient, QI of the prey type was calculated using the formula:

QI = NI x GI

Based on the QI value, the prey items were classified as the dominant prey item (QI≥200), secondary prey item (200> QI≥ 20) and accidental prey item (QI<20).

Diet breadth

Diet breadth indicates the diversity of food items ingested by the predator using:

1. Shannon-Wiener index (H').

$$H' = -\sum_{i=1}^{S} (P_i \log P_i)$$

Where, S = Total number of species; and P_i is the frequency of ith species

2. The Pielou's index (J'), which indicates the evenness of distribution of the prey items in the diet:

$$J' = \frac{H'}{\log S}$$

Where, H' is the Shanon- wiener index and "*S*" is the total number of species in the diet.

3. Margalef's richness index (d), which indicates species richness in the diet:

$$d = \frac{S - 1}{\log N}$$

where '*N*' is the total number of individuals present in the diet and '*S*' is the number of species recorded in the diet.

Diet shift

The seasonal variations in the feeding pattern, such as feeding intensity and foraging rate between the sexes, were determined using different indices. The feeding intensity was estimated as Vacuity index (VI), representing the percentage of empty stomach: VI = (Number of stomachs without prey/total number of stomachs) ×100 (Hyslop, 1980). The index of relative fullness (IRF) was calculated as IRF = Total weight of gut content (g) /Total weight (g) of fish having food in their stomach (Sen *et al*., 2018). The data on VI and IRF for both the male and female fishes were tested using Kolmogorov-Smirnov test. The difference in the diet quantity, in different seasons and sexes for two groups, was assessed with Mann Whitney's U test, while for more than two groups, the Kruskal-Wallis test was employed.

The individual prey abundance data collected from the diets of males, females, and undifferentiated individuals were analysed separately using PRIMER 6 (Ver. 6.1.13, PRIMER-E Ltd.). The raw data was subjected to square root transformation to normalise the skewed distribution. The resemblance of diet composition between the sex group was assessed using the Bray-Curtis similarity test. The cluster analysis and dendrogram of each group and food items were plotted using a similarity index.

Results

Sample structure

The composition of male, female and undifferentiated specimens in the studied samples (N=692 specimens) was 49% (n= 340, Wt= 62.78 kg), 44% (n=224, Wt= 53.82 kg) and 7% (n=48, Wt= 7.36 kg), respectively. The overall sex ratio of males to females was 1:0.90. The total length of male fish varied from 16.50 cm to 29.10 cm with dominance of individuals belonging to length group 21-25 cm. Whereas, the length of females ranged from 17.20 to 29.80 cm with dominance of length group 21-26 cm (Fig. 2a-b). The specimens with undifferentiated sex varied from 15.70 to 23.50 cm in total length, which was dominated by the length group 20-22 cm (Fig. 2c). The mean total length (TL) of male fish was found to be significantly lower (22.75±0.12 cm) than females (23.45±0.16 cm) ($p<0.01$).

Diet composition

Crustaceans (%QI=94.98%; IRI 93.01%) formed the prominent and preferred food items of the checkered snapper followed by teleosts (%QI=4.87%; IRI 6.83%) (Table 1). Molluscs (%QI=0.14%; IRI=0.14%), annelids (%QI=0.0008%; IRI=0.0143%) and mud (%QI=0.0006%; %IRI=0.0007%) constituted the accidental accessory food items and their proportion was insignificant (Table 1).

The crustacean diet of checkered snapper was contributed mainly by the true crabs of families Portunidae, Carpiliidae, Xanthidae, Calappidae and Trapeziidae, hermit crabs, penaeid shrimps, caridean shrimps and mantis shrimp (Table 2). A fraction of the gut content (~10%), was unidentified due to advanced stages of digestion and only the reminiscent of undigested claws and shells were observed, probably crustacean parts.

Teleosts, the second dominant accessory food item was constituted by the species belonging to the families Apogonidae (cardinalfishes), Ambassidae (glassfishes), Engraulidae (whitebaits)

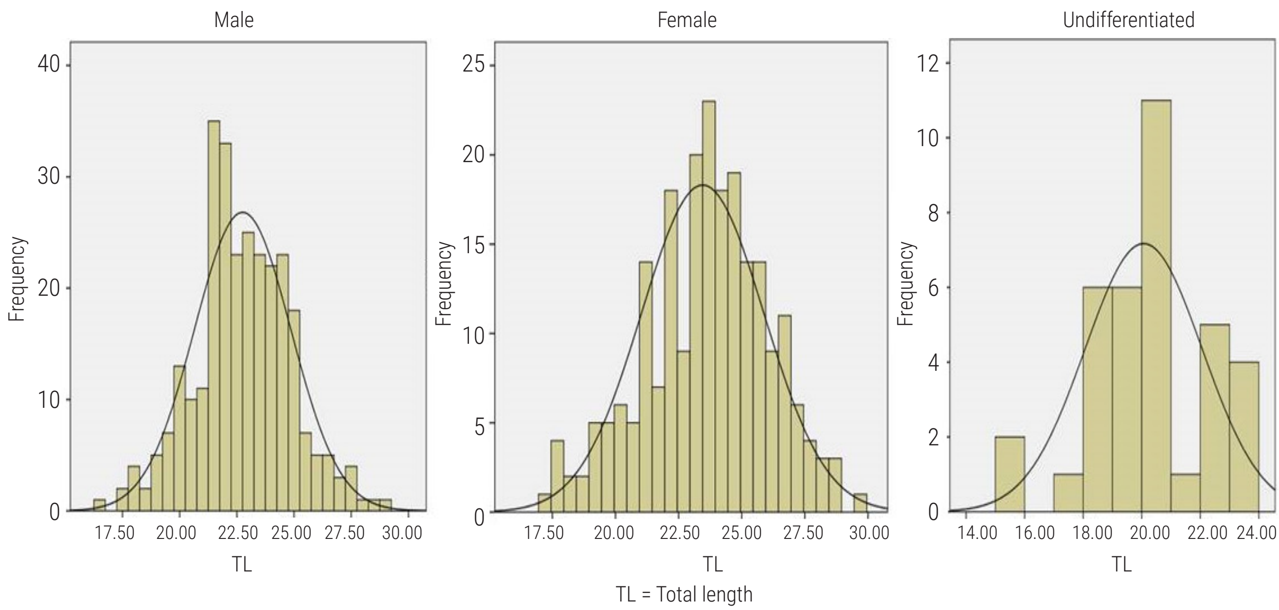

Fig. 2. Length class of fishes selected for the study

Table 1. Dietary coefficient (QI) and index of relative importance (IRI) of each prey item observed in the gut content of *L. decussatus* from Andaman and Nicobar Islands, India

Prey	QI	%QI	Prey type#	IRI	% IRI	Prey type*
Crustaceans	6054.8029	94.9800	Dominant	14670.421 5	93.0096	Preferential
Teleosts	311.0313	4.8790	Dominant	1078.3230	6.8365	accessory
Molluscs	8.8926	0.1394	Accidental	21.9030	0.1388	accessory
Annelids	0.0515	0.0008	Accidental	2.2546	0.0143	accessory
Mud	0.0386	0.0006	Accidental	0.1114	0.0007	accessory

Dominant prey type (QI≥200); Secondary prey type (200> QI≥ 20) or Accidental prey type (QI<20)
*Preferential prey type (%IRI>50%); Secondary prey type (%IRI ≥ 25%) and accessory prey type (%IRI<25%)

Gobiidae (shrimp gobies) Caesionidae (fusilier fishes) Synanceiidae (stonefishes) and Mullidae (goatfishes) (Table 2). Nevertheless, a portion of (~ 10%) the teleosts in the gut were unidentified because of the advanced stage of digestion. Molluscs, the accessory food items were composed mainly of cephalopods like squid and octopus, and in rare instances, a sea slug, nudibranch of the family Pleurobranchaeidae was identified.

Diet breadth

The seasonal sex-wise Shannon-Wiener Index (H'), Pielou's index (J') of evenness and Margalef's richness index (d) for the diet of *L. decussatus* are given in Table 3. The diversity indices did not show significant differences among the seasons and between the sexes (Kruskal-Wallis test (p>0.05 and Mann Whitney's U test (p>0.05). The species richness (diverse food items) was more evident in the sexually differentiated fish groups (male and female) than in the undifferentiated fish (Table 3). The most diverse prey items were observed in the female fish during pre-monsoon and post-monsoon seasons. The dietary breadth of female fish showed the highest value of Margalef's richness index due to the highest value of Pielou's evenness index for the prey species (Table 3).

Diet shift

In the present study, out of 692 specimens examined, 354 had food in their gut and the remaining were empty stomachs (338) resulting in an overall vacuity index (VI) of 48.84%. Similarly, the vacuity index for females was higher than the males, especially in the monsoon and post-monsoon seasons. The VI of undifferentiated specimens was minimal indicating the voracious feeding habit of smaller fish than the adults (Table 4). The IRF of male, female and sexually undifferentiated fish during the various seasons did not show significant differences between the sexes (Mann Whitney's U test; p>0.05). The maximum and minimum value of IRF was observed during the monsoon and pre-monsoon seasons, respectively. The mean number of prey items aslo indicated seasonal variations (Table 4).

A difference in prey preference by *L. decussatus* was observed in the indices; IRI and QI. The fishes preferred crustaceans as food followed by teleosts and molluscs. The difference in the prey preference between the sexes (in sexually differentiated fishes) as well as in undifferentiated fishes was also observed in the cluster analysis plotted in the Bray-Curtis similarity test (Fig. 3). The cluster analysis with the SIMPROF test showed a resemblance value of 65%

Table 2. Percentages number (NI), percentage weight (GI), frequency of occurrence (OI), dietary coefficient (QI) and index of relative importance (IRI) of each prey items of *L. decussatus* from Andaman and Nicobar Islands

Crustaceans	NI	GI	OI	QI	IRI	%IRI
Family: Alpheidae						
Alpheus sp.	3.2258	3.8476	4.2372	12.4119	29.9724	2.0416
Family: Palaemonidae						
Cuapetes sp.	1.9354	0.8502	2.5424	1.6455	7.0822	0.4824
Family: Stenopodidae						
Stenopus hispidus	1.9355	1.3052	2.5424	2.5262	8.2390	0.5612
Family: Solenoceridae						
Solenocera sp.	3.6559	3.0494	4.2373	11.148	28.4124	1.9353
Family: Sergestidae						
Acetes indicus	2.5806	1.0058	3.3898	2.5957	12.158	0.8281
Family: Penaeidae						
Parapenaeopsis stylifera	2.3656	2.1633	3.1073	5.1175	14.073	0.9586
Family: Pandalidae						
Heterocarpus sp.	3.4408	3.5483	4.2373	12.209	29.615	2.0173
Family: Diogenidae						
Diogenes sp.	2.1505	3.5443	2.8249	7.6222	16.087	1.0958
Family: Portunidae						
Charybdis sp.	9.4623	18.0458	12.4293	170.7562	341.9097	23.2896
Thaiamita sp.	7.9569	8.5854	10.1694	68.3143	168.2283	11.4591
Family: Carpiliidae						
Carpilius sp.	6.8817	8.2182	9.0395	56.5556	136.4969	9.2977
Family: Xanthidae						
Leptodius sp.	8.1720	9.8028	10.4519	80.1091	187.8729	12.7972
Family: Calappidae						
Calappa sp.	3.4409	6.1148	4.5197	21.0401	43.1894	2.9419
Family:Trapeziidae						
Trapezia sp	6.0215	6.5977	7.9096	39.7283	99.8133	6.7989
Family: Squillidae	1.9354	3.8133	2.5423	7.3807	14.61571	0.9956
Squilla sp.						
Unidentified crustacean	7.7419	2.5601	9.8870	19.8199	101.8560	6.9380
Teleosts						
Family: Apogonidae						
Ostorhinchus compressus	3.6559	2.4627	4.8023	9.0033	29.3831	2.0015
Family: Ambassidae						
Ambassis dussumieri	6.4516	4.2788	8.4746	27.6048	90.9354	6.1942
Family: Engraulidae						
Stolephorus commersonii	1.5054	1.0138	1.9774	1.5262	4.9814	0.3393
Family:Gobiidae						
Tomiyamichthys sp.	0.6452	0.6865	0.8474	0.4429	1.1285	0.0769
Family:Caesionidae						
Pterocaesio tile	1.2903	1.1974	1.6949	1.5451	4.2165	0.2872
Family: Synanceiidae						
Synanceia sp.	1.0753	0.8382	1.4124	0.9013	2.7026	0.1841
Family: Mullidae						
Upeneus vittatus	1.0753	1.3371	1.4124	1.4378	3.4073	0.2320
Unidentified fishes	6.8817	1.9598	9.0395	13.4866	79.9231	5.4441
Molluscs						
Family:Pleurobranchaeidae						
Pleurobranchaea sp.	0.2151	0.2794	0.2825	0.0601	0.1397	0.0095
Family: Loliginidae						
Uroteuthis duvaucelii	1.2903	1.5287	1.6949	1.9725	4.7780	0.3255
Family: Octopodidae						
Octopus sp.	1.5054	1.1455	1.6949	1.7244	4.4930	0.3060
Annelids						
Family: Nereididae						
Nereis sp.	0.2150	0.1796	0.2824	0.03862	0.1115	0.0076
Mud	1.2903	0.0399	1.6949	0.0515	2.2546	0.1535

Table 3. Diversity indices of prey composition in the gut content of *L. decussatus* from Andaman waters of India

Season	Population	S	N	H'	J'	d
Pre-monsoon	Male	14	46	2.319	0.8787	3.395
	Female	19	50	2.692	0.9141	4.601
	Undifferentiated	6	6	1.792	1	2.791
	Pooled	22	102	2.723	0.881	4.541
Monsoon	Male	19	45	2.725	0.9254	4.729
	Female	15	28	2.533	0.9355	4.201
	Undifferentiated	5	5	1.609	1	2.485
	Pooled	23	78	2.847	0.9078	5.05
Post- monsoon	Male	16	50	2.568	0.9263	3.834
	Female	19	72	2.727	0.9262	4.209
	Undifferentiated	7	9	1.831	0.941	2.731
	Pooled	24	131	2.808	0.8836	4.718

S: Total species; N: Total individuals; H': Shannon-Wiener index; J': Pielou's index; d: Margalef's index

Table 4. Comparison of feeding behaviour between the seasons in sex groups

Season	Population	S	N	N_{items}	W_{items}	Vi	MPS	IRF
Pre-monsoon	Male	90	53	62	269.44	41.11111	1.169811	0.025215
	Female	110	70	78	444.1	36.36364	1.114286	0.033051
	Undifferentiated	17	9	23	79.2	47.05882	2.555556	0.069163
	Pooled	217	132	163	792.74	39.17051	1.234848	0.031374
Monsoon	Male	139	59	81	410.4	57.55396	1.372881	0.03433
	Female	95	39	66	383.76	58.94737	1.692308	0.053257
	Undifferentiated	14	13	24	153.4	7.142857	1.846154	0.112362
	Pooled	248	111	171	947.56	55.24194	1.540541	0.046165
Post- monsoon	Male	111	39	50	323	64.86486	1.282051	0.044058
	Female	99	63	72	409.6	36.36364	1.142857	0.034772
	Undifferentiated	17	9	9	32.5	47.05882	1	0.024403
	Pooled	227	111	131	765.1	51.1013	1.18018	0.037426

S: No. of stomachs analysed; N: No. of stomachs containing food; N_{items}: No. of prey items; W_{items}: Weight of prey items, Vi: Vacuity index; MPS: Mean no. of prey per stomach; IRF: Index of relative fullness)

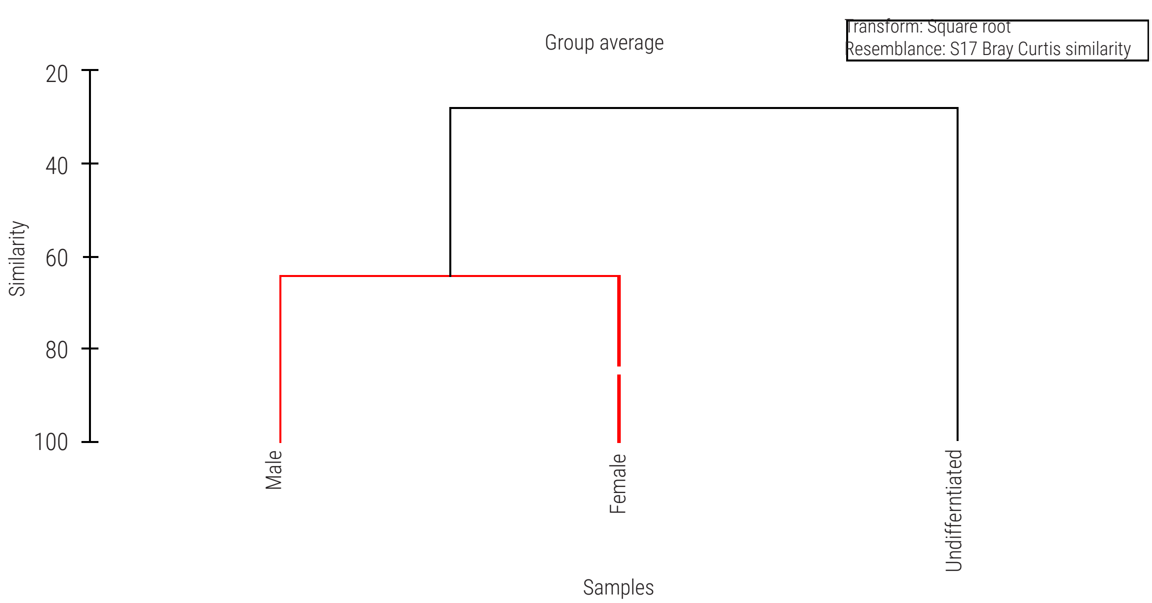

Fig. 3. Dendrogram showing the similarity in feeding among males, females and sexually undifferentiated group

indicating a non-significant difference in prey preference within adults (between male and females). However, the prey preference was significantly different between sexually undifferentiated individuals and sexually differentiated individuals with a lower resemblance of 30% (SIMPROF, $p<0.05$).

Discussion

Despite its ecological and economic importance, the food and feeding biology of *L. decussatus* has received little attention, particularly in the Andaman and Nicobar Islands. To date, only a few studies have addressed its foraging behaviour in the Okinawan reef of Japan and food intake in relation to jaw morphology (Nanami and Yamada, 2008; Nanami and Shimose, 2013). Therefore, comprehensive information on the dietary ecology of this species is lacking and the present study attempted to address this research gap. During the study, all collected specimens (n=692) were relatively large individuals (TL>15 cm), likely reflecting the selectivity of the fishing gear employed by the fishers, such as hand lines fitted with hook nos. 7 to 9. The sex ratio did not differ significantly from parity, with males and females occurring in the ratio of 1:0.90 ($p>0.05$).

The diet analysis showed that crustaceans were the preferential food items of the checkered snapper *L. decussatus* followed by teleosts. Masuda *et al*. (1984) also recorded similar observations in *L. decussatus* from Japanese water. Conversely, Nanami and Shimose (2013) reported teleosts as the dominant food items of *L. decussatus*, from Okinawan reef systems of Japan. The observed differences among the studies are anticipated, as the availability and composition of prey species are strongly influenced by ecological conditions and environmental dynamics (Larkin, 1996). Accordingly, habitat characteristics and ecosystem variability shape the dietary composition of a species across its geographic range (Stoner, 2004; Moreno-Sanchez *et al*., 2016). In the present study, crustaceans constituted the principal dietary component, with true crabs contributing the highest proportion followed by shrimps, hermit crabs, penaeid shrimps, caridean shrimps and mantis shrimps. Similarly, Nanami and Shimose (2013) reported that crabs formed the dominant crustacean prey item in the diet of *L. decussatus*. The present findings therefore contribute to the growing body of knowledge on the feeding ecology of *Lutjanus* species from different regions of the world (Kamukuru and Mgaya, 2004; Szedlmayer and Lee, 2004; Pimentel and Joyeux, 2010; Simonsen *et al*., 2015).

The study further revealed ontogenetic differences in feeding habits, with adult *L. decussatus* consuming a wider array of prey items than sexually undifferentiated individuals, whose diet was restricted to relatively few prey items compatable with their smaller mouth size. Adult fish likely require more energy for breeding and spawning (Winemiller, 1989), and possess a larger gape, enabling them to exploit a broader spectrum of available prey. Similar ontogenetic shifts in diet between juvenile and adult *Lutjanus* species have been documented previously and are attributed to changes associated with life history stages (Druzhinin, 1970; de la Moriniere *et al*., 2003a, b).

The diet breadth of *L.decussatus*, remained largely consistent across seasons and between sexes, indicating that individuals consumed similar prey items. irrespective of temporal or sex-related differences. Bray–Curtis similarity analysis revealed more than 75% similarity in dietary composition among seasons and between males and females. The high degree of similarity may be attributed to the species' association with the tropical coral reef ecosystems, where environmental and biogeographic conditions remain relatively stable throughout the year. In contrast ot open ocean environments, seasonal fluctuations in hydrological and ecological parameters areless pronounced in coral reef habitats, resulting in limited variation in prey availability and feeding patterns. Hence, cluster analysis demonstrated a high degree of similarity in diet composition between seasons.

The vacuity index (VI) was higher in female fish than in males, especially during the monsoon and post-monsoon periods, which coincide with the breeding season (Nanami *et al*., 2010). This could be attributed to the enlarged gonad occupying a substantial portion of the body cavity during maturation, thereby reducing stomach fullness. In contrast, sexually undifferentiated fish exhibited the lowest VI values, suggesting that juvenile fish feed more actively and voraciously than adults. During post-monsoon, male individuals showed higher stomach fullness than females, possibly because mature females reduce or cease feeding during the breeding season, as energy is redirected towards reproduction (Sargent, 1990).

The index of relative fullness (IRF), which represent the relative weight of gut contents in relation to body weight, did not differ significantly among seasons or between sexes ($p>0.05$). This suggests that food availability in the coral reef ecosystem remain relatively stable throughout the year and that *L. decussatus* maintains a consistent feeding intensity under normal conditions. However, feeding activity appears to decline during the period of gonadal maturation and spawning, likely due to the physiological demands associated with reproduction. Analyses of prey preferences revealed no significant differences between adult males and females, whereas the diet of sexually undifferentiated fishes differed from that of adults. These differences may be attributed to ontogenic changes in jaw morphology and prey handling ability, as well as variations in digestibility of different prey types, with teleost fishes generally being more easily digestible than crustaceans. In addition, during the reproductive period, adult fish may preferentially consume energy rich prey such as crustaceans and molluscs, to meet the increased energy demands for the gonadal development and spawning (Sargent, 1990). In contrast, sexually undifferentiated fish appear to allocate more energy for somatic growth than reproduction and and therefore rely proportionately more on finfish prey than on shellfish resources.

Habitat selection is a vital biological activity in reef-associated fishes, influencing access to prey resources while reducing the risk of predation (Mittelbach 2002). Habitat occupancy within coral reef ecosystems is governed by a complex interplay of ecological factors, including competition, predation, substrate characteristics, environmental conditions (*e.g*., temperature), and the availability of suitable food resources (Wootton 1998). In the present study, *L. decussatus* was found to be closely associated with live coral reef habitats with rich biodiversity. Consistent with this habitat preference, gut content analysis revealed that its diet was dominated by coral reef-associated crustacean and fishes, indicating a strong trophic dependence on reef ecosystems.

The gut content analysis provides valuable insights into the trophic ecology of fish species and serves as an important indicator of ecosystem health. Snappers prey on a wide variety of prey organisms inhabiting coral reef ecosystems, thereby playing a significant role in reef food webs. In India, *L. decussatus* is found only in reef ecosystems of the Andaman Islands and the Gulf of Mannar in the Bay of Bengal. Given the increasing threats posed by overexploitation and unsustainable fishing practices, effective conservation and management of these reef resources are essential. In this context, the present study provides baseline information on the feeding ecology of the *L. decussatus,* contributing to a better understanding of its trophodynamic role, offering a valuable reference for assessing the impacts of overfishing and climate change on reef ecosystems.

Acknowledgements

The authors express their sincere gratitude to Dr. Eaknath B. Chakurkar, former Director, ICAR-CIARI, Port Blair; Dr. Gopal Krishna, former Director, ICAR-CIFE and Dr. Grinson George, Director, ICAR-CMFRI, for their guidance, encouragement, and for providing the necessary facilities to carry out this study. This research was supported by the Indian Council of Agricultural Research (ICAR), New Delhi. The authors also extend special thanks to the fishermen of Wandoor Fishing Village for their invaluable assistance in the collection of fish samples.

References

Anderson, W. D. Jr. and Allen, G. R. 2001. Lutjanidae. Jobfishes. In: Carpenter, K. E. and Niem, V. (Eds.), *FAO Species identification guide for fishery purposes. The living marine resources of the Western Central Pacific, Vol. 5. Bony fishes Part 3 (Menidae to Pomacentridae)*. Food and Agricultural Organisation of the United Nations, Rome, Italy, pp. 2840-2918.

Attri, S. D. and Ajit, T. 2010. *Climate profile of India*. India Meteorological Department, Ministry of Earth Science, Environment Monitoring and Research Centre, New Delhi, India, pp. 1-8.

da Silveira, E. L., Semmar, N., Cartes, J. E., Tuset, V. M., Lombarte, A., Ballester, E. L. C. and Vaz-dos-Santos, A. M. 2020. Methods for trophic ecology assessment in fishes: A critical review of stomach analyses. *Rev. Fish. Sci. Aquac.*, 28(1): 71-106. https://doi.org/10.1080/23308249.2019.1678013.

de la Morinière, E. C., Pollux, B. J. A., Nagelkerken, I. and Van der Velde, G. 2003a. Diet shifts of Caribbean grunts (Haemulidae) and snappers (Lutjanidae) and the relation with nursery-to-coral reef migrations. *Estuar. Coast. Shelf Sci.*, 57(5-6): 1079-1089. https://doi.org/10.1016/S0272-7714(03)00011-8.

de la Morinière, E. C., Pollux, B. J. A., Nagelkerken, I., Hemminga, M. A., Huiskes, A. H. L. and van der Velde, G. 2003b. Ontogenetic dietary changes of coral reef fishes in the mangrove–seagrass–reef continuum: stable isotopes and gut-content analysis. *Mar. Ecol. Prog. Ser.*, 246: 279-289. https://doi.org/10.3354/meps246279.

De Grave, S. 2016. Indian Ocean marine Caridea: An overview. In: *Training manual on crustacean taxonomy, ITWOTAC 2016*. Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, India, 411 p.

Druzhinin, A. D. 1970. The range and biology of snappers (Fam. Lutjanidae). *J. Ichthyol.*, 10: 717-736.

Duarte, L. O. and García, C. B. 1999. Diet of the mutton snapper *Lutjanus analis* (Cuvier) from the Gulf of Salamanca, Colombia, Caribbean Sea. *Bull. Mar. Sci.*, 65(2): 453-465.

Fischer, W. and Whitehead, P. J. P. 1974. *FAO species identification sheets for fishery purposes: Eastern Indian Ocean (Fishing Area 57) and Western Central Pacific (Fishing Area 71). Vol. 2.* Food and Agricultural Organisation of the United Nations, Rome, Italy.

Gerking, S. D. 2014. *Feeding ecology of fish*. Academic Press, San Diego, California, USA, 399 p.

Grimes, C. B. 1979. Diet and feeding ecology of the vermilion snapper, *Rhomboplites aurorubens* (Cuvier) from North Carolina and South Carolina waters. *Bull. Mar. Sci.*, 29(1): 53-61.

Helfman, G. S. and Winkelman, D. L. 1997. Threat sensitivity in bicolor damselfish: Effects of sociality and body size. *Ethology*, 103(5): 369-383. https://doi.org/10.1111/j.1439-0310.1997.tb00153.x.

Hyslop, E. J. 1980. Stomach contents analysis-A review of methods and their application. *J. Fish Biol.*, 17(4): 411-429. https://doi.org/10.1111/j.1095-8649.1980.tb02775.x.

Kammerer, C. F., Grande, L. and Westneat, M. W. 2006. Comparative and developmental functional morphology of the jaws of living and fossil gars (Actinopterygii: Lepisosteidae). *J. Morphol.*, 267(9): 1017-1031. https://doi.org/10.1002/jmor.10293.

Kamukuru, A. T. and Mgaya, Y. D. 2004. The food and feeding habits of blackspot snapper, *Lutjanus fulviflamma* (Pisces: Lutjanidae) in shallow waters of Mafia Island, Tanzania. *Afr. J. Ecol.*, 42(1): 49-58. https://doi.org/10.1111/j.0141-6707.2004.00487.x.

Kiruba Sankar, K., George, G., Krishnan, P., Bharathi, M. G., Rajesh, S. and Roy, S. D. 2013a. Short term analysis of catch per unit effort (CPUE) and gut content analysis of groupers and snappers from Port Blair. *J. Andaman Sci. Assoc.*, 18(2): 170-174.

Kirubasankar, R., Dam Roy, S., George, G., Sarma, K., Krishnan, P., Ramkumar, S., Kaliyamoorthy, M. and Goutham Bharathi, M. P. 2013b. Fishery and exploitation of malabar grouper, *Epinephelus malabaricus* (Bloch & Schneider, 1801) from Andaman Islands. *Asian Fish. Sci.*, 26: 167-175.

Krishnan, P., Roy, S. D., George, G., Srivastava, R. C., Anand, A., Murugesan, S., Kaliyamoorthy, M., Vikas, N. and Soundararajan, R. 2011. Elevated sea surface temperature during May 2010 induces mass bleaching of corals in the Andaman. *Curr. Sci.*, 100: 111-117.

Larkin, P. A. 1996. Concepts and issues in marine ecosystem management. *Rev. Fish Biol. Fish.*, 6(2): 139-162. https://doi.org/10.1007/BF00182341.

MacArthur, R. H. and Pianka, E. R. 1966. On optimal use of a patchy environment. *Am. Nat.*, 100(916): 603-609. https://doi.org/10.1086/282454.

Majumdar, S. D., Hazra, S., Giri, S., Chanda, A., Gupta, K., Mukhopadhyay, A. and Roy, S. D. 2018. Threats to coral reef diversity of Andaman Islands, India: A review. *Reg. Stud. Mar. Sci.*, 24: 237-250. https://doi.org/10.1016/j.rsma.2018.08.011.

Manko, P. 2016. *Stomach content analysis in freshwater fish feeding ecology*. University of Presov, Slovakia,116 p.

Masuda, H., Amaoka, K., Araga, C., Uyeno, T. and Yoshino, T. 1984. *The fishes of the Japanese Archipelago*. Tokai University Press, Tokyo, Japan.

Meyer, A. 1989. Cost of morphological specialization: Feeding performance of the two morphs in the trophically polymorphic cichlid fish, *Cichlasoma citrinellum*. *Oecologia*, 80(3): 431-436. https://doi.org/10.1007/BF00379047.

Moreno-Sanchez, X. G., Abitia-Cardenas, L. A., Trujillo-Retana, G., Navia, A. F., Ramírez-Pérez, J. S. and Shirasago-German, B. 2016. Variation of feeding habits of *Lutjanus peru* (Actinopterygii: Perciformes: Lutjanidae) caught in two regions of the Gulf of California, Mexico. *Acta Ichthyol. Piscat.*, 46(2): 97-108. https://doi.org/10.3750/AIP2016.46.2.05.

Nanami, A. and Shimose, T. 2013. Interspecific differences in prey items in relation to morphological characteristics among four lutjanid species

(*Lutjanus decussatus*, *L. fulviflamma*, *L. fulvus* and *L. gibbus*). *Environ. Biol. Fishes.*, 96(5): 591–602. https://doi.org/10.1007/s10641-012-0049-7.

Nanami, A. and Yamada, H. 2008. Size and spatial arrangement of home range of checkered snapper *Lutjanus decussatus* in an Okinawan coral reef determined using a portable GPS receiver. *Mar. Biol.*, 153(6): 1103-1111. https://doi.org/10.1007/s00227-007-0882-y.

Nanami, A., Okuzawa, K., Yamada, H., Suzuki, N. and Aonuma, Y. 2010. Reproductive activity in the checkered snapper, *Lutjanus decussatus*, off Ishigaki Island, Okinawa. *Ichthyol. Res.*, 57(3): 314-318. https://doi.org/10.1007/s10228-010-0155-5.

Ng, P. K. L. 2016a. Marine crabs of India and the Indian Ocean. In: *Training manual on crustacean taxonomy, ITWOTAC 2016*. Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, India, 411 p.

Norton, S. F., Luczkovich, J. J. and Motta, P. J. 1995. The role of ecomorphological studies in the comparative biology of fishes. In: Wainwright, P. C. and Reilly, S. M. (Eds.), *Ecomorphology of fishes*. Chapman and Hall, New York, USA, pp. 287-304.

Pimentel, C. R. and Joyeux, J. C. 2010. Diet and food partitioning between juveniles of mutton *Lutjanus analis*, dog *Lutjanus jocu* and lane *Lutjanus synagris* snappers (Perciformes: Lutjanidae) in a mangrove-fringed estuarine environment. *J. Fish Biol.*, 76(10): 2299-2317. https://doi.org/10.1111/j.1095-8649.2010.02586.x.

Rajan, P. T. and Sreeraj, C. R. 2012. Structure of reef fish communities of seven islands of Andaman and Nicobar Islands, India. In: *Ecology of faunal communities on the Andaman and Nicobar Islands*. Springer, Berlin, Heidelberg, Germany, pp. 127-147.

Rooker, J. R. 1995. Feeding ecology of the schoolmaster snapper, *Lutjanus apodus* (Walbaum), from southwestern Puerto Rico. *Bull. Mar. Sci.*, 56(3): 881-894.

Salgado, J. P., Cabral, H. N. and Costa, M. J. 2004. Feeding ecology of the gobies *Pomatoschistus minutes* (Pallas, 1770) and *Pomatoschistus microps* (Krøyer, 1838) in the upper Tagus estuary, Portugal. *Sci. Mar.*, 68(3): 425-434. https://doi.org/ 10.3989/scimar.

Saikia, S. K. 2015. Food and feeding of fishes. *Transylv. Rev. Syst. Ecol. Res.*, 17(1): 71-84.

Sargent, R. C. 1990. Behavioural and evolutionary ecology of fishes: conflicting demands during the breeding season. *Ann. Zool. Fenn.*, 27: 101-118.

Sen, S., Chakraborty, S. K., Vivekanandan, E., Zacharia, P. U., Jaiswar, A. K., Dash, G., Bharadiya, S. A. and Gohel, J. K. 2018. Feeding habits of milk shark, *Rhizoprionodon acutus* (Ruppell, 1837) in the Gujarat coastal waters of north-eastern Arabian Sea. *Reg. Stud. Mar. Sci.*, 17: 78-86. https://doi.org/10.1016/j.rsma.2017.11.006.

Simonsen, K. A., Cowan, J. H. and Boswell, K. M. 2015. Habitat differences in the feeding ecology of red snapper (*Lutjanus campechanus*, Poey 1860): a comparison between artificial and natural reefs in the northern Gulf of Mexico. *Environ. Biol. Fishes*, 98(3): 811–824. https://doi.org/10.1007/s10641-014-0317-9.

Stoner, A. W. 2004. Effects of environmental variables on fish feeding ecology: Implications for the performance of baited fishing gear and stock assessment. *J. Fish Biol.*, 65(6): 1445–1471. https://doi.org/10.1111/j.0022-1112.2004.00593.x.

Svanback, R. and Eklov, P. 2003. Morphology dependent foraging efficiency in perch: A trade-off for ecological specialization. *Oikos*, 102(2): 273–284. https://doi.org/10.1034 /j.1600-0706.2003.12657.x.

Szedlmayer, S. T. and Lee, J. D. 2004. Diet shifts of juvenile red snapper (*Lutjanus campechanus*) with changes in habitat and fish size. *Fish. Bull.*, 102(2): 366–375.

Westneat, M. W. 2004. Evolution of levers and linkages in the feeding mechanisms of fishes. *Integr. Comp. Biol.*, 44(5): 378–389. https://doi.org/10.1093/icb/44.5.378.

Windell, J. T. and Bowen, S. H. 1978. *Methods for study of fish diets based on analysis of stomach contents*. In: Timothy, B. (Ed.), *IBP (International Biological Programme) Handbook, No 3 Methods for assessment of fish production in fresh waters*, 3rd edn. Blackwell Scientific Publications, Oxford, UK. pp. 219-226

Winemiller, K. O. 1989. Ontogenetic diet shifts and resource partitioning among piscivorous fishes in the Venezuelan llanos. *Environ. Biol. Fishes*, 26(3): 177–199. https://doi.org/ 10.1007/BF00004815.