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Diet composition and feeding dynamics of *Trichiurus lepturus* Linnaeus, 1758 off Gujarat, north-west coast of India

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ABSTRACT

The largehead ribbonfish, *Trichiurus lepturus* Linnaeus, 1758 forms a major fishery along north-west coast of India comprising the two coastal states of Gujarat and Maharashtra. Diet composition was analysed for five years (2010-2014) to understand shifts if any in the prey items. Seasonal changes in the prey items were studied for three years (2012-2014) to explore the temporal dynamics of prey availability in the ecosystem and in largehead ribbonfish guts. Feeding indices *viz.,* Stomach fullness index (SFI), empty stomach ratio (ESR), gastrosomatic index (GaSI) and relative gut length (RLG) explained the feeding behaviour, seasonal dynamics and ontogenetic shifts in prey items. The Vacuity Index (VI) was estimated as 37.56%, indicating that *T. lepturus* is a carnivore and relatively edacious. Diet of *T. lepturus* comprised of fishes (47.16%), crustaceans (45.22%), molluscs (4.33%) and miscellaneous items (3.28%). *Acetes* sp. was the most dominant prey item during the study period. Feeding intensity was found to be high during the post-monsoon months which coincided with the period of gonadal maturation of the fish. Significant variations ($p<0.05$) were seen in the feeding indices during different months, different sizes and between sexes due to the availability of prey items, physiological changes and ontogenetic shifts. A detailed knowledge on diet composition, temporal dynamics in diet patterns and feeding indices can reveal the trophic interaction of prey-predator, resource abundance and fluctuations which are important inputs in ecology-based fishery management models/tools.

Keywords: *Acetes* sp., Diet composition, Feeding indices, North-west coast of India, Temporal variations, *Trichiurus lepturus*

Introduction

Ribbonfishes are one of the most important finfish resource exploited all along the Indian coast for fresh consumption and export; both in frozen and dried form. Estimated catch of ribbonfishes in India during 2014 was 2,09,405 t and it contributed 5.6% to the total marine fish landings (CMFRI, 2015). Gujarat, with a contribution of 48% to the total ribbonfish catch of the country was the leading state. Ribbonfish formed 14.26% of total marine fish landings in Gujarat (CMFRI, 2014). The fish is targeted all along the Indian EEZ owing to its consistent export demand in frozen form, especially in China and other South-East Asian countries (Khan, 2006). Ribbonfish were mainly exploited by trawlers (single day and multiday) and gillnetters at depth ranging from 80 to 120 m. The largehead ribbonfish play an important role as a top predator in the ecosystem in controlling populations of mid and lower trophic level fishes, crustaceans and cephalopod species (Yan *et al.,* 2011).

Considerable research has been done on diet of ribbonfish, on biological interactions, ontogenetic and seasonal diet variations along different parts of the world (Yan *et al.,* 2012). Studies on fishery, population dynamics and reproductive biology of ribbonfish have been done along western Arabian Sea by Anees *et al.* (2012); Al-Nahdi *et al.* (2009) and Yousuf *et al.* (2012). However, very little work has been carried out on the food habits and feeding variations of *Trichiurus lepturus* Linnaeus, 1758 along west coast of India (Rohit *et al.,* 2015). Feeding habits and its variations can give an idea on ecological interactions of species and their prey, which are crucial inputs for conservation and management of the fishery resources. The present study thus aims at understanding the diet of the large head ribbonfish *T. lepturus*, its feeding habit, variations in the diet over seasons and any ontogenetic shift in diet composition so as to postulate suitable management measures to sustain the fishery.

Materials and methods

Whole fish samples for gut content analyses were collected at weekly intervals along the north-west coast of India bordering the north-eastern Arabian Sea (Fig. 1) from different fish landing centres along Gujarat (Jafrabad, Nawabandar, Vanakbara, Veraval, Mangrol and Porbandar). Data collected for the period 2010-2014 was used for the

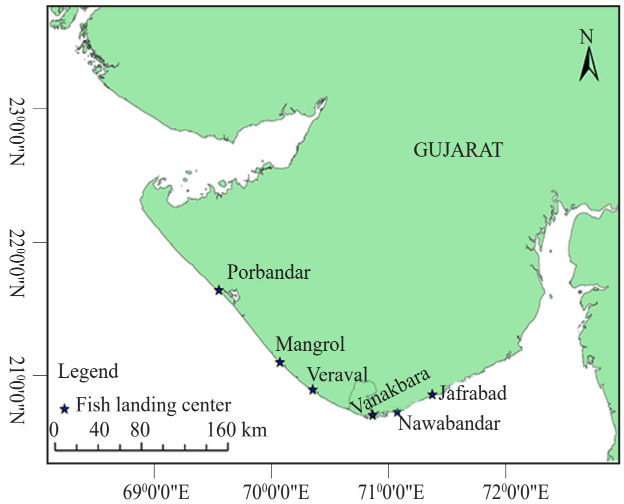

Fig. 1. Sample collection locations from different landings centres in Gujarat

calculation of index of relative importance (IRI) (Pinkas *et al.,* 1971). Seasonal changes in the diet composition of *T. lepturus* were analysed for a period of 3 years (2012-2014). A total of 410 samples were analysed for the estimation of other feeding indices *viz.,* stomach fullness index (SFI), empty stomach ratio (ESR), gastro-somatic index (GaSI) and relative gut length (RLG).

Fish samples were brought to the laboratory and their individual length (cm) and weight (g) were noted. The total length (TL) of the *T. lepturus* examined during the study period ranged between 40 and 110 cm. Stomachs were then taken out carefully for further analyses. The total weight of the stomach contents, number and weight of individual food items (identified to the nearest taxon) and collective weight of food belonging to each taxon were noted. Each food item was weighed to the nearest 0.1 g. The partially digested fish and shrimp remains were grouped as unidentified fish and shrimp respectively. The total length, sex and maturity stage of the fish were recorded and the stomach contents were analysed using IRI. The relative importance of each prey item in the diet and their seasonal variations were analysed (Pinkas *et al.,* 1971) on the basis of three indices: (i) percentage of wet weight of each food item to the total wet weight of all food items identified (%W); (ii) percentage of the number of each food item to the total number of all food items identified (%N); and frequency of occurrence of each food item in the total number of stomachs examined (%F). The index of relative importance (IRI) was calculated as:

$$IRI=(\%N+\%W)\times\%F$$

Feeding periodicity was determined by analysing the feeding intensity and the empty stomach ratio (ESR). The ESR was calculated as percentage of the number of specimens with an empty stomach, of the total number of specimens examined (Rohit *et al.,* 2015). Stomach fullness index (SFI) was used to measure the degree of feeding intensity (Chiou *et al.*, 2006). SFI was calculated as:

$$SFI = \left[\frac{\text{Weight of stomach contents}}{\text{(Bodyweight-Weight of stomach contents)}}\right] \times 100$$

The variations in the SFI were estimated between immature (<61.2 cm) and mature (>61.2 cm) categories. This size differentiation was made on the basis of length at first maturity as 61.2 cm TL (Ghosh *et al.*, 2014). The SFI of different size groups in different months were compared. Gastro-somatic index (GaSI), is a tool useful for comparing the scale of feeding (food consumption) during various months and for determining the environmental and physiological effects on feeding habits. GaSI was calculated using the equation suggested by Desai (1970):

$$GaSI = \frac{\text{Weight of gut}}{\text{Bodyweight}} \times 100$$

The stomachs were classified as gorged, full, ¾ full, ½ full, ¼ full, trace and empty and the data for the study period was pooled and classified as poorly fed (empty and trace), moderately fed (¼ full and ½ full) and heavily fed (¾ full, full and gorged) (Manojkumar *et al.,* 2015). The intensity of feeding was determined based on the degree of distension of the stomach due to feeding and the amount of food items contained. The Vacuity Index (VI) was calculated as follows: VI (%) = Number of empty stomachs / Number of total stomachs × 100. The index is interpreted according to the following five scales as suggested by Biswas (1993): VI = 0-20 (edacious); VI = 20-40 (relatively edacious); VI = 40-60 (moderately fed); VI = 60-80 (relatively low fed) and VI = 80-100 (low fed).

Data on different feeding indices was analysed to check for normal distribution using Kolmogorov-Smirnov test. Wilcoxon Rank Sum test/Mann-Whitney U test and Proc t-test were used to find out the variations between sexes and maturity categories depending on the sample distribution. Monthly variations in indices were observed using non-parametric Kruskal-Wallis test as the samples were not normally distributed. Variations between the different months were estimated using *post-hoc* tests like Bonferroni and Tukey's HSD. All statistical tests were carried out in R software version 3.3.

Results

The index of relative importance (IRI)

The diet spectrum of *T. lepturus* comprised of four general categories *viz.*, fishes, crustaceans, molluscs and miscellaneous items and the IRI of each category was; fishes 47.16%, crustaceans 45.22%, molluscs 4.33% and miscellaneous items 3.28% (Fig. 2).

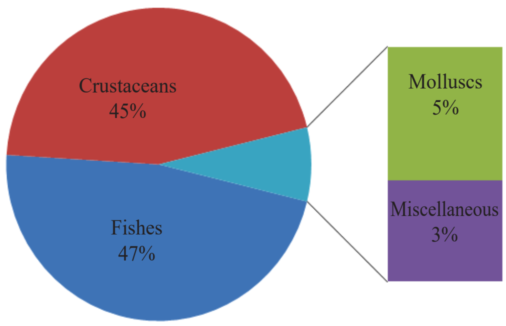

Fig. 2. Diet spectrum of *T. lepturus* landed in Gujarat

Data for the period of 5 years (2010-2014) was analysed to study the annual variations in the diet composition of *T. lepturus,* (Fig. 3). During the study period, fishes and crustaceans together formed the principal diet with the combined IRI values ranging from 75-99%. Among all diet groups, *Acetes* sp. contributed significantly in all years. This was followed by partially digested

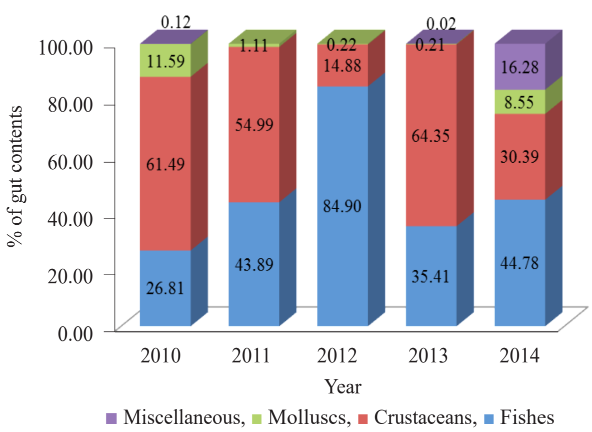

Fig. 3. Annual trend in gut contents (%) of *Trichiurus lepturus* (2010-2014)

unidentified fish remains, *Sepia* spp., *Sardinella* spp., *T. lepturus*, clupeoids and other shrimps. Estimated IRI values of *Acetes* sp. during the years were 61.44% (2010), 54.45% (2011), 14.66% (2012), 64.20% (2013) and 30.24% (2014). The unidentified partially digested fish remains formed a notable part of the diet during 2012 (80%) and was comparatively lesser in the remaining years. Among fishes, *Coilia dussumieri* constituted 8.05% during the year 2014 followed by sciaenids 3.30%, *Sardinella* sp. 3.27%, *Thryssa* spp. 1.34% and *T. lepturus* 1.22%. Cuttlefish constituted a significant part of the diet only during 2010 (11.06%) and 2014 (8.55%). (Table 1)

Seasonal variation in the diet composition of *T. lepturus* for the period was studied by analysing the data for three years from 2012 to 2014 (Fig. 4). In the pre-monsoonseason (February to May), fishes (47.14%) were the dominant food items found in the gut, followed by crustaceans (35.56%),

Table 1. Inter-annual variations of diet composition (IRI in %) of *T. lepturus*

Food items/groups	2010	2011	2012	2013	2014
Fishes					
Apogon sp.	--	--		1.17	0.93
Bregmaceros sp.	--	--	0.01	--	--
Catfish	--	--	0.02	--	--
Clupeoids	4.42	--	0.25	0.01	0.67
Coilia dussumieri	--	--	--	--	8.05
Decapterus russelli	--	1.41	0.17	--	--
Digested fish	15.63	35.17	80.86	30.19	25.75
Hilsa sp.	--	0.03	--	--	0.06
Lactarius lactarius	--	--	0.01	--	--
Megalaspis cordyla	--	0.07	--	--	--
Rastrelliger kanagurta	--	3.30	0.11	--	--
Nemipterus sp.	0.15	--	0.01	--	--
Otolithes sp.	--	--	--	2.13	--
Lagocephalus sp.	--	--	--	--	0.19
Trichiurus lepturus	0.04	2.14	0.15	1.12	1.22
Sardinella sp.	5.39	1.39	0.04	0.58	3.27
Sciaenids	0.95	0.02	--	--	3.30
Sphyraena sp.	0.11	--	--	--	--
Thryssa sp.	0.12	--	--	0.19	1.34
Other fishes	--	0.36	3.27	0.01	--
	26.81	43.89	84.90	35.41	44.78
Crustaceans					
Acetes sp.	61.44	54.45	14.66	64.20	30.24
Solenocera	--	--	0.03	0.16	0.11
Other shrimps	0.05	0.54	0.18	--	0.04
Squilla	--	--	0.01	--	--
	61.49	54.99	14.88	64.35	30.39
Molluscs					
Uroteuthis (P.) sp.	0.53	0.97	0.21	0.21	--
Sepia sp.	11.06	0.15	--	--	8.55
Octopus	--	--	0.01	--	--
	11.59	1.11	0.22	0.21	8.55
Miscelleneous					
Isopod parasite	0.12	--	--	0.02	--
Digested material	--	--	--	--	16.28
	0.12	0.00	0.00	0.02	16.28

molluscs (9.14%) and miscellaneous items (8.16%). Among fishes, unidentified fish remains (37.20%) formed the major category followed by *Sardinella* spp. (3.16%), *T. lepturus* (1.98%), clupeoids (1.29%) and *Thryssa* spp. (1.11%). Among crustaceans, *Acetes* sp. (31.45%) was the key prey followed by other shrimps. During monsoon season (June, July, August and September) also the maximum IRI was for fishes (65.60%), followed by crustaceans (20.46%), miscellaneous items (13.33%) and molluscs (0.60%). Among fishes, unidentified fish remains (55.16%), sciaenids (7.50%), clupeoids (1.68%) and *T. lepturus* (0.93%) comprised major part of the diet. While *Acetes* sp.

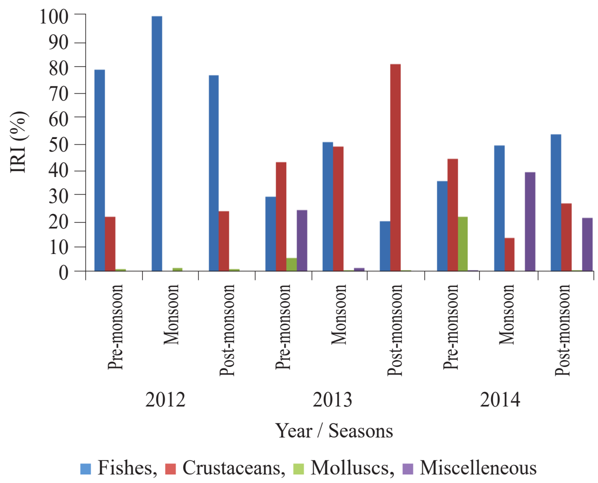

Fig. 4. Seasonal variations in diet composition (IRI in %) of *T. lepturus*

(19.77%), other shrimps (0.57%) and the *Solenocera* sp. (0.13%) constituted the crustacean component; *Uroteuthis (P.)* spp. (0.60%) constituted molluscs. Isopods, predominantly an external parasite on fishes also occurred in the diet of ribbonfish during the monsoon months. In the post-monsoon season (October, November, December and January), fishes and crustaceans formed the diet in almost equal proportion (49.3 and 43.18%) and the contribution of molluscs to the diet was negligible (0.61%). *Acetes* sp. (42.85%) contributed significantly to the diet during post-monsoon months. This was followed by unidentified fish (32.65%), *Coilia dussumieri* (6.7%), sciaenids (2.98%), *Apogon* sp. (2.0%) and *T. lepturus* (1.66%) (Table 1).

Empty stomach ratio (ESR) was analysed to estimate the feeding intensity and stomach status of *T. lepturus* during different months. The monthly changes in the ESR varied from 16.67 in October to 65 in December. Maximum ESR values were noticed during March to May and a lower peak was observed during August to October (Fig. 5). The Vacuity index (VI) for *T. lepturus* was estimated as 37.56%, indicating that the species is relatively edacious.

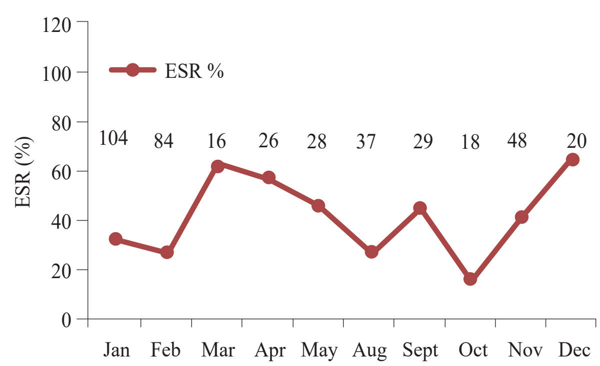

Fig. 5. Monthly variations of empty stomach ratio (ESR) of *T. lepturus*

Gastro-somatic index (GaSI) of *T. lepturus* was analysed to depict the feeding intensity (Fig. 6). GaSI was recorded highest (3.046) in the month of February in both male and female and the lowest value was noticed as 1.535 (August) for males and 1.668 (September) for females. Significant variations ($p<0.05$) were noticed in monthly values of GaSI. Significant variation as per Tukey's HSD *post hoc* test was apparent in February as compared to other months, specially August and September. Maximum feeding intensity was noticed both in males and females in the months of November to April. Lower feeding intensity was observed during August to October for males and August to September for females. Significant difference ($p<0.05$) was observed in GaSI between sexes.

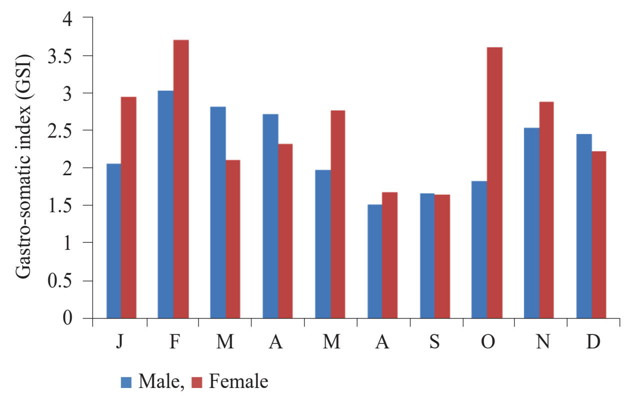

Fig. 6. Monthly variations of gastro-somatic index (GaSI) of *T. lepturus*

The monthly change in the stomach fullness index (SFI), a proxy to feeding intensity is depicted in (Fig. 7). SFI values ranged from 2.28 in January to 0.69 in August. SFI value showed two peaks during January to March and September to October, but was lower in November and December. Significant variations ($p<0.05$) were observed in SFI values in different months. January, February and May months showed significant variations from August.

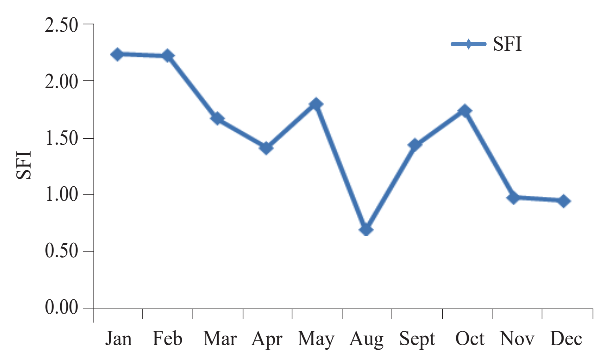

Fig. 7. Monthly variations of stomach fullness index (SFI) of *T . lepturus*

Table 2. Seasonal variations of diet composition (IRI in %) of *T. lepturus* (2012-2014)

Food items/groups	Pre-monsoon	Monsoon	Post-monsoon
Fishes			
Apogon sp.	0.77	0.00	2.00
Bregmaceros sp.	0.00	0.00	0.01
Catfish	0.00	0.00	0.02
Clupeoids	1.29	1.68	0.01
Coilia dussumieri	0.02	0.00	6.70
Decapterus russelli	0.00	0.00	0.14
Digested fish	37.20	55.16	32.65
Hilsa sp.	0.05	0.00	0.00
Lactarius lactarius	0.15	0.00	0.00
Megalaspis cordyla	0.15	0.00	0.00
Rastrelliger kanagurta	0.66	0.00	0.00
Nemipterus spp.	0.00	0.00	0.01
Otolithes spp.	0.00	0.23	0.17
Lagocephalus sp.	0.16	0.00	0.00
Trichiurus lepturus	1.98	0.93	1.66
Sardinella sp.	3.16	0.00	0.91
Sciaenids	0.14	7.50	2.98
Sphyraena sp.	0.00	0.00	0.00
Thryssa sp.	1.11	0.09	0.12
Other fishes	0.30	0.00	1.91
	47.14	65.60	49.30
Crustaceans			
Acetes sp.	31.45	19.77	42.85
Solenocera sp.	0.00	0.13	0.23
Other shrimps	4.10	0.57	0.09
Squilla	0.00	0.00	0.01
	35.56	20.46	43.18
Molluscs			
Uroteuthis (P.) spp.	2.15	0.60	0.35
Sepia spp.	6.99	0.01	0.25
Octopus	0.00	0.00	0.01
	9.14	0.60	0.61
Miscellaneous			
Isopod parasite	0.00	0.50	0.00
Digested material	8.16	12.83	6.91
	8.16	13.33	6.91
Total	100.00	100.00	100.00

SFI for the immature and mature individuals in different sexes was analysed to estimate the impact of maturity on the status of stomach (Fig. 8). The mean SFI values were higher for females compared to males. The feeding intensity of immature fishes (<61.2 cm TL) was lower than that of mature fishes (>61.2 cm TL), both in males and females (Fig. 8). Significant difference ($p<0.05$) was observed in SFI values between sexes and no significant ($p>0.05$) difference was noticed between immature and mature categories.

The relative length of gut (RLG) of *T. lepturus* for immature and mature categories in both males and females are depicted in Fig. 9. The average RLG value is 0.175 indicating the species to be highly carnivorous in its feeding behaviour. A significant variation in the RLG was noticed between immature and mature categories irrespective of sex. RLG values of immature category ranged from 0.088 to 0.215 for males and 0.106-0.236 for females. The RLG values of mature fishes were higher compared to that of immature fishes *i.e.* 0.084-0.322 for males and

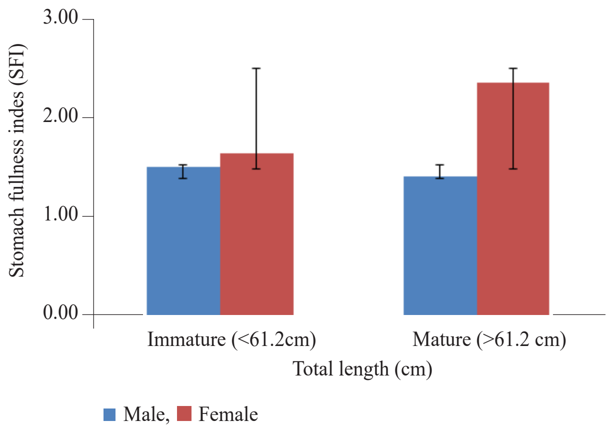

Fig. 8. Size-wise and sex-wise variations in stomach fullness index (SFI) of *T. lepturus* (Error bars indicate SE)

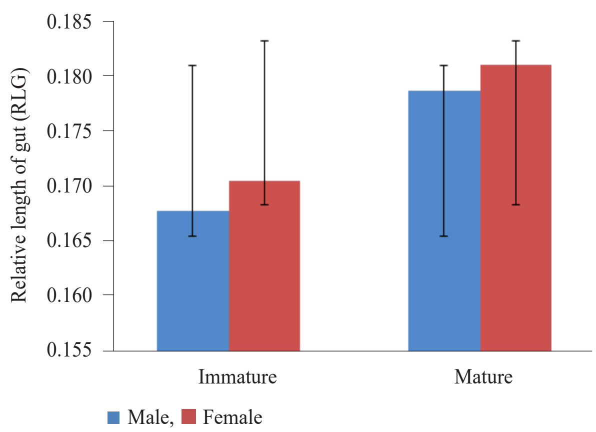

Fig. 9. Size-wise and sex-wise variations of relative length of gut (RLG) of *T. lepturus* (Error bars indicate SE)

0.113-0.256 for females. RLG values showed normal distribution and no significant difference ($p>0.05$) was observed between sexes. However, significant difference ($p<0.05$) was observed between RLG values of immature and mature groups.

Discussion

The current work was aimed at studying the inter-annual variations in diet composition of *T. lepturus* for the period of five years (2010-2014), followed by inter-seasonal diet variations for the period of three years (2012-2014). Feeding pattern, diet composition, feeding frequency and feeding dynamics of *T. lepturus* were studied using feeding indices like ESR, VI, FSI, GaSI and RLG.

Inter-annual variations in diet composition

The study showed that, off the north-west coast of India, *T. lepturus* is a mid-carnivore and facultative cannibalist. Fishes and crustaceans were the principal food items encountered in the guts, followed by molluscs and miscellaneous groups. Study of the diet structure during the five year period revealed that both the fish and crustacean groups formed the major diet. Contribution of crustaceans and fishes was almost equal during all years except in 2012, when finfishes dominated. *Acetes* sp. was the most predominant prey item found in the guts of *T. lepturus* in all years indicating that this was a preferred diet and the abundance of the largehead ribbonfish resource depended on *Acetes* availability. Cephalopods like cuttlefishes, squids and octopuses were preyed upon by the largehead ribbonfish only occasionally.

Inter-seasonal variations in diet composition

Study of seasonal variations in the IRI portrays the changes in diet spectrum or selectivity of the food based on availability of the prey. Seasonal differences in the diet were mainly governed by prey abundance. *Acetes* sp. was the key prey item encountered during pre-monsoon and post-monsoon months and was less during monsoon months. The presence of wide continental shelf rich with detritus, phyto and zooplankton which forms the food of *Acetes,* has led to this shrimp being a predominant organism in seas off the north-west coast of India. Due to its short life cycle and prolific reproductive behaviour, *Acetes* is a predominant resource in this region and functions as the key prey to many carnivorous fishes in this ecosystem. It is observed that the period of highest ribbonfish landing *i.e.* post-monsoon and pre-monsoon months coincides with the period when the proportion of *Acetes* is the highest in the guts. Thus, it can be presumed that *Acetes* is the key diet of *T. lepturus* and its availability can dictate the ribbonfish fishery along north-west coast of India. Among fishes, partially digested fish remains contributed significantly, followed by *Coilia* sp., *Trichiurus* sp., *Sardinella* spp., sciaenids, clupeoids, *Thryssa* spp. and *Apogon* sp.. Presence of cephalopods in the diet was considerable only during pre-monsoon months. Juveniles of *T. lepturus* were noticed in the guts during post-monsoon season, revealing the cannibalistic feeding behaviour of the species at times of abundance. A complex prey-predator relationship exists in the feeding behaviour of *T. lepturus* with significant predominant interaction with *Acetes*.

Empty stomach ratio (ESR)

The presence of high percentage of empty stomachs is characteristic of piscivorous fishes (Juanes and Conover, 1994). Higher proportion of empty stomachs in ribbonfishes were reported from Kakinada (Abdussamad *et al.,* 2006), Arabian Sea and northern Bay of Bengal (Ghosh *et al.,* 2014) in India; and Beibu Gulf of South China Sea (Yan *et al.,* 2012). ESR was maximum during March to May and minimum during August to October. The ESR pattern of the ribbonfishes in the region showed that the feeding intensity is more during the post-monsoon months; which incidentally is the peak period of landing of ribbonfishes in Gujarat. Similarly, it is less during the summer months which is the lean period for ribbonfish landing. Thus, there is a clear indication that the abundance of the ribbonfishes in the region during the 3rd and 4th quarter of the year (post-monsoon months) is consequent to the abundance of prey items. However, feeding intensity showed negative correlation with empty stomach ratio and positive correlation with spawning period, suggesting that feeding increases with gonad development to meet nutritional requirement for maturation (Rohit *et al.,* 2015).

Stomach fullness index (SFI)

Stomach fullness index (SFI), a proxy to feeding intensity varied significantly in different months, reaching its peaks during January to March and September to October and lower during November and December. SFI showed significant variation in different months ($p<0.05$). Occurrences of gravid and ripe gonads in females were noticed during the months of December and January along northern Arabian Sea indicating its breeding season in the area (Ghosh *et al.,* 2014). *T. lepturus* spawns during late spring or during onset of south-west monsoon (May-June) in the Arabian Sea region (Al-Nahdi *et al.,* 2009). SFI values during January, February and May (high SFI) showed significant variation with August (low SFI) as per Tukey's HSD *post hoc* test. During breeding season, fishes need higher nutritional energy for their gonad development and maturation. Earlier studies on ribbonfish have clearly pointed out high nutritional demand for reproductive activity (Chiou *et al.,* 2006). Current study revealed maximum feeding intensity to coincide with spawning period of *T. lepturus.* This might be due to supply of nutritional energy for gonad maturation. Monthly variations in SFI along northern Arabian Sea resembles the variation along southern Arabian Sea as reported by Rohit *et al.* (2015), indicating that seasonal variations in feeding intensity of *T. lepturus* along Arabian Sea is more or less uniform. SFI showed significant difference ($p<0.05$) between sexes.

Gastro-somatic index (GaSI)

Gastro-somatic index (GaSI) of *T. lepturus* showed variations during different months. Maximum GaSI was observed during post and pre-monsoon seasons (October to March). Significant variations ($p<0.05$) were noticed in monthly values of GaSI. Significant variation was observed for February month as compared to August and September months as per Tukey's HSD *post hoc* test. During the current study, feeding intensity was more during post-monsoon months (spawning season) probably to meet the nutritional demand required to restore the gonads from spent stage to spent recovering stage. It was also observed that feeding intensity was good during pre-spawning season, probably to meet the energy requirement for gonad development and maturation. Maximum GaSI was noticed during pre-monsoon and post-monsoon months when fish catches were also high owing to more abundance in the ecosystem (Rahimibashar *et al.,* 2012). Significant difference ($p<0.05$) was observed in GaSI between males and females, which might be due to differing energy requirement for females as compared to males for gonad maturation and reproduction.

Relative length of gut (RLG)

The average relative length of gut (RLG) of *T. lepturus* was 0.175 indicating that this species is highly carnivorous in its feeding behaviour. Significant difference ($p<0.05$) in the RLG was observed between two size groups *i.e.* immature (<61.2 cm) and mature individuals (>61.2 cm) and this could be due to ontogenetic changes. The ontogenetic increase in gut length is well known in marine and freshwater herbivorous fishes (Gallagher *et al.,* 2001; Drewe *et al.,* 2004). RLG in the mature specimens will be high as the quantum of food intake will be more and size of intake prey will be larger compared to immature group. Even in carnivorous fishes, increase in gut length with increase in standard length has been observed, but herbivores tend to show a more rapid increase (Kramer and Bryant, 1995). No significant difference ($p>0.05$) was observed in RLG values between different sexes.

The study indicates that *Trichiurus lepturus* is a voracious carnivore and its principal food in the north-east Arabian Sea ecosystem is *Acetes* sp. Fishes such as sardines, other clupeoids, *Coilia* sp., sciaenids and *Apogon* sp. also formed its food during different seasons. Molluscan resources such as *Sepia* spp. and *Loligo* spp. also constituted the diet significantly during pre-monsoon season. The principal food remained the same in all years throughout the study period indicating consistency in food preference. However, the principal food varied between seasons over the three year period of study. The chosen food during the pre-monsoon period was *Acetes* sp., *Sepia* sp., *Sardinella* sp. and juveniles of *T. lepturus*; during monsoon period it was digested fishes, *Acetes* sp., sciaenids and clupeids and during post-monsoon months it was *Acetes sp*., digested fishes, *Coilia* sp., sciaenids, *Apogon* sp. and juveniles of *T. lepturus*. The study indicated preference for *Acetes* sp. during the pre-spawning periods and it could be attributed to the nutritional quality of the shrimps over other species of fishes aiding in the maturation process. Results of the various indices of feeding suggest that feeding intensity of this species varies over the seasons. The feeding intensity was found to be more during the post-monsoon period which incidentally is the period of maturation of the fish.

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