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FOOD AND FEEDING HABITS OF *SECURICULA GORA* (HAMILTON, 1822) IN MEGHADRIGEDDA RESERVOIR, VISAKHAPATNAM, ANDHRA PRADESH, INDIA

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ABSTRACT

A total of 186 fishes of *Securicula gora* were collected from Meghadrigedda Reservoir during June 2021 to May 2022. Which are having 99 fishes are full gut and 87 are empty stomachs were observed. The food items of insect and crustacean pieces were showed highest part in September (66.0%) and the lowest in March (42.0%), fish scales and spines were appeared highest in July (15%) and lowest in March (2%), molluscan shells highest in arch (7%) and lowest in July (0.5%), Micro algae highest in February and March (12%) and lowest in October and November (4%), Filaments algae highest in February (12.5%) and lowest in September (2%), digested food highest in March (27%) and lowest in July (12%). The Relative Frequency (%RF) is highest (11.82) in June and less (4.3) in January. An average seasonal variation of RF% resulted more (10.21± 1.58) in monsoon period and low (6.85±2.46) in post-monsoon period. In the present investigation food dominance, Gut repletion index**,** K-factor and the Gastro Somatic Index were observed during in different seasons.

KEYWORDS: Gut content, Gut repletion index**,** K-factor, Gastro Somatic Index.

INTRODUCTION

Securicula gora is a common fresh water indigenous small fish of India and it is commonly called as chela. This fish is very much popular and less costly, which is available in the rivers, canals, ponds, and lakes. These small indigenous fish is not only as a source of animal protein but also a source of vitamin, iron, calcium, phosphorus etc. The study of the food and feeding habits of fish species is a subject of continuous research because it constitutes the basis for the development of a successful fisheries management programmed on fish capture and culture.[1] and because the aquatic ecosystem is dynamic. The gut content is reflection of the water quality and other factors. The natural habitats offer a great diversity of organisms that are used as food by fish, which differ in sizes.[2] The dietary analysis of fish in their natural habitats enhances the understanding of the growth, abundance, productivity and distribute on of organisms.[3] Hence, most studies which are aimed at obtaining such information are based on the analysis of gut contents of fish caught from their natural habitats.[4] A total of 40 genera, and 63 of phytoplankton species are reported in the Meghadrigedda Reservoir, which belong to Chlorophyta with 35 species, Bacillariophyta with 13 species, Cyanophyta with 12 species and Euglenophyta with 3 species were determined from the water samples[5] A total of 46 species of zooplankton belonging to 16 species of rotifer, 8 species of cladocera, 6 species of copepod, 3 species of ostrocoda, 3 species of protozoa, 7 species of crustacean, one species of mollusca and 2 species of fish larva were identifiedin Meghadrigedda Reservoir.[6] Proper knowledge about the food and feeding habits of fish are very important for increasing fish production. The food habits of fishes vary with time of the day, size of the fish, season of the year, locality and availability of several food stuffs. Many investigators made studies on the food and feeding habits of different fishes, but so far literature reviewed no published report was found on food and feeding habits of *Securicula gora*. Therefore, the present study on the food and feeding habits of common fish species in Meghadrigedda Reservoir was conducted to make available this important information, which might be helpful to the fish culture ponds and other water bodies.

MATERIALS AND METHODS

Fish samples were collected with the help of local fishermen using traditional fishing gear such as cast-net and set gillnets. For examination, the specimens were preserved in 10% formalin solution and injected into the

gut of all the fishes in order to stop digestion of food items. A total of 168 specimens of Gora Chela were collected from June 2021 to May 2022. The month-wise collection and experiments were made to show the seasonal variation in food choice of the fish. All the experiments were carried out in the laboratory of the Dept. of Zoology and Aquaculture, Dr. V. S Krishna Govt. Degree & PG College (A). The stomach of the fishes were dissected with the help of a simple scissors and the stomach contents were taken into a petridish and the food items were identified by Binocular microscope (Magnification 5X, 10X) and weighted in an electronic balance (Fig 1, 2 & 3). Gravimetric method was followed for estimation of the percentage composition of food items.[7,8]

Gut contents analyses

Each opened stomach was assigned a number of points proportional to its degree of fullness according to an arbitrary 0-20 point scale. In this method, 0, 5, 10, 15 and 20 points were scored for empty, ¼ full, ½ full, ¾ full and full stomachs respectively. Intermediary points were also allotted where necessary according to the proportion of food in the stomach. Stomach contents were sorted out into categories using and analyzed using Relative Frequency (%RF) methods.

$$RF = \frac{Fi}{Fi} \times 100 \text{ ---------- 1}$$

Whereas, Fi = Frequency of item i; Fi = Frequency of the nth item i.e. number of all Fi. All RF values sum up to 100%. RF is un-weighted by the actual amounts of items in the stomachs but is responsive to the frequency of each in relation to the frequencies of all others. The integrated importance of each food item was then expressed as an Index of Food Dominance (IFD) according to the formula:

$$IFD = \frac{RF.PP}{\Sigma RF.PP} \times 100 \text{ ---------2}$$

Whereas, RF = % Relative Frequency of food item; PP = % Point Percentage

This index ranges from 0-100%. Food items with IFD ≥10% were arbitrarily considered as primary diets; those with IFD between 1-9.9% as secondary diets and those with IFD between 1-9.9% as secondary diets and those with IFD <1% as incidental food items. The use of IFD to establish overall food preponderance is adequate as it incorporates the RF and PP data, thus minimizing the bias characteristic of cases in which results from different analytical methods are independently interpreted.[9,10]

The Gut repletion index (GRI) was calculated using the formula

$$GRI = \frac{\text{Number of non} - \text{empty guts}}{\text{Total number of specimens examined}} \times 100 - - - - - - 3$$

In the point method, the points previously assigned to each stomach were shared among the various contents or food items, taking account of the relative proportions by volume. The mean points gained by each food item were determined.

Numerical count method

The food items were identified taking a portion of the gut material. The whole volume of the sample was oserved under a microscope. The number of individuals identified and counted a total number of food items. The percentage of individual food item was also determined and recorded. This method was given by Hynes (1950).[7,8,9]

$$\text{Percentage of numerical count} = \frac{\text{Number of individual food item}}{\text{Total number of food items}} \times 100 - - - 4$$

K-factor or the condition – It could call it the BMI or health index of the fish. The factor is calculated using the Fulton formula.

Fish condition factor was calculated as: k = 100×TW/L^3---------(5)

The condition factor of a fish is regarded as the fitness or relative well-being of the fish and it indicates the general metabolism of the fish.

The Gastro Somatic Index (GSI) was calculated to show the trends in the feeding activity of the fish according to the formula.[7]

GSI = 100Wf/Wt ---------- (6)

Whereas, Wf = Weight (g) of food in the gut; Wt = Total weight (g) of the fish

Occurrence method: The number of stomach containing one or more food items were recorded (Hyslop 1980). The number was then expressed as a percentage of all stomach.

Points method: In this method, each of the food item was allotted of points on the basis of quantity and all the points gained by different food items were summed up and scale down to percentage to express them in percentage composition of the gut contents of all the fish examined.[7,11]

Fig. 1: Sample collection at Meghadrigedda Reservoir.

Fig. 2: Fin formula: D iii 7; A ii-iii 13-15; P i 12-13; V i 7; LL 120-123.

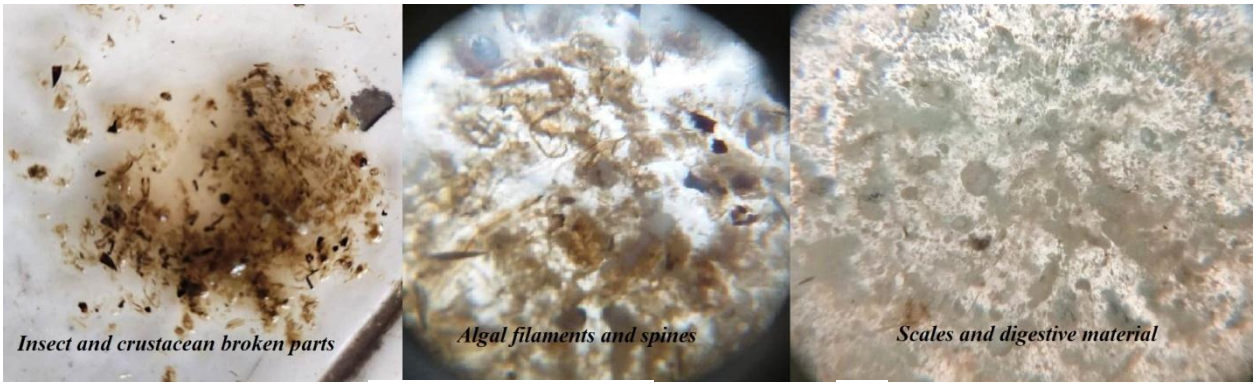


Fig. 3: Food materials in *Securicula gora* Gut.

RESULTS AND DISCUSSIONS

A total of 186 *Securicula gora* gut content were analysed for food items, in these 99 specimens were contain full gut and empty stomachs in87 species. The relative frequency was observed highest (11.82%) in June and lowest (4.30%) in January (Table 1). The mean sizes Total Length were observed highest (15.2 ± 4.26) in May and lowest (8.22±3.42) in August. The mean sizes Total Weight were observed highest (21.2±2.92) in May and lowest (14.91±3.45) in September. The gut repletion index (GRI) highest (70.00%) in November it exhibits an active feeder and lowest (30.77%) in April exhibit to non-active feeder (Table 1). In the similar pattern Pampa and Prasenjit Pal[12] studied the food and feeding habit and the relative length of gut, stomach, and feeding intensity were examined. The morphology and morphometrics of the alimentary canal have also been studied along with the gut content analysis using standard methods. The Relative length of Gut of the dissected fish was studied meticulously and recorded the food contents as per point's methods.

Primary dietary composition of food item was most abundant and occurred regularly in the gut of *Securicula gora*. Monthly feeding intensity was observed the insect and crustacean food item was showed highest in September (66.0%) and the lowest in March (42.0%), fish scales and spines was appeared highest in July (15%) and lowest in March (2%), molluscan shells highest in arch (7%) and lowest in July (0.5%), Micro algae highest in February and March (12%) and lowest in October and November (4%), Filaments algae highest in February (12.5%) and lowest in September (2%), digested food highest in March (27%) and lowest in July (12%). (Table 2 & 3). The seasonal food organisms recorded to Insect and Crustacean parts were highest (62.87±3.06) in monsoon season and lowest (47.37±4.74) in pre-monsoon. The fish scales and spines were second highest (9.62±3.56) represented in monsoon and lowest (5.62±2.62) in pre-monsoon. The least preferential food organisms are Molluscan shells (Table 4). The food and feeding habits of freshwater fishes in reservoirs the results were reported by various investigators. Rama Rao[13] reported the catfish of *M.*

tengara diet composition of crustaceans and insect parts (82.40%) constituted the most important diet followed by fish remains (75.00%), plant materials (76.85%), molluscs (71.30%), algae/ protozoan (68.98%), detritus (52.78%) and sand grains (33.33%) in Lower Manair Dam. Kiran and Puttaiah[14] represented the order of preference of the food items were: desmids, bluegreens, chlorococcales, diatoms and zooplankton from Bhadra Reservoir, Karnataka.

The results of stomach contents were sorted out into categories using Relative Frequency (%RF) methods, it is highest (11.82) in June and less (4.3) in January. An average seasonal variation of RF% resulted more (10.21± 1.58) in monsoon period and low (6.85±2.46) in post-monsoon period (Table 2 & 4). The mean Gastro Somatic Index (GSI%) highest (6.10) in September and lowest in (1.79) in May. The mean seasonal variation highest (4.78±1.28) recorded in Post-monsoon and lowest (2.43±0.51) in Pre-monsoon seasons (Table 2 & 4). The mean condition factor highest (2.3) in September and lowest (0.2) in August, an average seasonal variation of K factor highest (1.22±0.23) in post-monsoon period and low (0.67±0.08) in pre-monsoon period (Table 3 & 4). Rama Rao[15] reported the numerical method of various food organisms in *Xenentodon cancila* and *Hyporhamphus gaimardi* contributes major food organisms were vertebrates 32.00% followed by crustaceans/insect parts 27.56%, fish remains 18.37%, plant materials12.59% and miscellaneous 9.48% were noticed from Lower Manair Dam. Adadu et al.,[16] studied *Labeo coubie* in Lower Benue River were in good condition, taking a critical look at the mean condition factor and the standard deviation. The mean body weight was 183.23+22.13 showing the mean condition factor of 1.84+0.12.

Present results mentioned an average yearly food organisms was observed in the gut content for insect and crustacean food item appeared to be highest 55.33% of the total percentage of occurrence, followed by digested food 18.45%, Filaments algae 7.87%, Micro algae 7.76, scales and spines 7.16 and lowest Molluscan shalls were observed in entire study period (Table 3, Fig 6). The results of seasonal variations of average and standard values of food items dominance during study period analysed and represented in Table 4, Fig 7 to 15. Mamun and Azad[17] reported to dominance of insects (35.89%) and Zooplankton (31.79%) (Rotifera and Crustacea) should be treated as the basic food in *Oxygaster bacaila* from Kaptai Lake. The present study it should be claimed that *Securicula gora* mainly depend on insects, Zooplankton, Crustaceans and Phytoplankton, Which is rightly indicated that the fish *Securicula gora* is a omnivorous with preference for animal nature like insects and Zooplankton plankton.

Table 1: Mean size variation, condition factor and feeding intensity of *Securicula gora.*

Month	Sample size/RF%	Records on food availability		Mean TL(cm)	Mean Wt (g)	GRI (%)	Feeding intensity
		Full stomachs	Empty stomachs				
June	22/ 11.82	10	12	13.8± 2.05	19.3± 2.30	45.45	Non- active
July	19/ 10.22	08	11	12.82±4.24	18.42±3.12	42.10	Non- active
Aug	20/ 10.75	10	10	8.22±3.42	16.52±2.86	50.00	Active feeder
Sep	15/ 8.06	08	07	8.62±2.89	14.91±3.45	53.33	Active feeder
Oct	18/ 9.68	12	06	10.11±3.12	15.32± 4.25	66.66	Active feeder
Nov	10/ 5.37	07	03	10.53±3.44	16.04±5.01	70.00	Active feeder
Dec	15/ 8.06	10	05	12.04±4.12	16.24±4.32	66.66	Active feeder
Jan	8/ 4.30	06	02	11.89±2.01	18.42±5.42	75.00	Active feeder
Feb	16/ 8.60	10	06	13.18±3.28	18.34±3.26	62.50	Active feeder
Mar	12/ 6.45	07	05	14.27±1.82	20.23±4.24	58.33	Active feeder
Apr	13/ 6.99	04	09	14.5±1.25	19.64±3.33	30.77	Non- active
May	18/ 9.67	07	11	15.2 ± 4.26	21.2±2.92	38.88	Non- active
	186	99	87				

Table 2: Size ranges and primary dietary composition based on %IFD of *Securicula gora.*

Month	RF%	Food weight (g)	Mean GSI (%)	Primary dietary composition (%IFD)
June	11.82	0.52	2.63	Insect and Crustacean broken parts (60.5), fish scales and spines (7.50), mollusca shells (3.5), Micro algae (10.0), Filaments algae (5.5), digested food (13.0)
July	10.22	0.61	3.31	Insect and Crustacean broken parts (65.0), fish scales and spines (15.0), mollusca shells (0.5), Micro algae (5.0), Filaments algae (2.5), digested food (12.0)
Aug	10.75	0.78	4.72	Insect and Crustacean broken parts (60.0), fish scales and spines (8.0), mollusca shells (0.3), Micro algae (7.2), Filaments algae

				(4.0), digested food (20.5)
Sep	8.06	0.91	6.10	Insect and Crustacean broken parts (66.0), fish scales and spines (8.0), mollusca shells (0.5), Micro algae (5.0), Filaments algae (2.0), digested food (18.5)
Oct	9.68	0.91	5.93	Insect and Crustacean broken parts (63.0), fish scales and spines (7.0), mollusca shells (3.0), Micro algae e (4.0), Filaments algae (8.0), digested food (15.0)
Nov	5.37	0.89	5.54	Insect and Crustacean broken parts (60.0), fish scales and spines (10.0), mollusca shells (3.0), Micro algae (4.0), Filaments algae (8.0), digested food (15.0)
Dec	8.06	0.75	4.61	Insect and Crustacean broken parts (52.0), fish scales and spines (5.0), mollusca shells (5.0), Micro algae (6.0), Filaments algae (10.0), digested food (22.0)
Jan	4.3	0.56	3.04	Insect and Crustacean broken parts (48.0), fish scales and spines (3.0), mollusca shells (5.0), Micro algae (10.0), Filaments algae (9.0), digested food (25.0)
Feb	8.6	0.56	3.02	Insect and Crustacean broken parts (45.0), fish scales and spines (5.5), mollusca shells (5.0), Micro algae (12.0), Filaments algae (12.5), digested food (20.0)
Mar	6.45	0.52	2.57	Insect and Crustacean broken parts (42.0), fish scales and spines (2.0), mollusca shells (7.0), Micro algae (12.0), Filaments algae (9.0), digested food (27.0)
Apr	6.99	0.46	2.34	Insect and Crustacean broken parts (50.0), fish scales and spines (8.0), mollusca shells (5.0), Micro algae (8.0), Filaments algae (12.0), digested food (17.0)
May	9.67	0.38	1.79	Insect and Crustacean broken parts (52.5), fish scales and spines (7.0), mollusca shells (4.0), Micro algae (10.0), Filaments algae (12.0), digested food (16.5)

Table 3: Index of Food Dominance (IFD) and Average Gut Fullness (AGF).

Season	month	K-Factor	Insect and Crustacean broken parts	fish scales and spines	Molluscan shalls	Micro algae	Filaments algae	digested food
Monsoon	June	0.7	60.5	7.5	3.5	10.0	5.5	13.0
	July	0.9	65.0	15.0	0.5	5.0	2.5	12.0
	Aug	0.2	60.0	8.0	3.0	7.2	4.0	20.5
	Sep	2.3	66.0	8.0	0.5	5.0	2.0	18.5
Post-monsoon	Oct	1.5	63.0	7.0	3.0	4.0	8.0	15.0
	Nov	1.4	60.0	10.0	3.0	4.0	8.0	15.0
	Dec	0.9	52.0	5.0	5.0	6.0	10.0	22.0
	Jan	1.1	48.0	3.0	5.0	10.0	9.0	25.0
Pre-monsoon	Feb	0.8	45.0	5.5	5.0	12.0	12.5	20.0
	Mar	0.7	42.0	2.0	7.0	12.0	9.0	27.0
	Apr	0.6	50.0	8.0	5.0	8.0	12.0	17.0
	May	0.6	52.5	7.0	4.0	10.0	12.0	16.5
	Average		55.33	7.16	3.71	7.76	7.87	18.45

Table 4: Seasonal variations of average food organisms dominance during study period.

Season	Monson	Post-monsoon	Pre-monsoon
Insects and Crustacean parts	62.87±3.06	55.75±6.94	47.37±4.74
Fish scales and spines	9.62±3.56	6.25±2.98	5.62±2.62
Molluscan shells	1.87±1.60	4.0±1.15	5.25±1.25
Micro algae	6.80±2.37	6.0±2.82	10.5±1.91
Filaments algae	3.50±1.58	8.75±0.95	11.37±1.60
Digested food	16.0±4.14	19.25±5.06	20.12±4.83
Relative Frequency (%RF)	10.21± 1.58	6.85±2.46	7.92±1.47
K-Factor	1.02±0.77	1.22±0.23	0.67±0.08
Gut repletion index (GRI)	47.72±4.94	69.58±3.94	47.62±15.23
Mean Gastro Somatic Index %	4.19±1.54	4.78±1.28	2.43±0.51

Fig 4. Records on food availabilityin fish gut

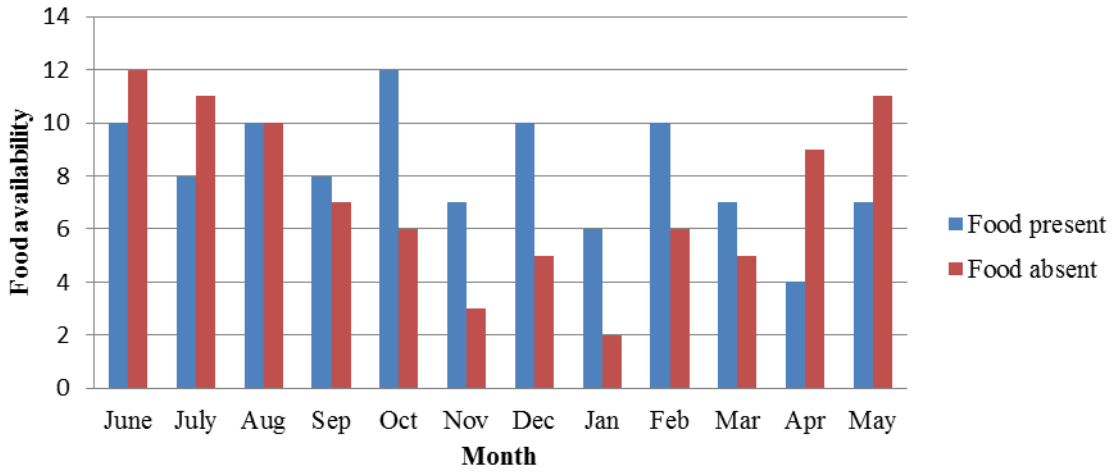


Fig 5. Dietary composition (%IFD)

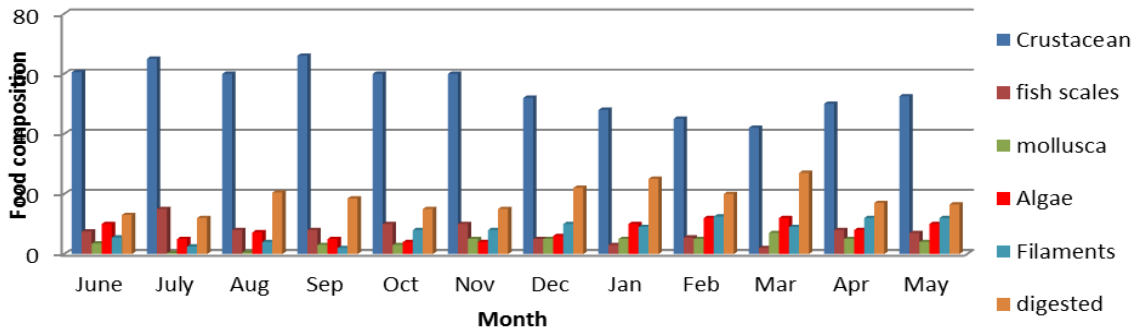
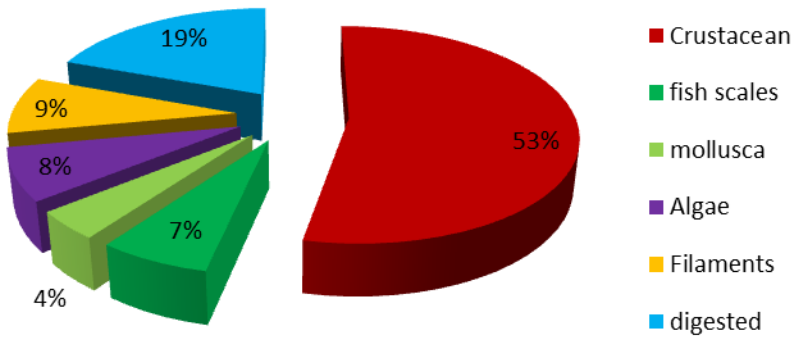
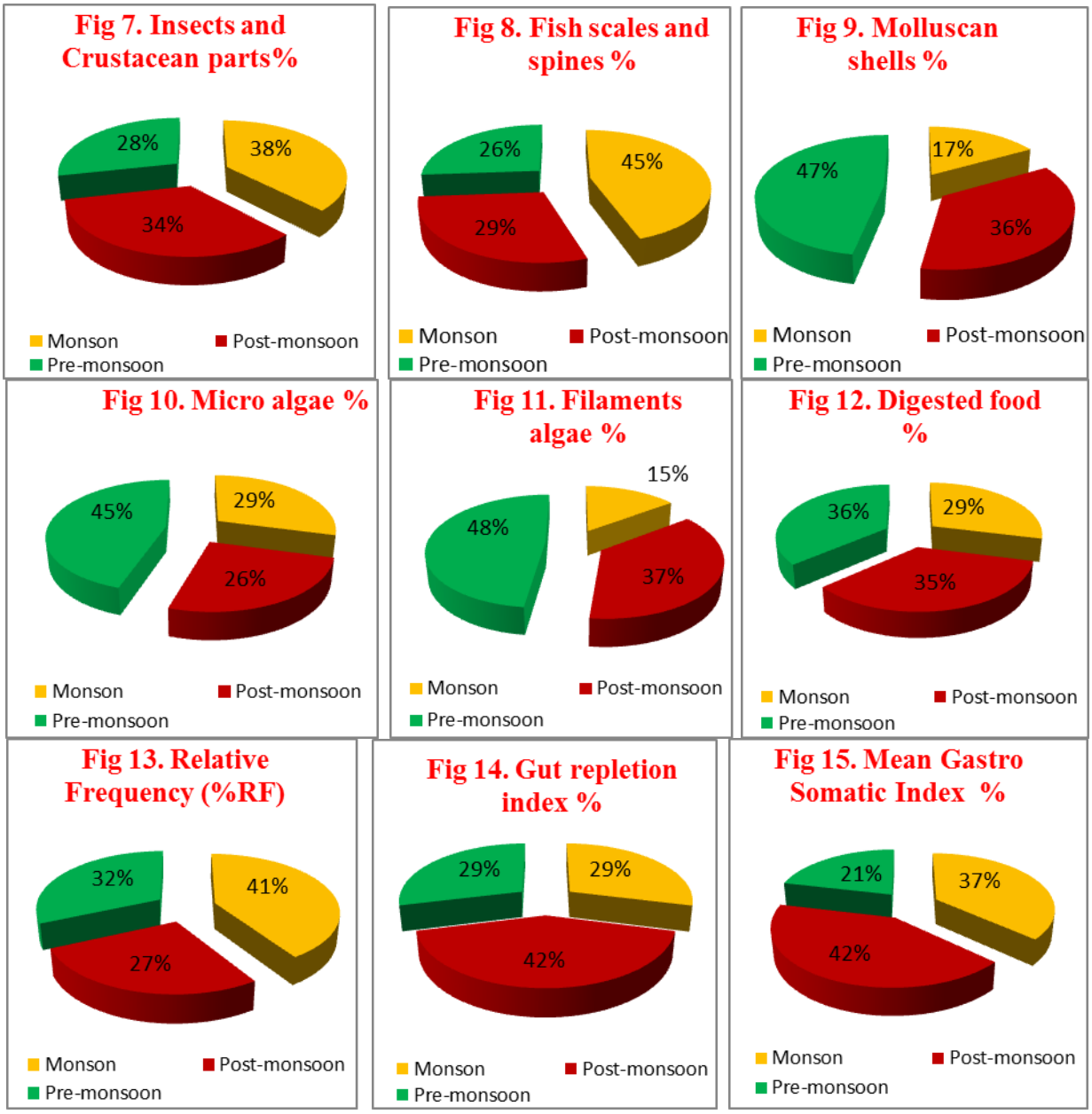


Fig 6. Average percentages of food composition in fish gut





CONCLUSION

Gut content analysis in *Securicula gora* revealed that crustaceans are the most preferred food items. It, perhaps, is a surface feeder with occasional visits to the column. Another interesting observation from the present data is that the feeding intensity was low during spawning months from April to August. In general during spawning season the feeding rate would be at the minimum and immediately after spawning it gets increased as the organisms feed voraciously to recover fast. According to the gut content analysis in the present study crustaceans were found to be the preferential food for *Securicula gora*, next being fish larva. During summer months when the water column drops considerably and the availability of the above said organisms is minimum, to browse and feed on column organisms like, molluscans and filamentous algae. However, the presence of crustaceans at times indicates that in the absence or non availability of preferential food they feed on other organisms.

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