Journal of Advances in Biology & Biotechnology

Volume 27, Issue 6, Page 498-515, 2024; Article no.JABB.117356
ISSN: 2394-1081

Food and Feeding Habits of *Gerres filamentosus* in the Cochin Backwaters

Gopika Suresh Babu [a], M. K. Sajeevan [a], U.A. Suryawanshi [b], H. N. Anjanayappa [c], S. R. Somashekara [c], A.S. Kumar Naik [c], P. Nayana [c] and J. G. K. Pathan [b*]

[a] Kerala University of Fisheries and Ocean Studies, Panangad, Kerala, India.
[b] College of Fishery Science, Nagpur Maharashtra Animal and Fisheries Sciences University, Nagpur, India.
[c] College of Fisheries, Mangaluru Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, Karnataka, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jabb/2024/v27i6910

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/117356

Original Research Article

Received: 15/03/2024
Accepted: 17/05/2024
Published: 17/05/2024

ABSTRACT

A total of 601 specimens of Gerres filamentosus were collected from the sampling sites and were subjected to gut content analysis. Guts were visually classified according to the fullness of the stomach. Occurrence, gravimetric and volumetric methods were followed to quantify the gut contents. Feeding intensity was assessed using methods such as the Gastro rosomatic index, mean index of feeding intensity, and index of fullness. Sex wise, month and length group-wise fluctuations in the feeding intensity were also studied. It can be seen that the percentage of actively feeding fish was observed to be high during pre-monsoon and monsoon months. Feeding intensity

**Corresponding author: E-mail: drjgkpathan@gmail.com;*

Cite as: *Babu, G. S., Sajeevan, M. K., Suryawanshi, U., Anjanayappa, H. N., Somashekara, S. R., Naik, A. K., Nayana, P., & Pathan, J. G. K. (2024). Food and Feeding Habits of Gerres filamentosus in the Cochin Backwaters. Journal of Advances in Biology & Biotechnology, 27(6), 498–515. https://doi.org/10.9734/jabb/2024/v27i6910*

was at its peak during April and July 2019, and the main food was found to be prawn juveniles, polychaete worms and other detritus matter.

Keywords: Gerreids; feeding habits; cochin backwaters; Gerres filamentosus.

1. INTRODUCTION

To understand their growth, breeding, and migration, food and feeding studies are crucial among the pioneering works on feeding and food for mojarras fishes [1-5] presented marine fishes' food and feeding habits, including Gerreid fishes' feeding habits. Jhingran et al. [6] and Jhingran and Natarajan [7] have accounted for food types of *G. setifer* from the Chilika Lake. Patnaik) [8] observes the fishery and biology of Chilka Jagili, *G. setifer,* including fish's food and feeding habits. Badrudeen and Pillai [9] observed that polychaete worms were the predominant food source for big-eyed mojarras, Gerres macracanthus, in both Palk Bay and the Gulf of Mannar during their study on the species' food and feeding habits.

The feeding behaviour of *Gerres filamentosus* from the Sharavati estuary was investigated by Renuga and Bhat [10], and it was concluded that the *Gerres* species was an omnivorous bottom feeder. Prawns dominated its stomach content, but it differed at different times. A study on *G. filamentosus* by Sreeja and Geetha [11] in the Kollam area also showed that its food consists of various crustaceans, polychaetes, bivalves, etc.

Different authors studied Mojarras's food and feeding habits elsewhere [2,12-16]. However, an attempt has yet to be made to understand the food and feeding habits of *Gerres filamentosus* occurring in Cochin backwaters. These study attempts to understand the food and feeding habits of the *Gerres filamentosus* occurring in Cochin backwaters.

2. MATERIALS AND METHODS

Fish *G. filamentosus* were collected from the regular fortnightly samples from selected landing centres of Cochin backwaters from 2019 to 2020. A total of 601 specimens were subjected to gut content analysis. The fishes were thoroughly cleaned in the laboratory, and their length, weight, sex, gut length, gut volume, gonad length, gonad weight, stage of maturity and the degree of fullness of the stomach were recorded following Sajeevan and Kurup [17]. The stomachs were preserved in 4% formalin for later examination. Volume was measured using a measuring glass using Archimedes principle.

The qualitative analysis of stomachs was done by observing gut content and identifying all the food organisms depending on the stages of digestion. If the digestion had already advanced to a digested stage, identification was difficult, so the contents were treated as semi-digested matter. There are several methods for the enumeration of the stomach contents of fish [18].

Stomach contents were assessed using the point's method [19], the volumetric method, and the index of preponderance [20]. Feeding intensity was also assessed by following two methods: Mean Index of Feeding intensity (MIF) [21] and Index of Fullness (IF) [22]. GaSI [23] was also calculated every month lengthwise and sex-wise.

The stomachs were classified into ' full' ' ¾ full', ' ½ Full', '1/4 full', 'little' and 'empty' depending on the degree of fullness and the amount of food contained. Points 80, 60, 40, 20, 10, and 0 were allotted to these stomachs, respectively, from which monthly averages and percentages were computed by point methods [19].

3. RESULTS AND DISCUSSION

3.1 Food Composition

The composition of gut contents of both males and females was calculated, and results data were presented in Fig. 1, Fig. 2 and Fig. 3. The gut contents of the samples of *Gerres filamentosus* were mostly digested matter (35%), and the identified gut contents were prawn juvenile (28%), polychaete worms (18%), mud and detritus (15%), crab instar (2%), plankton and clam shells 1% and other food items 0.0001% respectively. In the case of males, most of the gut was digested matter (52%), followed by prawn (25%), then mud (11%), polychaete worms (9%), crab instar (2%), clam (1%) and tiny amounts of plankton (0.3%) and others (0.03%). Lugendo et al. [24] reported that the feeding habits of Gerres filamentosus involve consuming mainly crustaceans, such as copepods, crabs, and shrimps, regardless of the habitat in which

they are caught. *Gerres longirostris*' feeding habits primarily consist of consuming small molluscs and crustaceans. Additionally, it is characterized as an omnivore and a moderate to poor bottom feeder [15].

AbuAlnasr, (2015) reported that the crustaceans and polychaetes emerge as significant dietary components for *Gerres filamentosus* from the Hurghada Red Sea [25]. This aligns with Cyrus and Blaber (1984), who emphasized the dominance of polychaetes in varied diets, providing substantial energy [26]. Additionally, Badrudeen and Mahadevan [9] noted polychaetes as the primary food item, followed by *Penaeus semisulcatus, Parapenaeopsis tennela*, and *Metapenaeus affinis*, in descending order of abundance.

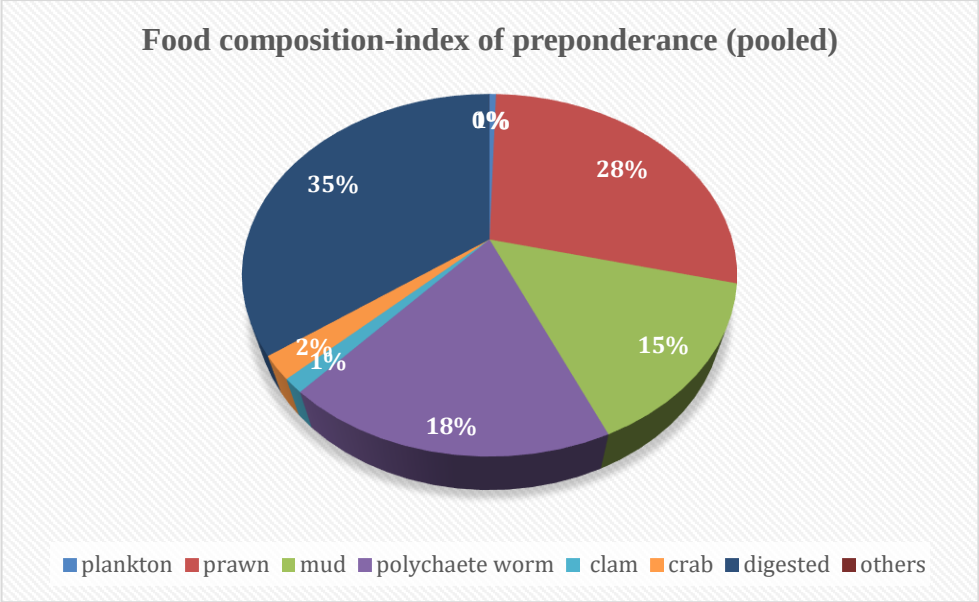

Fig. 1. Composition of gut contents of *Gerres filamentosus* – Pooled

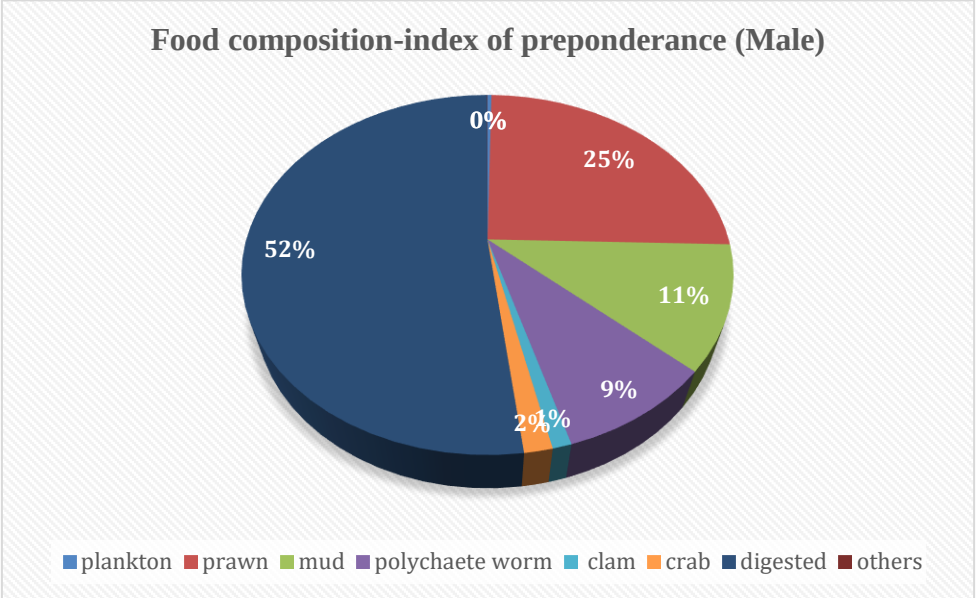

Fig. 2. Composition of gut contents of *Gerres filamentosus* – Male

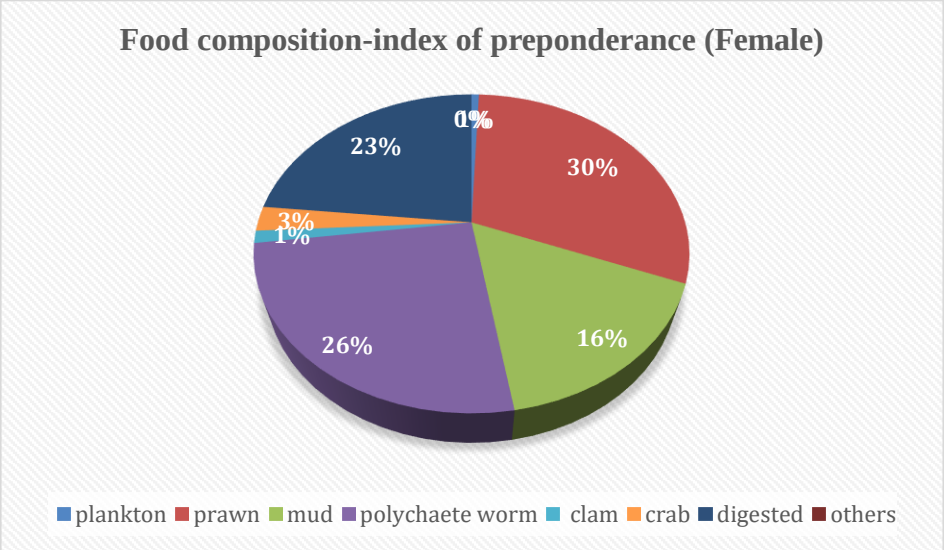

Fig. 3. Composition of gut contents of *Gerres filamentosus* - Female

3.2 Variation of Food Composition in Different Size Groups

The index of preponderance method was used to discern the variation in food preference of *Gerres filamentosus* during their life history stages and was presented. It was observed that in the gut contents of adults (7.1 -18 cm), polychaete worms amounted to about 48.3%, followed by prawn larvae (20.7%), then mud (13.8%), digested matter (9.3%), crab (7.3%), clam (0.6%) and minimal amount of plankton. While in the juveniles (7.1 -18 cm), it was noted that most of the contents were digested matter (40.8%); other than this, it was dominated by prawn juveniles (31.8%), then mud and detritus (12.8%), polychaete worms (11.5%), crab (1.7%), plankton (0.8%), clam (0.6%) and very minute amount of some fish remains like bones and otolith (0.01%). The amount of polychaete worms was higher in adults than juveniles, while the amount of prawn larvae was higher in juveniles than adults. Another observable characteristic is that the amount of plankton is slightly higher in juveniles than adults. It may be because the smaller individuals eat smaller-sized food items. Rao, [27] also documented in *G. oyena* and *G. filamentosus* that smaller individuals rely more on smaller prey, while larger ones shift to larger prey, sometimes exclusively. Small-sized fish were seen to feed to a greater extent on copepods and diatoms, which in larger fish were replaced by larger items like bivalves, polychaetes and amphipods [27].

3.3 Seasonal Variation in the Food Composition

The month-wise food composition of pooled data is given in Table 1. Table 1 showed that prawns dominated the gut contents during July, September, 2019 and March, April, 2020. Polychaete worms dominated during October, 2019 and February, 2020. Crab larvae dominated during November, while detritus and mud were more during August. Clams were also recorded more in June, July, and October, 2019.

Results of the month-wise gut composition of the males are given in Table 2. It showed that prawns dominated during July, September, October, 2019 and April, 2020. At the same time, polychaete worms dominated during August and November, 2019. Clams were seen more in July, and crabs in November. In males, most of the gut contents were seen as digested.

Similarly, the month-wise gut composition of females is given in Table 3. Table 3 illustrates that polychaete worms were present more often in October, 2019 February, and March, 2020. Prawns dominated the guts during August, September, 2019 and April, 2020. Clam was found to be dominant in June, 2019 while crab was found in high amounts during November, 2019. In general, results indicate the dominance of benthic organisms in the gut content of *Gerres filamentosus*. The fish fed poorly during the summer, having 54.26 % of empty guts, while high feeding was recorded during the spring [25].

Table 1. Month-wise variation in the food composition of *Gerres filamentosus* in % of index of preponderance – Pooled

Month	Plankton	Prawn	Mud	Polychaete	Clam	Crab	Digested	Others
May	0.56	4.23	16.53	0.00	0.00	0.00	78.68	0.00
June	1.82	0.91	8.09	8.09	21.03	0.00	60.06	0.00
July	2.61	29.79	26.98	2.90	11.51	0.00	26.11	0.10
August	10.12	24.91	33.95	20.37	0.00	1.12	9.52	0.00
September	0.82	74.05	4.87	16.37	0.00	0.00	3.90	0.00
October	0.14	28.02	5.15	44.39	10.08	6.00	6.00	0.21
November	0.09	22.77	6.29	13.33	0.00	45.81	11.71	0.00
December	0.97	13.47	3.59	12.53	0.00	0.00	69.44	0.00
January	0.47	2.49	14.13	10.34	0.00	2.81	69.76	0.00
February	0.00	5.92	23.48	56.82	0.00	0.73	13.04	0.00
March	0.00	41.14	16.07	12.93	0.00	0.00	29.86	0.00
April	0.00	79.89	0.94	0.86	0.00	0.00	18.31	0.00
Average	**1.47**	**27.30**	**13.34**	**16.58**	**3.55**	**4.71**	**33.03**	**0.03**

Table 2. Month-wise variation in the food composition of *Gerres filamentosus* in % of index of preponderance – Male

Month	Plankton	Prawn	Mud	Polychaete	Clam	Crab	Digested	Others
May	0.37	6.59	19.76	0.00	0.00	0.00	73.28	0.00
June	0.47	0.00	1.42	1.89	1.42	0.00	94.79	0.00
July	2.61	29.79	26.98	2.90	11.51	0.00	26.11	0.10
August	17.35	12.70	33.46	35.32	0.00	0.00	1.16	0.00
September	1.09	72.73	8.00	18.18	0.00	0.00	0.00	0.00
October	0.05	37.46	8.39	24.98	5.49	5.39	17.48	0.75
November	0.00	0.00	20.91	34.84	0.00	31.4	12.89	0.00
December	0.00	4.76	0.00	0.00	0.00	0.00	95.24	0.00
January	0.00	4.76	2.86	25.71	0.00	0.00	66.67	0.00
February	0.00	9.42	22.29	3.14	0.00	8.63	56.51	0.00
March	0.00	9.38	7.13	0.31	0.00	0.00	83.18	0.00
April	0.00	72.73	0.11	0.34	0.00	0.00	26.81	0.00
Average	**1.83**	**21.69**	**12.61**	**12.30**	**1.54**	**3.78**	**46.18**	**0.07**

Table 3. Month-wise variation in the food composition of *Gerres filamentosus* in % of index of preponderance- Female

Month	Plankton	Prawn	Mud	Polychaete	Clam	Crab	Digested	Others
May	0.61	7.98	14.11	0.00	0.00	0.00	77.30	0.00
June	3.00	2.79	15.28	12.58	42.24	0.00	24.12	0.00
July	4.06	16.91	55.79	0.00	5.92	0.00	17.33	0.00
August	1.02	35.81	25.58	5.63	0.00	5.12	26.85	0.00
September	0.72	73.13	4.60	14.69	0.00	0.00	6.86	0.00
October	0.22	16.51	2.39	61.16	13.90	5.67	0.14	0.00
November	0.18	41.32	1.32	4.68	0.00	43.51	8.99	0.00
December	1.52	14.77	10.23	20.45	0.00	0.00	53.03	0.00
January	1.01	1.68	15.13	5.51	0.00	6.05	70.61	0.00
February	0.00	3.55	18.33	75.20	0.00	0.00	2.92	0.00
March	0.00	0.00	16.01	51.70	0.00	30.59	1.70	0.00
April	0.00	87.34	3.35	1.86	0.00	0.00	7.44	0.00
Average	**1.03**	**25.15**	**15.18**	**21.12**	**5.17**	**7.58**	**24.77**	**0.00**

3.4 Feeding Intensity

The stomach condition of *Gerres filamentosus* was calculated every month and represented in Table 3 & Fig. 4 with the percentage of occurrence of the stomach in different degrees of fullness and feeding condition. It can be seen from Table 4 that the percentage of actively feeding fish was seen to be high during pre-monsoon and monsoon seasons, reaching its peak in July, 2019 and April, 2020. However, it is remarkable that feeding was very low during August, i.e., the time of the flood in Kerala in 2019. Feeding was also seen as low during December, 2019 and January, 2020 with the highest occurrence of empty stomachs during December, as shown in Fig. 5. Overall, almost 35% of the fish were actively or moderately fed. In *Gerres longirostris*, feeding intensity showed seasonal fluctuations, peaking from August 2019, to February 2020 and declining from March 2020 to July 2020, while bivalves emerged as the primary food source [15].

Gerres filamentosus fish exhibit higher feeding intensity in the Hurghada Red Sea during February, March and April, 2010 [25]. For the pooled sexes, the feeding index increases in winter and spring while it declines in summer [25].

Table 4. Monthly variation of feeding intensity in the percentage of *Gerres filamentosus* – Pooled

Month	Poor Feeding			Moderate	Active Feeding			No. of Observations
	% empty	% trace	% one fourth	% half	% three fourth	% full	% gorged	
May	26.9	32.7	13.5	13.5	1.9	3.8	7.7	52
June	30.6	12.2	26.5	16.3	4.1	6.1	4.1	49
July	23.4	14.9	10.6	10.6	10.6	14.9	14.9	47
August	50.0	32.0	8.0	4.0	2.0	4.0	0.0	50
September	48.0	22.0	16.0	2.0	0.0	6.0	6.0	50
October	24.5	20.4	10.2	14.3	4.1	14.3	12.2	49
November	20.0	20.0	12.0	22.0	6.0	12.0	8.0	50
December	74.5	13.7	5.9	2.0	2.0	2.0	0.0	51
January	48.0	32.0	8.0	4.0	2.0	4.0	0.0	50
February	32.0	14.0	12.0	18.0	2.0	12.0	10.0	50
March	28.0	18.0	30.0	16.0	8.0	0.0	0.0	50
April	21.3	2.1	6.4	29.8	19.1	23.4	0.0	47
Total	35.8	19.7	13.3	12.6	5.0	8.4	5.2	595

Table 5. Monthly variation of feeding intensity in the percentage of *Gerres filamentosus* –Male

Month	Poor Feeding			Moderate	Active Feeding			No. of Observations
	% empty	% trace	% one fourth	% half	% three fourth	% full	% gorged	
May	34.8	30.4	13.0	13.0	4.3	0.0	4.35	23
June	37.5	16.7	29.2	8.3	4.2	4.2	0	24
July	16.0	12.0	12.0	16.0	12.0	12.0	20	25
August	53.6	28.6	7.1	7.1	0.0	3.6	0	28
September	68.2	18.2	4.5	4.5	0.0	0.0	4.55	22
October	24.1	24.1	13.8	10.3	6.9	10.3	10.35	29
November	31.8	9.1	13.6	31.8	4.5	0.0	9.09	22
December	92.3	7.7	0.0	0.0	0.0	0.0	0	26
January	53.6	28.6	7.1	7.1	0.0	3.6	0	28
February	41.7	16.7	12.5	16.7	0.0	8.3	4.17	24
March	33.3	20.0	36.7	10.0	0.0	0.0	0	30
April	19.2	0.0	3.8	34.6	23.1	19.2	0	26
Total	42.0	17.9	13.0	13.0	4.6	5.2	4.24	307

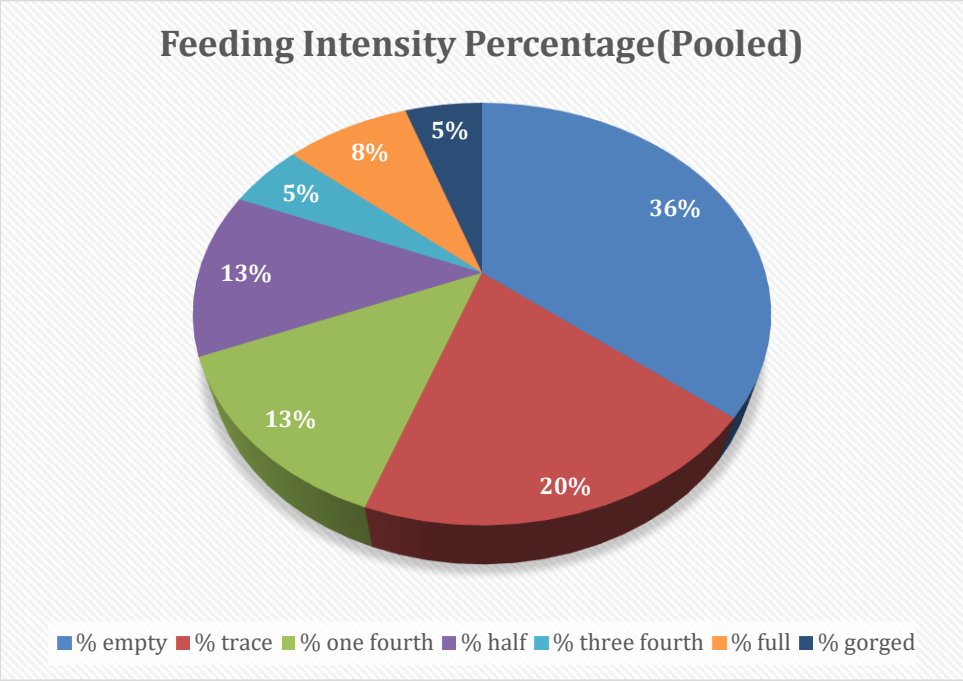

Fig. 4. Percentage of feeding intensity of *Gerres filamentosus* – Pooled

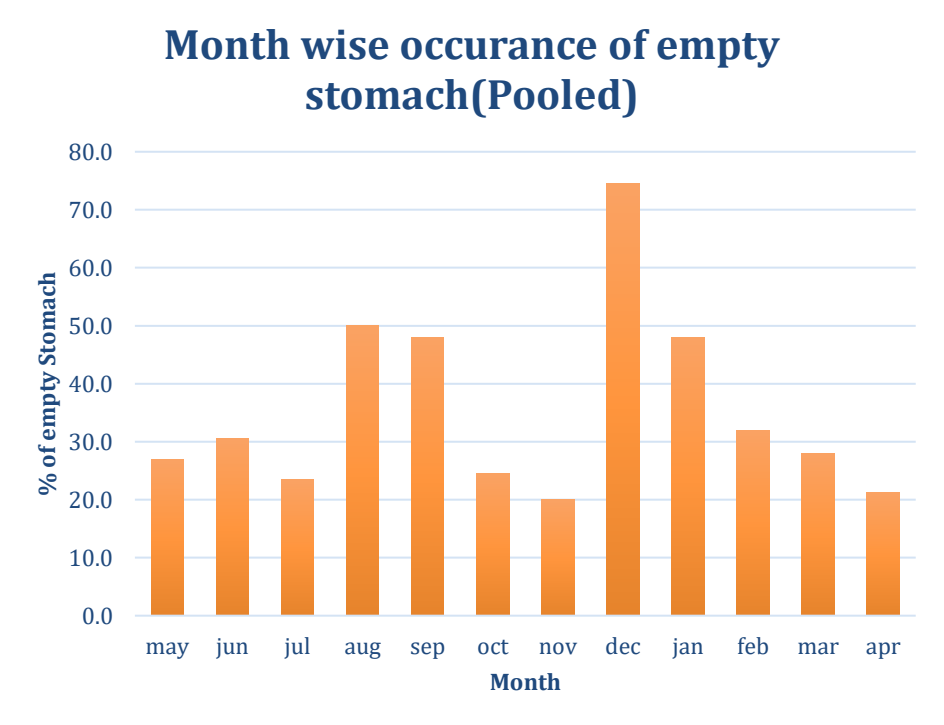

Fig. 5. Monthly variation of percentage of empty stomach of *Gerres filamentosus* – Pooled

The monthly variation of male and female stomach conditions was also demonstrated in Tables 5 & 6, Figs. 6, 7, 8 & 9. Males actively fed in July, October, 2019 and April, 2020, while the highest feeding occurred in July 2019, and the lowest in December 2019 and March 2020. In general, 27% of males were in the actively fed state. Females were actively or moderately fed all the months except August, December, 2019 and January 2020. About 36 % of the females were in active or moderate feeding.

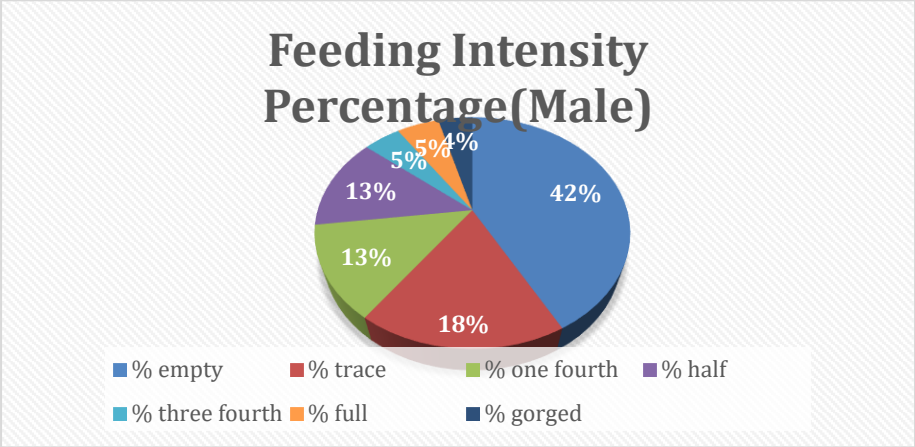

Fig. 6. Percentage of feeding intensity of *Gerres filamentosus*- Male

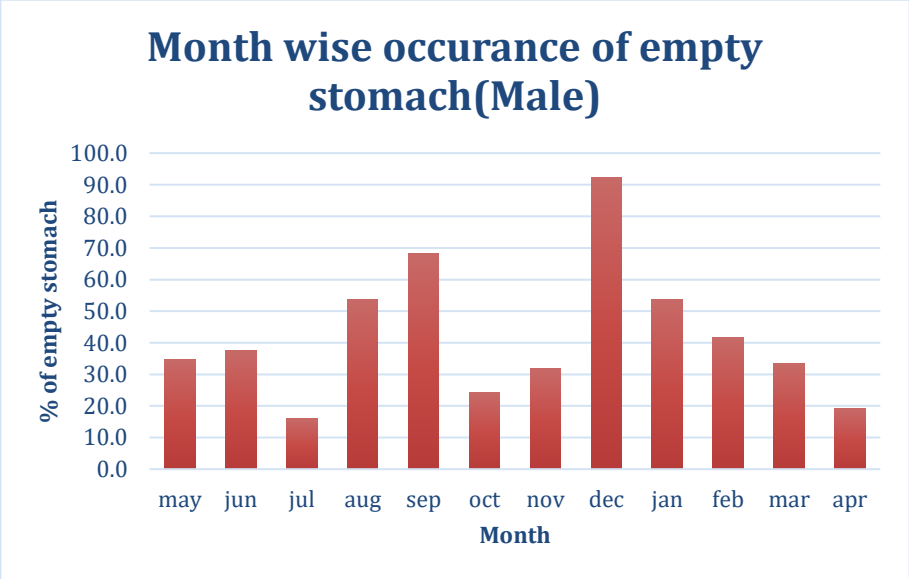

Fig. 7. Monthly variation of percentage of empty stomach of Gerres filamentosus – Male

Table 6. Monthly variation of feeding intensity in the percentage of *Gerres filamentosus* – Female

Month	Poor Feeding			Moderate	Active Feeding			No. of Observations
	% empty	% trace	% one fourth	% half	% three fourth	% full	% gorged	
May	20.7	34.5	13.8	13.8	0.0	6.9	10.34	29
June	24.0	8.0	24.0	24.0	4.0	8.0	8	25
July	31.8	18.2	9.1	4.5	9.1	18.2	9.09	22
August	45.5	36.4	9.1	0.0	4.5	4.5	0	22
September	32.1	25.0	25.0	0.0	0.0	10.7	7.14	28
October	25.0	15.0	5.0	20.0	0.0	20.0	15	20
November	10.7	28.6	10.7	14.3	7.1	21.4	7.14	28
December	56.0	20.0	12.0	4.0	4.0	4.0	0	25
January	45.5	36.4	9.1	0.0	4.5	4.5	0	22
February	23.1	11.5	11.5	19.2	3.8	15.4	15.38	26
March	20.0	15.0	20.0	25.0	20.0	0.0	0	20
April	19.0	4.8	9.5	23.8	14.3	28.6	0	21
Total	29.2	21.5	13.5	12.2	5.6	11.8	6.25	288

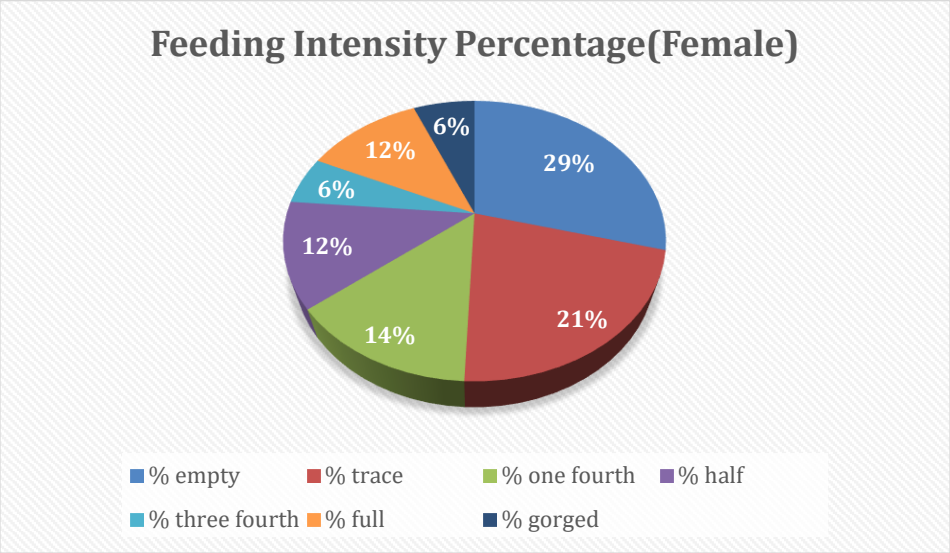

Fig. 8. Percentage of feeding intensity of *Gerres filamentosus*- Female

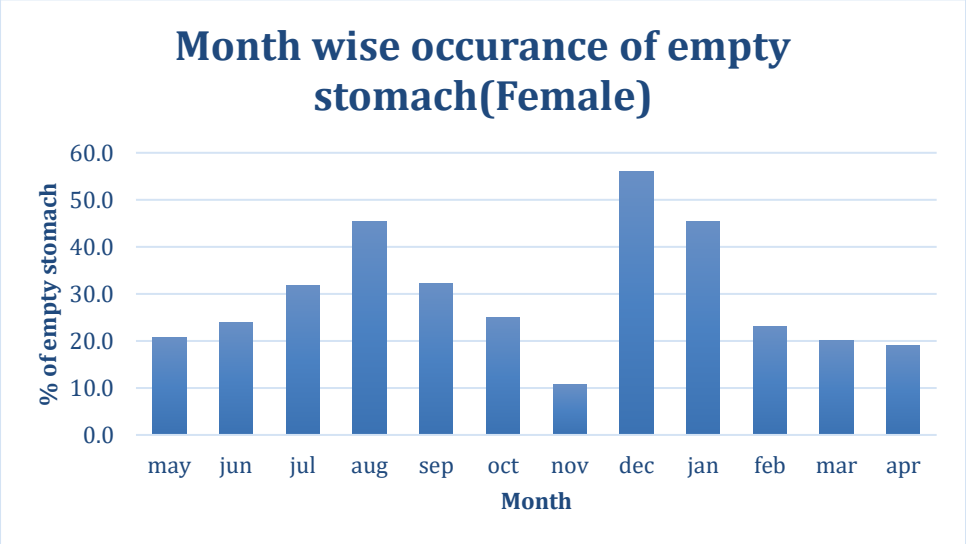

Fig. 9. Monthly variation of percentage of empty stomach of *Gerres filamentosus*- Female

3.5 Lengthwise Feeding Intensity

The samples of *Gerres filamentosus* were categorised lengthwise, and the feeding intensity was observed and shown in Table 7, Fig. 10 and Fig. 11. Feeding intensity showed an increasing trend up to a length of 17 cm and then started to decrease as length increased. Similar finding were reported by the AbuAlnasr, [25] from the Hurghada Red Sea. This coincides with the length at first maturity, which begins between 17.5 and 18.5 cm. The percentage of occurrence of empty stomachs was seen to decrease up to the point of length and then increase as the fish grew. Generally, it was observed that 32% of juveniles and 55% of adults were either in active or moderately fed conditions. As *Gerres filamentosus* grows, its feeding habits evolve, with polychaetes being a prevalent food item across all size categories. Notably, crustaceans and molluscs constitute a more significant portion of the diet in smaller, immature fish, diminishing as body length increases [25].

3.6 Mean Index of Feeding Intensity (MIF) and Index of Fullness (IF)

The monthly mean Index of Feeding intensity (MIF) and Index of Fullness (IF) values for pooled male and female data are presented in Table 8, Fig. 12, Fig. 13 and Fig. 14. The fish

were fairly well-fed in most months except August, December 2019 and January 2020. In the case of males, they are poorly fed during August, September, and December 2019, with the lowest value in December 2019. For females, it is the same as that of the pooled data, with them being poorly fed during August, December 2019 and January 2020. The values of MIF and IF were almost similar in trend, with some exceptions during certain months. Generally, *Gerres filamentosus* was fed fairly well almost throughout the year, with the most minor feeding condition occurring in December 2019. Abeyrami and Shivashantini (2008) found the satiation index of *Gerres oblongus* from Jaffna lagoon to be 8.3 for February 2005, which indicates that feeding intensity was high during that time [28].

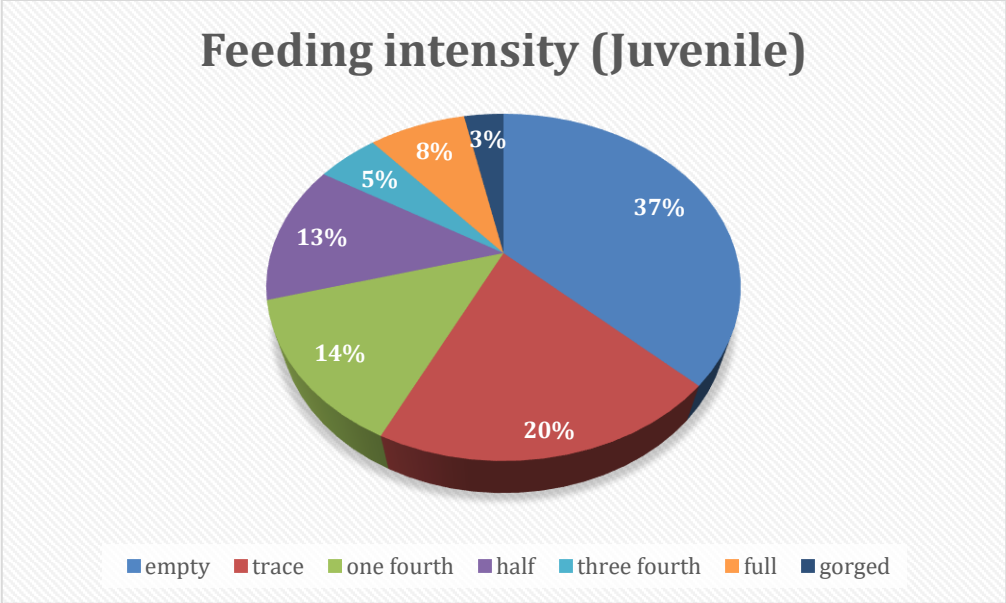

Fig. 10. Length wise feeding intensity of Juveniles of *Gerres filamentosus*

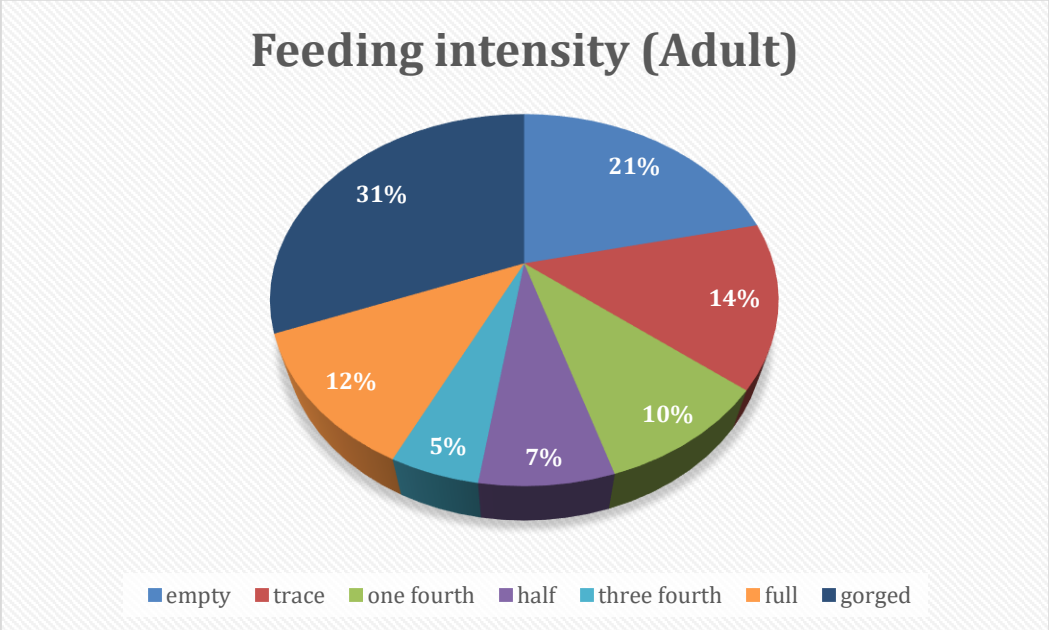

Fig. 11. Length wise feeding intensity of Adult of *Gerres filamentosus*

Table 7. Length-wise feeding intensity of *Gerres filamentosus*

		Poor Feeding			Moderate		Active Feeding		No. of Observations
	Mid length	**% empty**	**% trace**	**% one fourth**	**% half**	**% three fourth**	**% full**	**% gorged**	
Juvenile	7.50	0.00	0.00	0.00	0.00	0.00	100.00	0.00	1
	8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	9.50	36.36	54.55	0.00	9.09	0.00	0.00	0.00	11
	10.50	57.14	19.05	7.14	9.52	2.38	4.76	0.00	42
	11.50	31.03	17.24	10.34	17.24	10.34	13.79	0.00	29
	12.50	39.58	25.00	16.67	4.17	10.42	4.17	0.00	48
	13.50	52.44	18.29	9.76	8.54	4.88	3.66	2.44	82
	14.50	39.29	21.43	11.61	12.50	4.46	6.25	4.46	112
	15.50	25.00	20.00	21.25	15.00	2.50	11.25	5.00	80
	16.50	26.04	16.67	16.67	19.79	7.29	9.38	4.17	96
	17.50	32.69	17.31	13.46	15.38	1.92	13.46	5.77	52
Adult	18.50	13.04	26.09	8.70	8.70	8.70	17.39	17.39	23
	19.50	50.00	0.00	0.00	0.00	0.00	0.00	50.00	2
	20.50	28.57	0.00	14.29	0.00	0.00	0.00	57.14	7
	21.50	100.00	0.00	0.00	0.00	0.00	0.00	0.00	1
	22.50	0.00	0.00	0.00	0.00	0.00	25.00	75.00	4
	23.50	40.00	0.00	20.00	20.00	0.00	0.00	20.00	5
	Total	**35.97**	**19.66**	**13.28**	**12.61**	**5.04**	**8.24**	**5.21**	**595**

Table 8. Month-wise Mean Intensity of feeding and index of the fullness of *Gerres filamentous* – Sex wise

Month	Pooled		Male		Female	
	MIF	IF	MIF	IF	MIF	IF
May	2.60	0.53	2.04	0.98	3.03	1.09
Jun	2.87	0.72	2.00	0.68	3.70	2.26
Jul	4.57	1.19	5.20	2.25	3.86	2.51
Aug	1.23	0.47	1.14	0.84	1.34	1.08
Sep	1.86	0.72	0.98	0.96	2.55	1.70
Oct	3.99	1.40	3.59	2.07	4.58	4.00
Nov	3.93	1.33	3.27	1.97	4.45	2.91
Dec	0.71	0.20	0.08	0.19	1.36	0.61
Jan	1.23	0.47	1.14	0.84	1.34	1.08
Feb	3.57	1.52	2.48	1.86	4.58	3.91
Mar	2.33	0.90	1.62	1.17	3.40	2.78
Apr	2.35	1.90	2.38	4.37	2.31	3.05
Average	**2.59**	**0.95**	**2.14**	**1.52**	**3.04**	**2.25**

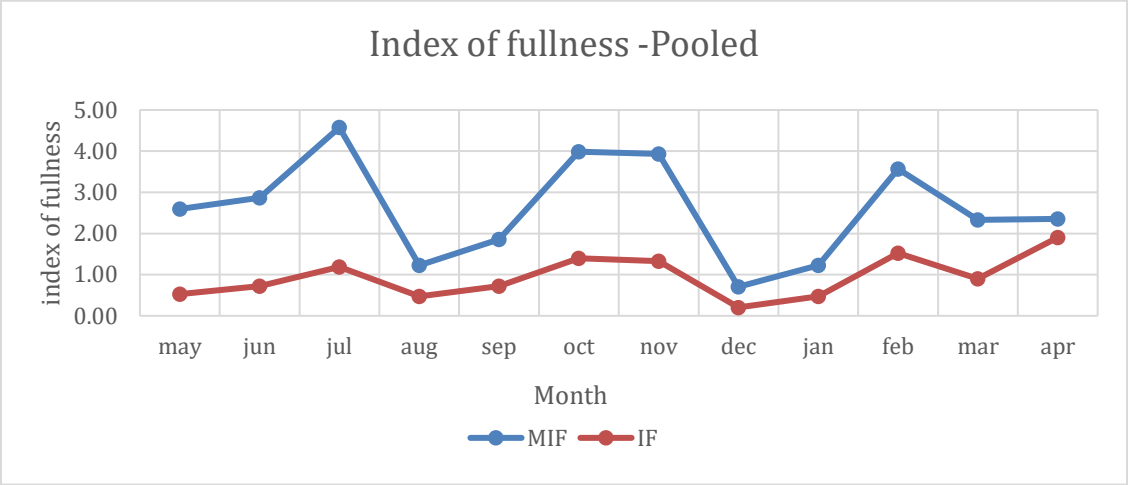

Fig. 12. Mean Intensity of Feeding and Index of fullness of *G. filamentosus* –pooled

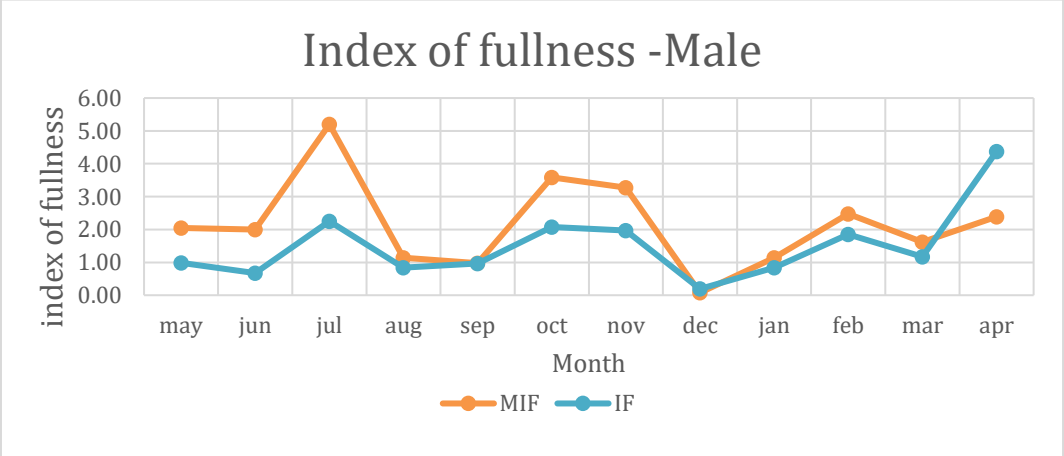

Fig. 13. Mean Intensity of Feeding and Index of fullness of male *Gerres filamentosus*

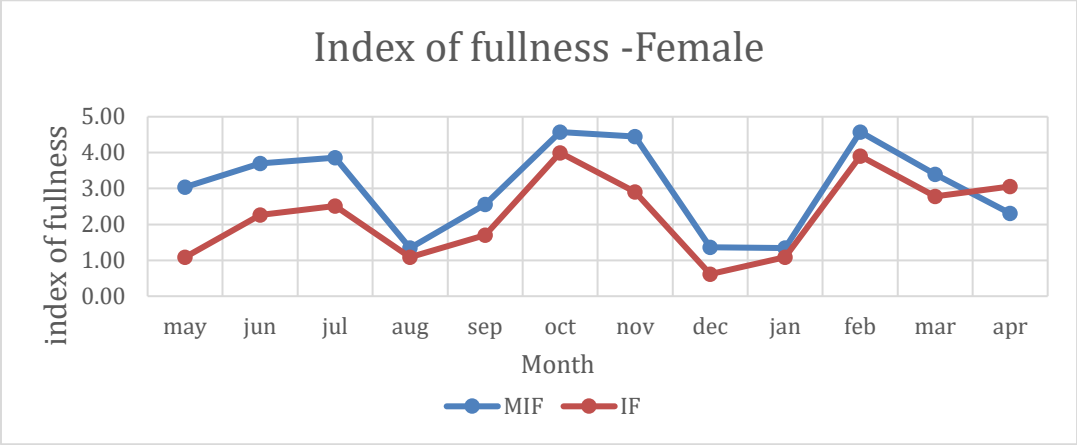

Fig. 14. Mean Intensity of Feeding and Index of fullness of female *Gerres filamentosus*

Table 9. Lengthwise Mean Intensity of Feeding and Index of the fullness of *Gerres filamentosus*

Mid-length (cm)	MIF	IF
7.5	9.00	180.83
8.5	0.00	0.00
9.5	1.00	2.42
10.5	1.45	0.85
11.5	3.31	2.83
12.5	2.03	0.78
13.5	1.79	0.38
14.5	2.50	0.34
15.5	3.18	0.67
16.5	3.38	0.48
17.5	3.21	0.64
Juvenile	**2.80**	**1.35**
18.5	4.87	3.40
19.5	5.00	42.32
20.5	6.07	10.75
21.5	0.00	0.00
22.5	9.75	26.16
23.5	3.50	11.29
Adult	**4.87**	**2.24**

The length-wise variation of MIF and IF was also calculated and represented in Table 9. The length group of 7.5 was found to have higher MIF and IF. Length groups with mid-length 9.5, 10.5, 13.5, 17.5 and 21.5 cm were poorly fed as both MIF and IF values recorded were low. MIF and IF values of juveniles were 2.80 and 1.34, respectively, against 4.86 and 2.23 recorded for adults. This designates that adults were fed more than juveniles.

3.7 Gastrosomatic Index (GaSI)

Month-wise, Gastrosomatic index values of male and female fishes are illustrated in Table 10 & Fig. 15. Females have been found to have slightly higher GaSI, so they are more well-fed than males. Females had higher GaSI values than males. Generally, GaSI values were higher during June, September, October, 2019, February and April, 2020, whereas August and December 2019 held the lowest GaSI values. On the contrary, in *Chanda nama*, the values of GaSI were observed to be low from June 2018 to September 2018 and high from December 2018 to January 2019 [29]. The monthly values of the Gastro-somatic Index (GaSI) indicate a peak from March to May 2016, with March showing the highest levels in the *Ctenops nobilis* [30]. The highest value of the gastro-somatic index (GaSI)

for *Acanthopagrus berda* was recorded in January 2016 (2.65±2.31), indicating increased feeding activity, while the lowest was observed in October 2016 (0.12±0.31), corresponding to reduced feeding during the spawning season [31].

Lengthwise Gastrosomatic index values and the Relative Condition Factor (Kn) values of *Gerres filamentosus* are provided in Table 11 Fig. 16. Generally, feeding intensity is higher in some larger groups and mid-lengths like 7.5 and 11.5.

Results of this analysis (Fig. 1, Fig. 2 and Fig. 3) showed that prawn larvae (28%) dominated the food composition, excluding the digested matter. Polychaete worms (18%), mud and detritus (15%), crab instar (2%), plankton and clam shells, each amounting to about 1%, and very minute amounts of other food items like remains of fish (0.0001%) were the composition of gut content recorded.

The present investigation recorded sex-wise variation in the composition of gut contents of *G. filamentosus* occurring in Cochin backwaters. In the case of males, most of the gut was with digested matter (52%). Prawn, mud and polychaete worms constituted 25%, 11%, and 9%, respectively. In females, prawn juveniles dominated among the gut contents with 30%, followed by polychaete worms and digested matter.

Table 10. Month-wise gastrosomatic index values for *Gerres filamentosus*

	GaSI		
Month	**Pooled**	**Male**	**Female**
MAY	1.27	1.08	1.42
JUNE	1.29	0.87	1.76
JULY	2.66	2.77	2.54
AUG	1.12	1.14	1.10
SEPT	1.51	1.10	1.83
OCT	1.98	1.67	2.40
NOV	1.98	1.66	2.19
DEC	0.70	0.60	0.80
JAN	1.12	1.14	1.10
FEB	2.01	1.61	2.34
MARCH	1.39	1.07	1.73
APR	2.28	2.53	2.01
Average	**1.61**	**1.44**	**1.77**

Table 11. Length-wise Gastrosomatic index values for *Gerres filamentosus*

Mid-length (cm)	GaSI	Condition factor (Kn)
7.5	5.424955	0.955620
8.5	0.000000	0.000000
9.5	1.240695	0.960833
10.5	1.691397	1.062167
11.5	2.308339	1.100908
12.5	1.561147	1.085050
13.5	1.444591	1.050828
14.5	1.484259	1.036797
15.5	1.585123	1.038715
16.5	1.694779	0.958642
17.5	1.310403	0.968065
18.5	2.057295	0.830522
19.5	2.454507	0.745404
20.5	2.296941	0.901732
21.5	1.097293	0.724463
22.5	1.827830	0.934288
23.5	1.156783	0.872704

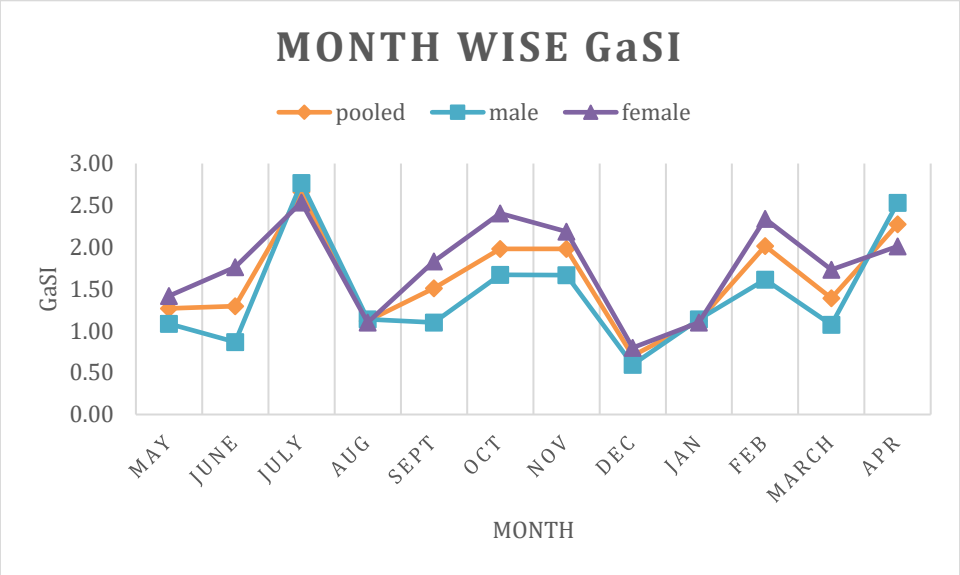

Fig. 15. Month wise Gastrosomatic index values for *Gerres filamentosus*

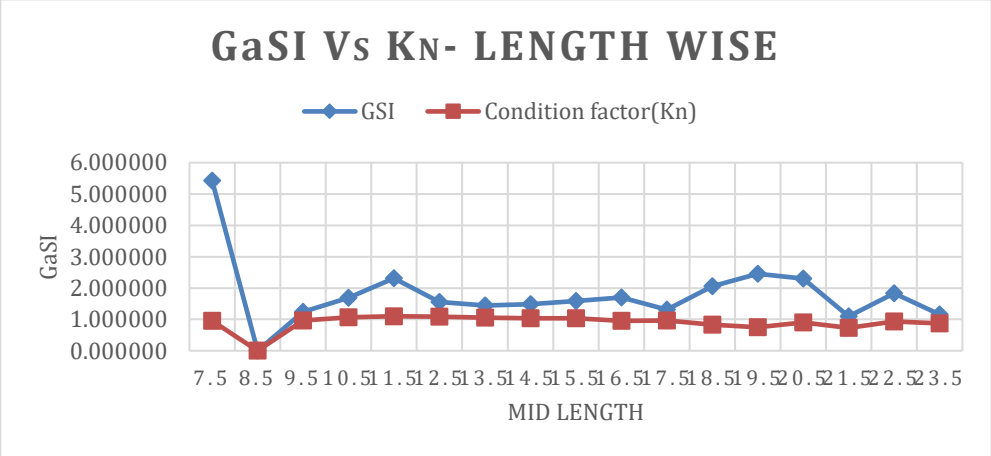

Fig. 16. Month wise Gastrosomatic Index (GaSI) and Relative condition factor values of *Gerres filamentosus*

The current study's results on preferential food were resembled with those of earlier workers and summarized in Table 12. The earlier workers reported that prawn larvae, Polychaete worms, detritus, crab instar, plankton and clam shells are components of gut contents. However, there is a contradiction among the authors as far as preferential food is concerned. The present investigation reported prawns as a major food item, which aligns with the findings of Renuga and Bhat [10]. Rao [27] and Sreeja and Geetha [11] reported that amphipods followed by polychaetes as major food items. The studies recorded polychaetes as the second most preferred food. Studies mentioned in Table 12 are conducted in different water bodies, and the dominance of prey items in these water bodies may differ. It can be ascribed to the difference in the fish's preferred food item.

The present research observed seasonal variation in the gut content of the fish. The occurrence of prawns was high in July, September 2019, March, and April 2020. In the meantime, bivalves were high in June, July, and October 2019. Polychaete worms dominated during October 2019 and February 2020. Renuga and Bhat [10] recorded the dominance of prawns among gut contents from July to September 2008. The presence of bivalves was noticed throughout the year, with a maximum quantity in October 2008 and high amounts of

polychaetes reported in April 2008. The general results of the present investigation on seasonality in gut contents are matched.

The present examination recorded digested matter as the major component, followed by prawn juveniles among the gut contents of juveniles (7.1 -18 cm). Polychaete worms dominated as the major gut content of adult (18.1-24 cm) fish. Differences in feeding preference during shifts in the life cycle may be ascribe to this variance.

The findings of this investigation noted heightened feeding activity among fish specimens in July 2019 and April 2020. Feeding intensity was lower during August 2019. According to Sreeja and Geetha [11], the overall feeding intensity was high during May 2005 and low during July to September 2005. However, Renuga and Bhat [10] noted that it was high in January 2008 and fell sharply by July 2008. Variations in feeding intensity across different geographic regions within the study area could account for this observed difference.

The present analysis recorded that feeding intensity was increases up to 17 cm and subsequently decreases as length increases, and the size at maturity of *G. filamentosus* lies from 17.5 to 18.5 cm. From this, it can be assumed that feeding intensity starts to decrease after maturity, especially during spawning season. Gastrosomatic index (GaSI) results supported these findings (Fig. 17).

Table 12. Comparative statement of results of studies on food composition of *G. filamentosus* by various authors

Area of Study	No. of observation	Major food item	Author
Chennai coast	10	Polychaetes and crustaceans	Job [5]
Gulf of Mannar	260	Bivalve and worms	Chacko [4]
Pulicat Lake	500	Amphipods, detritus, polychaetes, bivalves, decapod crustacea,	Rao [27]
Sharavati estuary	1013	Prawns, bivalves, polychaetes, gastropods, mysids	Renuga and Bhat [10]
Paravur Lake, Kollam	580	Amphipods, polychaetes, juvenile crabs, bivalve molluscs, juvenile prawns	Sreeja and Geetha [11]
Cochin Backwaters	601	Digested matter, prawn larvae, Polychaete worms, mud and detritus crab instar, plankton and clam shells	Present study

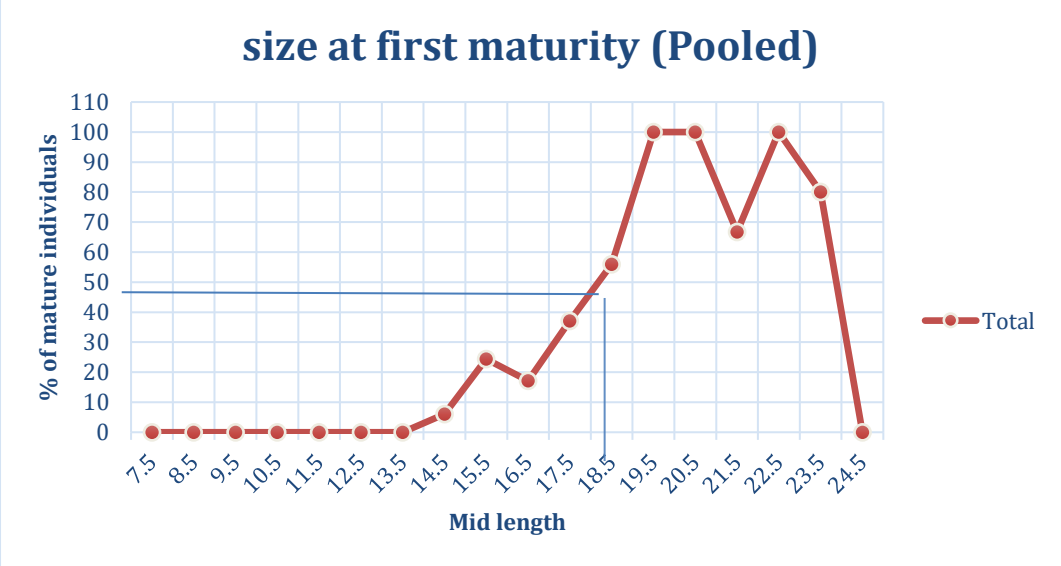

Fig. 17. Percentage of occurrence of mature specimens in various length groups of *Gerres filamentosus* (Pooled)

Renuga and Bhat [10] reported that the length group of 5.1 -11.0 cm appeared to have fed very actively. There was a decline in the feeding intensity in size 11.1 – 18.0 cm fishes. Above this group, the feeding activity gradually increases, only to fall again in size groups 24.1-25.0 cm. The current study's findings regarding size-wise changes in feeding intensity concur with the results of Renuga and Bhat [10]. However, there are differences in the pattern of shifts in feeding intensity.

4. CONCLUSION

The study on the food composition and feeding habits of *Gerres filamentosus* in Cochin backwaters revealed larvae as the dominant food item, particularly in female fishes. At the same time, males exhibited a higher proportion of digested matter. Seasonal variation showed fluctuations in prey abundance, with distinct feeding patterns observed across different months. Feeding intensity peaked during pre-monsoon and monsoon seasons but diminished during flood periods and specific months. Length-wise analysis indicated a decline in feeding intensity post-maturity, suggesting a shift in feeding behaviour influenced by spawning activities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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