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STOMACH CONTENT ANALYSIS OF SILVER POMFRET FROM MON COASTAL AREA

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Abstract

Stomach content analysis of the silver pomfret, *Pampus argenteus* was examined from March 2019 to February 2020. A detail investigation of food items of the *P. argenteus* was undertaken from Mon Coastal Areas. Copepods were the main food item in the diet of *P. argenteus* followed by the other zooplankton and crustacean appendages. The fish was a carnivore feeding mainly on zooplanktonic organisms while phytoplankton was a minor part of the diet. The semi-digested food was highly macerated and pulpy. Empty stomachs appear in very high percentages within study period. The highest value of gastrosomatic index (GaSI) was observed in February (4.09±1.22) and lowest in November (1.41±0.2) with an annual average of 2.15±0.9. The highest level of vacuity index (VI) was observed in pre-monsson and the lowest in post-monsoon with an annual value was 67%.

Keywords: *P. argenteus*, food content analysis, feeding intensity, gastrosomatic index, vacuity index, Mon Coastal Area.

Introduction

Food is one of the essential requisites of living beings in nature for persistence of their vital needs viz., growth and reproduction for survival and thus maintain their kind. The importance of the knowledge of food and feeding habits of a fish in understanding its biology has been well established. Some times the rate of feeding has an influence the spawning rate of fish. The nature of food composition of a fish species will also throw light on the possible habits it frequents.

Fishes directly depend upon their surrounding aquatic environment for their food requirements and are highly adapted in their food and feeding habits, utilizing most of the readily available food. Studies on the food and feeding habits, an important aspect in the biology of fishes, have shown that the requirements at different stages in their life cycle differ with space and time (Krishna, *et. al.*, 2016).

In general, the growth of a fish is influenced by the quality and quantity of food materials available and consumed. Thus, any variation in quality and quantity of food materials will affect the growth rate of the fish. The qualitative and quantitative variations of natural food materials in a water body are under the influence of several abiotic and biotic factors. These variations could be known by qualitative and quantitative analysis of gut contents of a fish and/or by the estimation of gastrosomatic index (Lalit *et. al.*, 2015).

The study of food and feeding habits of fish attracted the attention of fishery biologists from the beginning of the present century in view of the recognized importance of food and feeding habits as an environmental factor influencing the growth and distribution of fishes and success of their fishery. Therefore, knowledge of the food and feeding habits of various fishes is advantageous in their proper management and exploitation (Qasim, 1973).

There were several investigations that mentioned the feeding biology of the silver pomfret from abroad. There was no information on detail feeding biology of silver pomfret from Mon Coastal Area except some taxonomic information and some biological measures of pomfret fish from Mon Coastal Area.

The objectives of this study are; 1) to identify the food items and to determine the percentage of prey items in the diet of *Pampus argenteus*, 2) to estimate the feeding intensity of

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P. argenteus from Mon Coastal Area and 3) to investigate Gastrosomatic index and Vacuity Index of *P. argenteus* from Mon Coastal Area.

Materials and Methods

Sample Collection Sites

The samples of silver pomfret, *Pampus argenteus* were collected from Kyaikkhami fish landing centre (16°05'N and 97°34'E) and Asin fish landing centre (15˙19′ N and 97˙76′ E) of Mon Coastal Area from March 2019 to February 2020 (June 2019 to August 2019 was closing season).

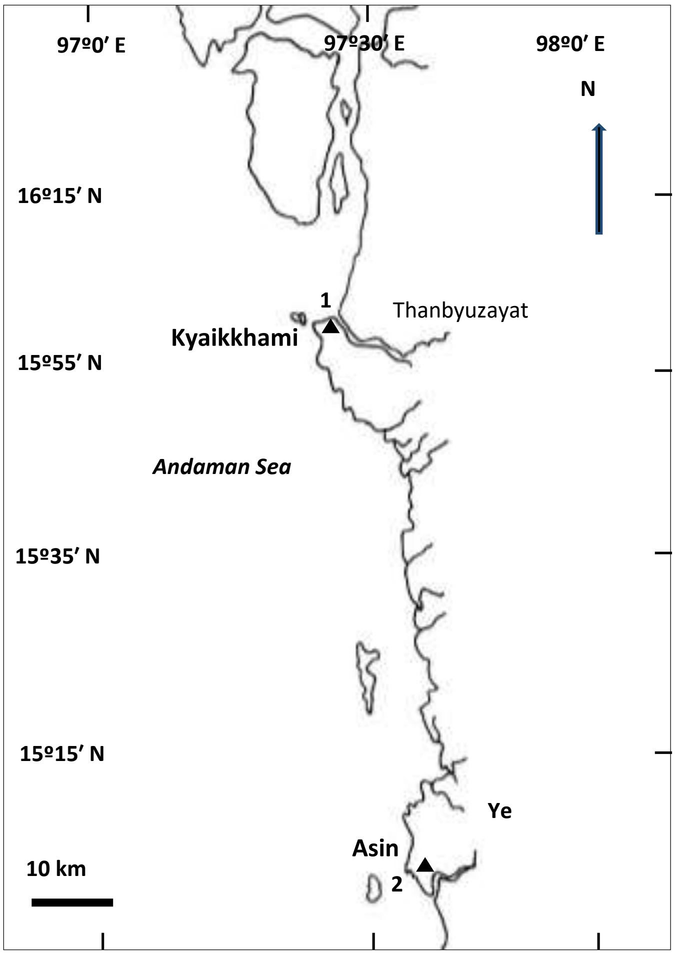

Figure 1 Map showing the fish landing centers during the present study.

Gastro-Somatic Index (GaSI)

The specimens collected were properly cleaned in the laboratory, dissected and the stomachs were removed. The total weight of the stomach with its contents was measured to the nearest 0.01 g. The contents of stomach and foregut were examined under a microscope and further identification within each taxonomic group was done following appropriate taxonomic identification guides. Gastro-Somatic Index (GaSI) based on monthly and seasonal calculation was obtained as described by Biswas (1993):

GaSI = (Total weight of stomach / Bodyweight) × 100

Stomach contents are analyzed both qualitatively and quantitatively. The volume of food in each gut of fish was measured and various food items are identified. The food content found in the stomach was divided into four groups.

1. Full : Stomach was full with food

2. ½ Full : Stomach was ½ full and slightly distended

3. ¼ Full : Stomach was ¼ food

4. Empty : Stomach without food

Point's method: The degree of apparent fullness of the stomach was determined and point's was assigned. Gorged (1.25), Full (1.00), ½ Full (0.50), ¼ Full (0.25), Empty (0.00) (as cited in Khrisha, *et al.*,, 2016).

Vacuity Index (VI)

Vacuity Index or the stomach emptiness index determines the amount of fish appetite for food. VI was calculated using the equation given by Euzen, 1987 (as cited in Norouzi, *et al.,* 2012).

VI= (The number of empty stomachs / total number of the stomachs examined) × 100.

The intensity of feeding as indicated by the VI is interpreted as:

- Edacious species $0 \leq VI \leq 20$
- Relatively edacious species $20 \leq VI \leq 40$
- Moderate feeder $40 \leq VI \leq 60$
- Relatively abstemious $60 \leq VI \leq 80$
- Abstemious $80 \leq VI \leq 100$

Results

In the present study, the stomach contents of *Pampus argenteus* were conducted by using during the number and occurrence methods. A total of 296 specimens of *P. argenteus* were collected during March 2019 to February 2020 except closing reason (June, July and August). The stomach contents found in *P. aegenteus* were grouped into nine categories, namely; copepod, other zooplankton, crustacean appendages, molluscan larvae, fish scales, small fish, diatoms, algal filaments and semi-digested pulp. The stomachs of fish contained largely quantities of whitish pulp semi-digested matter and copepod dominated in the diet of *P. argenteus* during present study period.

Copepods were found to be an important food items which occurred throughout the different months. Contribution of copepod as food for the fish was highest in the months of February (19.22%); followed by November (18.12%). The lowest value was in the month of September (5.88%). Other zooplankton was found commonly in the stomachs with peaks in the months of February (4.85%) and November (3.29%). The low percentage was in January (1.14%). The months of March to October was not recorded in the stomachs during present study. Crustacean appendages were also found commonly with the maximum percentage in number (5.88%) in September and the minimum number (0.22%) in February. The remaining zooplanktons were encountered in small quantities in diet and found occasionally. Molluscan larvae and algal filaments were found in the stomach of *P. argenteus* only in February and small fish was only found in September. Diatomss were occurred in small amount of percentage in the months of December (0.85%), January (0.72%) and February (0.45%). Fish scales were recorded in the stomach in September and October but formed the largest portion (35.3% and 33.33%) among all food items in both months. The sizes of scales were very small. So, these scales may belong to different species of fish. Among food items, copepod was the most abundant with the percentage (13.46%) followed by fish scales (10.77%), other zooplankton (1.86%) and crustacean appendages (1.26%) (Table 1 and Figure 2).

According to the natural stomach condition, fishes were categorized as high feeding (full), moderate feeding (¾ and ½ full), low feeding (¼ full) and empty. Monthly fluctuations were also witnessed in the presence of occurrence of stomachs with different degrees of fullness. It is evident that higher percentage of empty of the stomach was recorded in the months of March to May and lowest percentage in the October. The lowest percentage was due to non-availability of food organisms.

In this study, percentage of high feeding was in the months of November (7.69%) followed by February (16.67%). In moderate feeding category, the highest percentage (16.67%) was recorded in September followed by November (11.54%), January (11.43%) and February (11.11%). Low feeding was observed to be more in December (38.09%) followed by January (37.14%), September (36.66) and November (34.62%). The occurrence of fishes with empty stomach was recorded during most of the months. The highest percentage (100%) of empty stomach was in the months of March, April and May and the lowest percentage of empty stomach was in the month of February (38.89%) (Table 2 and Figure 3).

Monthwise Gastro-somatic index (GaSI) of *P. argenteus* ranged from 1.41 to 4.09 and fluctuated over months. The lowest value (1.41±0.2) was found in November while the highest value (4.09±1.22) was in February (Table 3 and Figure 4). Lengthwise GaSI values for *P. argenteus* were not significantly differed with the range between 1.3 and 3.35. The maximum value was recorded in 10.0-12.9cm length group and the minimum value was found in 19.0-21.9cm length group (Table 4 and Figure 5).

The results of vacuity index (VI) showed random monthly variation in the values. The percentage range of VI was from 39% to 100%. The most abstemious fish (80≤VI ≤100) were found in the months March, April and May. And then the relatively abstemious fishes were found in October (60≤VI≤ 80) while the moderate feeder fishes were in months of September, November, December and January (40≤VI≤60). Moreover, the relatively edacious fish was observed in February (20≤VI≤40) (Table 3 and Figure 6).

Table 1 Monthwise percentage of food composition in *Pampus argenteus* from March 2019 to February 2020.

	Months								
Food Items	**Mar. 2019**	**Apr.**	**May**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan. 2020**	**Feb.**
Copepod	-	-	-	5.88	11.11	18.12	16.84	15.35	19.22
Other zooplankton	-	-	-	-	-	3.29	2.7	1.14	4.85
Crustacean appendages	-	-	-	5.88	-	1.32	-	0.66	0.22
Molluscan larvae	-	-	-	-	-	-	-	-	0.33
Fish scales	-	-	-	35.3	33.33	-	0.63	-	-
Small fish	-	-	-	5.88	-	-	-	-	-
Diatoms	-	-	-	-	-	-	0.85	0.72	0.45
Algal filaments	-	-	-	-	-	-	-	-	0.15
Semi-digested pulp	-	-	-	70.10	75.45	77.27	78.98	82.13	74.78

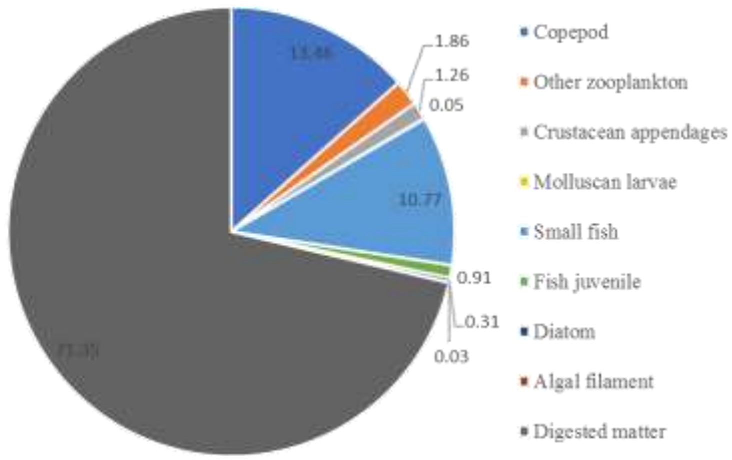

Figure 2 Percentage composition of food items in stomach of *Pampus argentus* from March 2019 to February 2020

Table 2 Monthwise percentage of feeding intensity in *Pampus argenteus* from March 2019 to February 2020.

Months	**March (2019)**	**April**	**May**	**Sept.**	**Oct.**	**Nov**	**Dec**	**Jan (2020)**	**Feb**
	n=34	n=31	n=30	n=30	n=32	n=26	n=42	n=35	n=36
Empty	100	100	100	46.67	75	46.15	52.38	45.71	38.89
¼ full				36.66	25	34.62	38.09	37.14	33.33
½ full				16.67		11.54		11.43	11.11
¾ full							9.53	5.72	
full						7.69			16.67

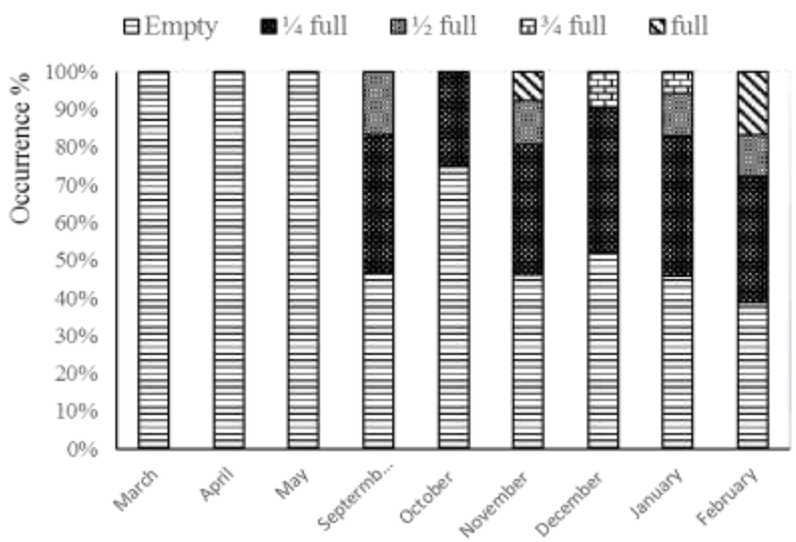

Figure 3 Month-wise percentage composition of stomach fullness of *Pampus argentus* from March 2019 to February 2020.

Table 3 Monthwise Gastrosomatic index and visceral mass index of *Pampus argenteus* from March 2019 to February 2020.

Months	Specimen examined	GaSI±SD	VMI±SD
March	34	2.24±0.91	7.57±1.78
April	31	3.18±1.15	8.5±2.56
May	30	1.91±0.77	4.87±0.94
September	30	2.1±0.49	6.25±0.81
October	32	1.58±0.24	6.37±2.1
November	26	1.41±0.2	6.56±3.57
December	42	1.56±0.32	4.17±1.38
January	35	1.6±0.19	5.35±0.46
February	36	4.09±1.22	11.02±3.66

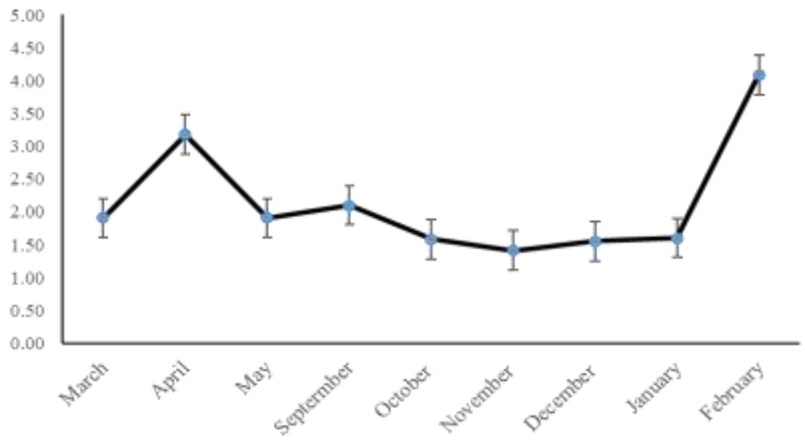

Figure 4 Month-wise Gastrosomatic index of *Pampus argenteus* from March 2019 to February 2020.

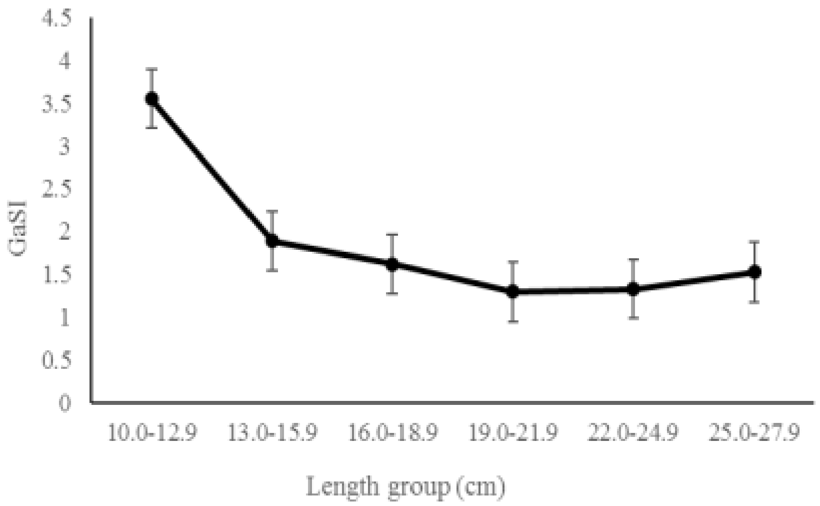

Figure 5 Length-wise Gastrosomatic index of *Pampus argenteus* from March 2019 to February 2020.

Table 4 Lengthwise Gastrosomatic index of *Pampus argenteus* from March 2019 to February 2020.

Length group	Specimen examined	GaSI±SD
10.0-12.9	71	3.55±1.31
13.0-15.9	144	1.89±0.64
16.0-18.9	65	1.62±0.39
19.0-21.9	5	1.3±0.21
22.0-24.9	9	1.33±0.46
25.0-27.9	2	1.53±0.43

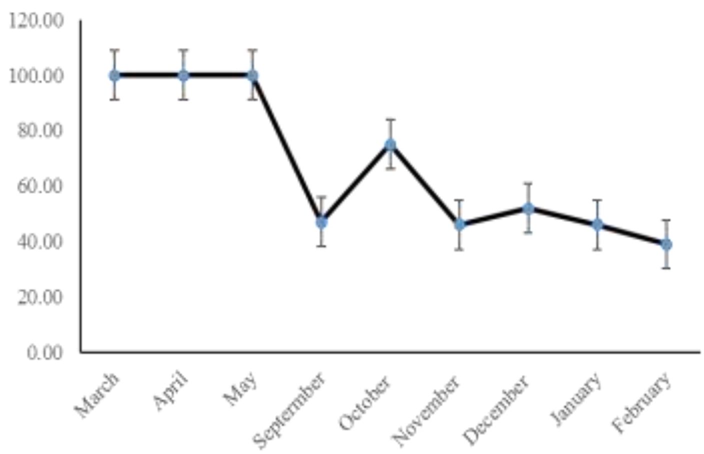

Figure 6 Month-wise percentage of vacuity index of *Pampus argenteus* from March 2019 to February 2020.

Discussion

Fishes feed on wide range of materials of plant and animal origin. They convert part of the organic materials ingested into living biomass; this process is influenced by quantity, quality of the food material and surrounding environment. Understanding fish nutrition habits requires extensive field and laboratory studies to infer the main sources of nutrition for a species. Even then, feeding studies can identify the prevalence of food items but it is not possible to assess the diet preferences of fish without detail complementary studies to estimate the range and abundance of potential food items available in their natural environment (Valinassab, *et al.,* 2011).

In the present study, *Pampus argenteus* feed largely on copepod because more copepods were found than other food items in the stomach content. Similarity, Abdu Rahiman (2006) reported that *P. argenteus* was an omnivore which fed mainly on copepod and detritus. Then the mean weight of detritus gradually decreased with increasing length but in the largest length class, it again increased. The number of copepods fluctuated without a clear pattern between length groups. The present study is agreement with his result.

Pati (1978) investigated the food of fish and stated that copepods play an important food items throughout the year, the peak occurrence found during the early southwest monsoon months of April-May and the post-monsoon months of August-November. Therefore, copepods are very important part of diet both in Pre-monsoon and post-monsoon seasons in Bay of Bengal. Moreover, Rao (1964) observed a high percentage of copepods along with amphipods, ostracods, other crustacean zooplankton, gastropod larvae and fish remains in the stomachs of *P. argenteus*.

Abdurahiman, Zacharia, Nayak and Mohamed (2006), also observed copepods formed the largest proportion in the stomachs of *P. argenteus* from the Southeast Arabian Sea. Rao (1964) also reported that copepods were important food items in the stomachs of *P. argenteus* in the Bay of Bengal. Similarity, Thangavelu *et. al,* (2012) also reported that copepods were important food items in the stomachs of *P. argenteus* in Gujarat of Indian.In the present study, other zooplankton and crustacean appendages were found second most abundance food items in the stomachs of *P. argenteus*. Similarity, Rao (1964) observed other zooplankton (other than copepod) and crustacean remain were found second most components of food items in the stomachs.

In the present study, molluscan larvae, algal filamentss and small fishs were found occasionally in the stomachs of *P. argenteus*. Similarity, molluscan larvae and algal filamentss were recorded occasionally in fish stomachs from the Bay of Bengal (Pati, 1978). Pati (1978) described that the pomfret fishes possess tooth pharyngeal sac which acts as grinding mill to convert the food into pulpy mass and hence making the identification of food components very difficult. Therefore, the fishes in the foos component could not be identified but fish scale frequently encountered which remain undigested in the gut.

Fish scales were found in most of the months throughout the study period (Pati,1978) but only recorded in September and October with the largest percentage (35.3% and 33.33%) among all food items in both months in the present study. Occurrence of fish scales though in less quantities, indicated that small fishes formed diet of *P.* argenteus. In Rao (1964), fish scales were found occasionally in the stomachs of *P. argenteus* with a small proportion (0.8%). During the present study, diatomss were occurred in small quantities of percentage which was similar to the findings by Abdurahiman, *et al.,* (2006). Basheeruddin and Nayar (1961) investigated semi-digested pulp with fish scales, bones of fish, copepods, *Acetes* spp. and other crustacean that were entangled in the gut of pomfret fishes. Abdurahiman, *et al.*, (2006) reported that the copepods were significance in the diet of *P. argenteus* and that was also greatly emphasized in other studies such as Kuthalingam (1967), Dadzie *et al* (2000).

In a closely related species (*Parastromateus niger,* black pomfret), Sivaprakasam (1967) observed that food was present in highly macerated and in advanced state of digestion. Crustacean was main food items for *P. niger*. Dadzie (2007) also stated that crustaceans were the most common food items in the stomachs of *P. niger*. Among crustaceans, copepods were found to be higher than another crustacean group. Moreover, copepods were highly distinct components in the seasonal variation of prey items in pomfret fishes (Chinese pomfret and black pomfret) as mentioned by Abdurahiman, *et al.,* (2006). Moreover, Chinese pomfret, *Pampus chinensis* fed mainly on zooplankton in which proportion of copepod was higher than that of other zooplankton (Pati, 1977)

During the present study, the stomach contents of silver pomfret were examined from 296 samples collected from March 2019 to February 2020. On the average in length range of 10.0-26.6cm were examined. Regarding the feeding habits, the degree of fullness in stomach was occurred as full, ¾ full, ½ full, ¼ full and empty in which full was regarded as high feeding, ¾ full and ½ full was moderate feeding and ¼ full was low feeding and empty. In the present study, empty stomach was found throughout the year while the highest was found in the pre-monsoon season. Similarity, fishes with poorly fed stomach condition were dominant in all seasons and the highest proportion occurred in pre-monsoon followed by monsoon season was reported by Abdurahiman, *et al.,* (2006).

In present study, high feeding was recorded to be more in post-monsoon season and moderately feeding and low feeding also found to be high in post-monsoon seasons. Abdurahiman, *et al.*, (2006) found proportion of empty stomachs was higher in large fishes and the diet changed with body size as well as with season. Abdu Rahiman (2006) reported that the poor feeding condition of *P. argenteus* was found throughout the year in which the highest proportion occurred in pre-monsoon followed by the monsoon season. Moreover, empty stomachs fishes with high proportion were found in the post-monsoon season. The percentage of empty stomach was high in April to July while high feeding intensity was from August to November. The occurrence of high feeding coincides with the abundance of copepods (Pati, 1978).

Size-wise feeding intensity analyzed revealed that in all the size groups (150-549 mm TL) higher percentage of empty stomach was observed and no full and gorged stomachs of *P. argenteus* was observed during the study period (Thangavelu *et. al*, 2012). In the pomfret fish, *P. niger*, fishes with empty stomachs were recorded throughout the year except December though the maximum proportion of stomachs occurred in March and April and the minimum values in January and February (Dadzie, 2007).

During the present study, monthly gastro-somatic index of *P. argenteus* ranged from 1.41 to 4.09. The minimum value of GaSI (1.41±0.2) was found in November while the maximum value (4.09±1.22) was in February. And then Lengthwise GaSI values for *P. argenteus* were differed with the range between 1.3 and 3.35. The highest value was reported in 10.0-12.9cm length group and the lowest value was in 19.0-21.9cm length group. The GaSI value slightly varies with size group which indicated that fish feed at the same rate. The relationship between mean body weight and mean gastro-somatic index (GaSI) differed significantly. Although the body of fish increased, the weight of stomach in fish did not significantly increased. The stomach of *P. argenteus* was very small so the food contained very little in the stomach.

In the present study, the results of vacuity index (VI) indicated random monthly variation in the values. The abstemious fishes ($80 \le VI \le 100$) and relatively edacious fishes ($20 \le VI \le 40$) occurred in pre-monsoon. And then the relatively abstemious fishes ($60 \le VI \le 80$) were found in post-monsoon while the moderate feeder fishes ($40 \le VI \le 60$) were in months of post-monsoon season. Hashemi and Taghavimotlagh (2013) described that vacuity index (VI) indicated moderately feeding and the fluctuation in fullness of stomach show correlation with temperature and fish with empty stomachs occurred at mature fish during spawning season. Thomas *et al* (2018) observed the highest vacuity index (VI) found at the mature fish within the spawning season. Similarity, the high VI values were also observed at the mature fish in present study.

Conclusion

In the present study, it was noticed that copepods are present in substantial quantities in the stomachs of *P.* argenteus. From the results of this study, it could be concluded that silver pomfrets, *Pampus argenteus* is a specialized feeder on semi-digested pulp and copepods. *P.* argenteus was a carnivore feeding mainly on zooplanktonic organisms especially copepods. The fishes with empty stomachs were found to be higher than high feeding during present study period. The monthly GaSI values was differed and lengthwise GaSI varies slightly with size group which indicated that fish feed at the same rate.

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