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VARIATION OF FOOD ITEMS IN THE STOMACH CONTENTS OF TWO MULLETS, *CHELON SUBVIRIDIS* AND *VALAMUGIL BUCHANANI*, FROM MERBOK ESTUARY, KEDAH, MALAYSIA

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Abstract: This study was conducted in Merbok estuary, Kedah, Malaysia during January to December 2011 to assess monthly and seasonal variation in food items in the stomach of *Chelon subviridis* and *Valamugil buchanani*. A total of 341 fish samples (225 for *Chelon subviridis* and 116 for *Valamugil buchanani*) were collected from upper zone (Lalang and Sameling Rivers) of Merbok estuary. Among the stomach contents plant materials, diatom, cyanobacteria and detritus were the main food items in both fish species. In both fishes the highest numbers of food items were found in the month of November. *Chelon subviridis* consumed plant materials 65.84% by number and 8.55% by frequency of occurrence in the dry season whereas 66.25% by number and 9.73% by frequency of occurrence in the wet season. On the other hand, *Valamugil buchanani* consumed plant materials 59.54% by number and 12.28% by frequency of occurrence in the dry season whereas 72.89% by number and 11.96% by frequency of occurrence in the wet season respectively. Monthly variations of diatom as food item between *C. subviridis* and *V. buchanani* were found to be statistically significant ($p<0.05$). Both of the fish species consumed more food (by numerical method) in wet season than dry season.

Key words: Variation of food items, *Chelon subviridis* and *Valamugil buchanani*

INTRODUCTION

Fishes are highly responsive to seasonal changes in food availability. Changes from one trophic level to another are also known to occur. Fish may switch from a diet of invertebrates to a diet of algae as invertebrate numbers decline toward the end of summer (Kitchell and Windell 1970). Thus, to adequately describe the trophic resources utilization by a fish population, it is often necessary to sample at frequent intervals throughout the year. Analysis of gut content is widely used to ascertain the food and feeding habit of a fish species. Accurate description of diets and feeding habits provides the basis for understanding the trophic interactions in aquatic food webs (Sivadas and Bhaskaran 2009, Kariman and Khalifa 2009). Food and feeding habits of the

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fish vary with time of the day, season of the year, size of the fish, environmental condition and with different food substances present in the water body (Hynes 1950). The correct picture of the food and feeding habit of a fish may not be obtained by examination of the gut contents of a few specimens at random; but an intensive study of the gut contents over the various seasons of the year can yield information of the value for fisheries development and management (Pillay 1952). Wotton (1998) mentioned that many fishes display great flexibility in their feeding ecology, for example, ontogeny and seasonal changes in diet composition.

There is less information on the feeding habit of mullet fish in Malaysia especially on Merbok River estuary (Mansor *et al.* 2012, Fatema *et al.* 2013a,b). Therefore, this study was undertaken to assess the monthly and seasonal variation of food items in the stomachs of two mullet fish species (*Chelon subviridis*, *Valamugil buchanani*) which may provide some input in relation to the habitat of these fish species.

MATERIAL AND METHODS

Fish samples were collected monthly from the upper zones of Merbok estuary i. e. upstream of Lalang and Sameling River from January to December 2011. The descriptions of the sampling sites are given elsewhere (Fatema *et al.* 2014). The samples were collected from artisanal fishermen who operate the barrier nets, with the dimensions of the net at 100 – 120 m long, 3 – 5 m deep, and with 2.5 cm mesh size and without bunt. A total of 341 fish samples (225 for *Chelon subviridis* and 116 for *Valamugil buchanani*) were collected for the analysis of stomach contents.

Stomach contents were analyzed by two methods, such as (i) numerical and (ii) frequency of occurrence methods Hyslop (1980).

(i) *Numerical method*: The number of individuals in each food category was recorded for all stomachs and the total was expressed as a proportion, usually a percentage, of the total individuals in all food categories (Ikusemiju and Olaniyan 1977). The mean number of individuals per stomach in each food category was calculated.

(ii) *Frequency of occurrence method*: This method is a way of recording data gleaned from stomach contents for calculating the number of stomachs containing one or more individuals of each food category. This number was then expressed as a percentage of all stomachs.

Frequency of occurrence was calculated according to the formula by Hyslop (1980) and Bowen (1983):

$Fi = (ni/n) * 100$

Where, *Fi*: frequency of occurrence of the *i* food item in the sample

ni: number of stomachs in which the *i* item is found

n: total number of stomachs with food in the sample

'Kruskal Wallis H test' was used to show any significance differences of food items among studied fishes based on numerical and frequency of occurrence method.

RESULTS AND DISCUSSION

Tables 1 and 2 show the monthly changes of food items based on numerical method in the stomachs of *C. subviridis and V. buchanani*. In both fish species the major monthly components of the diet were plant materials, diatom, cyanobacteria and detritus. Zooplanktons were found in every month except January in the stomach of both fish species. Desmids and pisces were the least observed item in the stomachs of both fishes. No detritus were found in both the fish species. The highest numbers of food items were found in the month of November in both fishes. The lowest was in January in *C. subviridis* and September in *V. buchanani*. Figures 1 and 2 show the monthly changes of food items based on frequency of occurrence method in the stomachs of *C. subviridis* and *V. buchanani*. In case of *C. subviridis* the peak zooplankton was observed in July whereas the second highest food item, diatom was found in October. On the other hand, the highest diatom was found in February in case of *V. buchanani* while the second highest observed food item was zooplankton in the month of February.

Table 1. Monthly variations of food items based on numerical method in the stomach of *C. subviridis* (n = 225) during 2011

Food Items	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Diatoms	20	150	122	593	203	128	328	417	68	342	309	144
Cyanobacteria	3	29	21	191	65	18	49	188	26	272	15	38
Desmids	0	13	0	1	0	0	2	7	0	11	0	1
Plant materials	18	1931	731	888	459	391	979	271	167	286	2363	96
Zooplankton	0	42	34	60	31	55	207	20	46	63	57	33
Detritus	-	-	-	-	-	-	-	-	-	-	-	-
Sand grains	-	-	-	-	-	-	-	-	-	-	-	-
Pisces (bones, scales)	0	0	2	2	0	0	0	0	7	1	1	0
Total	41	2165	910	1735	758	592	1565	903	314	975	2745	312

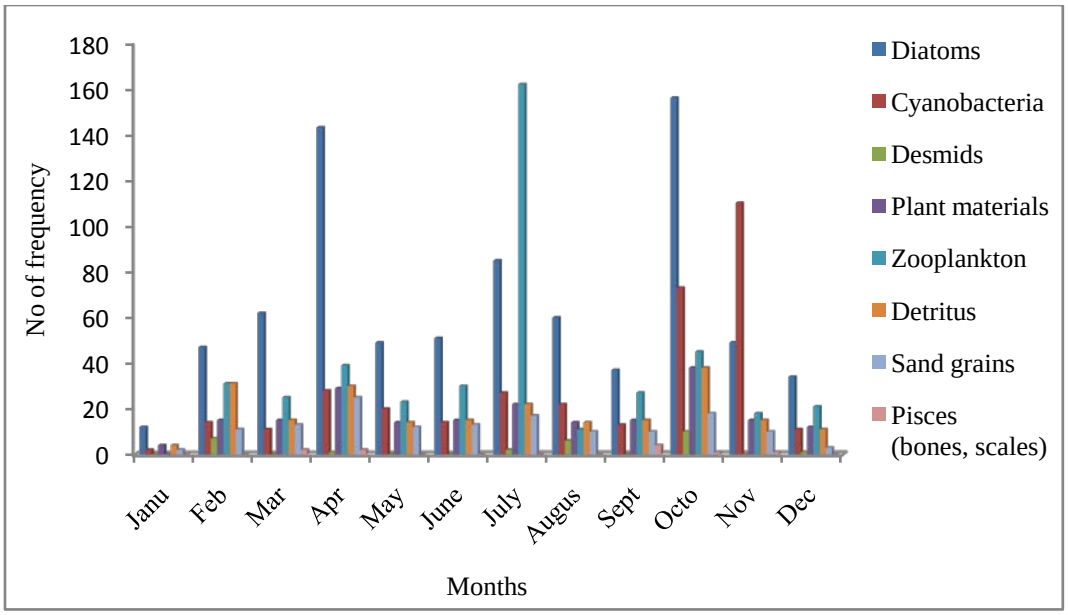

Fig. 1. Monthly variation of food items based on frequency of occurrence method in the stomachs of *C. subviridis*.

Table 2. Monthly variations of food items based on numerical method in the stomach of *V. buchanani* (n = 116) during 2011

Food items	Jan	Feb	Mar	April	May	Jun	July	August	Sept	Octo	Nov.	De
Diatoms	102	473	35	38	168	-	23	63	4	56	291	32
Cyanobacteria	17	27	6	2	36	-	3	60	2	6	69	18
Desmids	1	5	0	0	2	-	1	1	0	1	3	0
Plant materials	70	1115	241	441	416	-	118	216	7	54	1336	69
Zooplankton	24	124	24	46	33	-	12	11	6	27	80	8
Detritus	-	-	-	-	-	-	-	-	-	-	-	-
Sand grains	-	-	-	-	-	-	-	-	-	-	-	-
Pisces (bones, scales)	0	6	1	0	1	-	0	0	1	0	5	3
Total	214	1750	307	527	656	-	157	351	20	144	1784	130

*No samples were found in the month of June

Kruskal- Wallis H-test showed that monthly variations of food items between *C. subviridis* and *V. buchanani* were not statistically significant ($p>0.05$) except diatom ($p<0.05$) based on numerical method. This test also showed that monthly

variations of food items between *C. subviridis* and *V. buchanani* were statistically significant ($p<0.05$) except desmid and pisces ($p>0.05$) based on frequency of occurrence method. Therefore, in both methods diatom showed its variation between *C. subviridis* and *V. buchanani*.

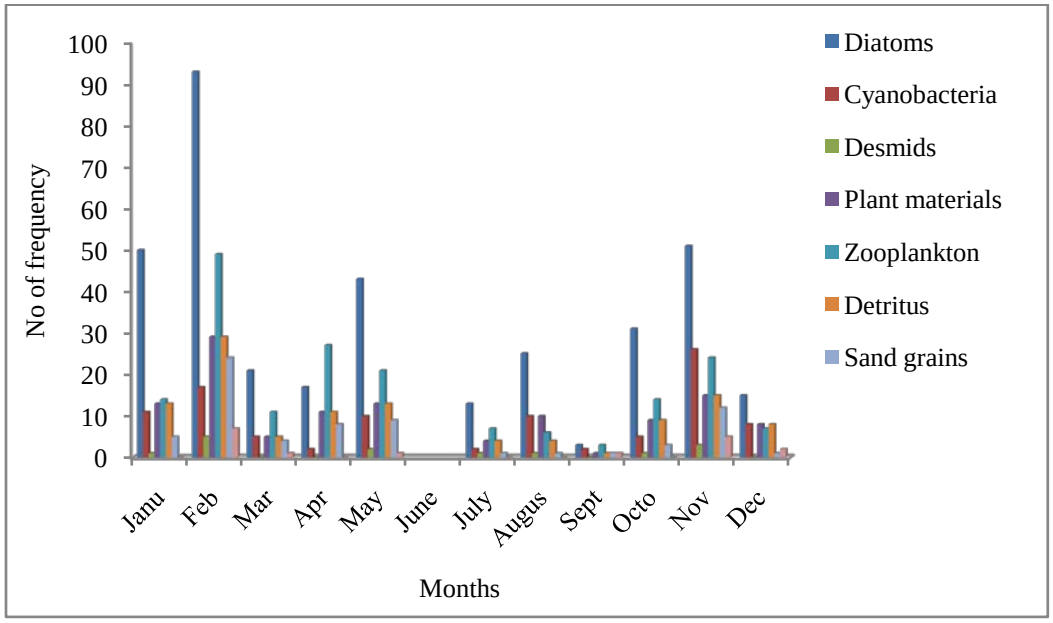

Fig. 2. Monthly variations of food items based on frequency of occurrence method in the stomachs of *V. buchanani*.

The seasonal variation of the stomach contents of *C. subviridis* and *V. buchanani* examined for Merbok estuary is presented in Tables 3 and 4. Both *C. subviridis* and *V. buchanani* consumed mainly of plant materials in the dry and rainy season respectively. In both fish species plant materials consumed were 65.84 and 59.54% by number and 8.55 and 12.28% by frequency of occurrence in the dry season and 66.25 and 72.89% by number and 9.73 and 11.96% by frequency of occurrence in the wet season respectively (Table 3 and 4) .The diatoms were next in abundance with 19.78 and 28.64% by number in the dry season and 23.25 and 16.43% by number in the rainy season. In both fish species, diatoms were the most consumed item with 35.03 and 39.38% by frequency method in the dry season and 38.17 and 34.78% in the wet season respectively. Zooplanktons were next in abundance after diatom with 26.30 and 17.74% by frequency of occurrence in the dry season; 13.65 and 20% in the wet season. In both seasons desmids and pisces were the least consumed food items in the stomach of both fish species.

Table 3. Summary of the seasonal variation in the stomach contents of *C. subviridis* from Merbok estuary (January to December, 2011) (n = 225)

Food Items	Dry season				Wet season			
	Numerical method		Frequency of Occurrence method		Numerical method		Frequency of Occurrence method	
	No	%	No	%	No	%	No	%
Diatoms	1112	19.78	385	35.03	1712	23.25	400	38.17
Cyanobacteria	380	6.76	141	12.83	506	6.87	204	19.47
Desmids	27	0.480	20	1.82	8	0.109	7	0.668
Plant materials	3701	65.84	94	8.55	4879	66.25	102	9.73
Zooplankton	400	7.12	289	26.30	248	3.37	143	13.65
Detritus	-	-	105	9.55	-	-	103	9.83
Sand grains	-	-	64	5.82	-	-	80	7.63
Pisces (bones, scales)	1	0.018	1	0.091	12	0.163	9	0.859
Total	5621		1099		7365		1048	

Table 4. Summary of the seasonal variation in the stomach contents of *V. buchanani* from Merbok estuary (January to December, 2011) (n = 116)

Food Items	Dry season				Wet season			
	Numerical method		Frequency of Occurrence method		Numerical method		Frequency of Occurrence method	
	No	%	No	%	No	%	No	%
Diatoms	686	28.64	202	39.38	599	16.43	160	34.78
Cyanobacteria	71	2.96	43	8.38	175	4.80	55	11.96
Desmids	8	0.334	8	1.56	6	0.165	6	1.30
Plant materials	1426	59.54	63	12.28	2657	72.89	55	11.96
Zooplankton	195	8.14	91	17.74	200	5.49	92	20
Detritus	-	-	63	12.28	-	-	49	10.65
Sand grains	-	-	34	6.63	-	-	35	7.61
Pisces (bones, scales)	9	0.376	9	1.75	8	0.219	8	1.74
Total	2395		513		3645		460	

Present study observed that both the fish species *C. subviridis* and *V. buchanani* fed on plant materials, diatom, zooplankton, cyanobacteria, sand grain, detritus, desmid and pisces in the dry and wet season respectively. This study also indicated that both fish species fed more food (by numerical method) in wet season as compared to dry season. Labropoulou *et al.* (1997) studied the ontogenic, feeding trends and seasonal changes in trophic biology of striped red

mullet. They reported that crustaceans such as amphipods and decapods were the prominent diet of striped red mullet which varied with season. Cardona (2000) stated that seasonal changes in the food quality, dial feeding rhythm and growth rate of juvenile leaping grey mullet (*Liza saliens*). The author also reported that there was a relationship between the summer season food and reduced fish growth. These research findings comply with the previous study results. The foods of four juvenile mugilid fishes such as *Liza falcipinnis*, *L. dumerili*, *Mugil bananensis* and *M. curema* were composed of bacteria, diatoms, blue green algae, protozoan, detritus and particulate organic matter (Blay 1995) with no remarkable seasonal changes in the diet and feeding activities (Blay1995 and Soyinka 2008).

In this study plant material, diatoms, cyanobacteria and detritus were main food items in the stomach contents of *Chelon subviridis* and *Valamugil buchanani* by both frequency of occurrence and numerical method. Fish feeding rate in both the species were found to be decreased during dry season than wet season. Monthly and seasonal variation was noticed in the consumed food items of two fish species by both the methods.

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