

## DIGESTIVE TRACT AND STOMACH CONTENTS OF THREE FISH SPECIES FROM AYEYAWADY RIVER SEGMENT AT LEKONE QUARTER IN MYITKYINA TOWNSHIP, KACHIN STATE

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### Abstract

The study was conducted from the Ayeyawady River Segment at Lekone Quarter in Myitkyina Township, Kachin State to investigate the digestive tract and stomach contents of three fish species (*Channa striata*, *Cirrhinus latia* and *Barilius barna*) from December 2018 to August 2019. The gut index of *C. striata* (0.59), *C. latia* (9.25) and *B. barna* (0.71) were recorded. According to the stomach content analysis, the value of frequency occurrence of *C. striata* showed earthworm (37.5%), insect parts (25%), mud (25%) and fish (12.5%). The species *C. latia* showed each 80% for plant materials and mud. *B. barna* showed mud (75%), insect parts (62.5%), plant materials (12.5%) and earthworm (25%). The vacuity index in *C. striata* and *B. barna* showed 20% in each and 0% in *C. latia*.

**Keywords:** Ayeyawady River, fishes, gut index, stomach contents, frequency, vacuity index

### Introduction

Myanmar is rich in natural resources of both marine and freshwater, such as rivers, streams and lakes providing a wide range of commercially valuable fish species. Human livelihoods especially in many developing countries depend on aquatic resources mainly fish. The Kachin State has also a variety of rivers, streams and lakes that support rich fish diversity. Moreover, Ayeyawady River starts its origin near Myitkyina, Kachin State.

Fish are generally divisible into herbivores, carnivores and omnivores. The different types of feeding habits could be determined by their morphology of digestive tracts (Kalaya-murthy and Rao, 1970; Ramakrishniah, 1983; Santhanakuma and Job, 1983; Devi *et al.*, 1992; Yusuf and Majumdar 1993; Raj, 2002).

Hickman *et al.* (2001) reported most fishes are carnivores that prey on a myriad of animal food from zooplankton and insect larvae to large vertebrates. A second group of fishes are herbivores that eat plants and alga but that are few number and crucial intermediates in the food chain, especially freshwater rivers, lakes, and ponds that contain very little planktons. Omnivores feed on both plants and animals food.

Thandar Aye (2010) stated that determination of food and feeding habit has been made on the basic of the occurrence of food items in the stomach contents, relative length of the alimentary canal, variation among the digestive system.

Hyslop (1980) described that study of diet based upon analysis of stomach contents is now a standard practice in fish ecology works. Pillay (1952) also reported that the analysis of stomach contents of fish could provide information about the niche of a particular of fish in its ecosystem.

The present study is focused on the analysis of stomach contents of three fish species such as *Channa striata*, *Cirrhinus latia* and *Barilius barna* according to feeding habits from the upper most part of Ayeyawady River Segment at Lekone Quarter in Myitkyina Township, Kachin State. Thus, the main objectives of the study were;

- to access the length ratio of standard length and digestive tract length of each study species

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- to examine the types of stomach, intestine and stomach contents
- to record the intensity of feeding, vacuity and gut index of the fish species based on the stomach contents

## Materials and Methods

### Study site

The present study was conducted to investigate the digestive tract and stomach contents of three fish species from the Ayeyawady River at Lekone Quarter in Myitkyina Township, Kachin State. It is located at 25° 20' 50.492" N and 97° 24' 30.063" E (Fig. 1 and Plate 1).

### Study period

The study was conducted from December 2018 to August 2019.

### Specimen collection and identification

Specimens were randomly collected from study site, emphasize on *Channa striata*, *Cirrhinus latia* and *Barillus barna*. Three species were approximately collected from three feeding categories, carnivores, harvivores and omnivores. Each specimen was taken as photo for records. These species were preserved in 10 percent formaldehyde solution for further investigation. The collected specimens were identified according to Talwar and Jhingram (1991) and Rainboth (1996).

### Data collection

Ten individuals of each studied fish species were observed to investigate the feeding habits. Collected fishes were measured individually for total body length (cm), standard length (cm) and length of alimentary canal (cm) were taken by in situ and by removing of its body. The stomach contents of each species were examined and identified by naked eyes, dissecting microscope and stereo microscope. Then recorded contents from stomach were photographed.

### The ratio between length of digestive tract and standard length

The ratio between length of digestive tract and standard length (L ratio) was calculated using the following formula according to Taki, 1978.

$$\text{Length ratio} = \frac{\text{Digestive tract length}}{\text{Standard length}}$$

### Frequency occurrence of foods in the stomach

The food items in the stomach were evaluated by calculating the frequency of occurrence method of Hyslop, 1980.

$$F_p = N_s \times 100 / N_f$$

Where,  $F_p$  = the percentage frequency of occurrence of one prey item or prey occurrence index

$N_s$  = the number of stomachs containing the prey item

$N_f$  = the number of stomach that contained food

**Intensity of feeding**

The intensity of feeding was determined based on the degree of distention of stomach wall and amount of contained food in it and classified as full (gorged), 3/4full, 1/2full, 1/4 full, trace and empty (Pillay, 1952).

**Vacuity index**

The vacuity index or index of emptiness was estimated from the equation

$$CV = ES \times 100 / TS \text{ (Euzen, 1987).}$$

Where, CV = the vacuity index

ES = the number of empty stomachs

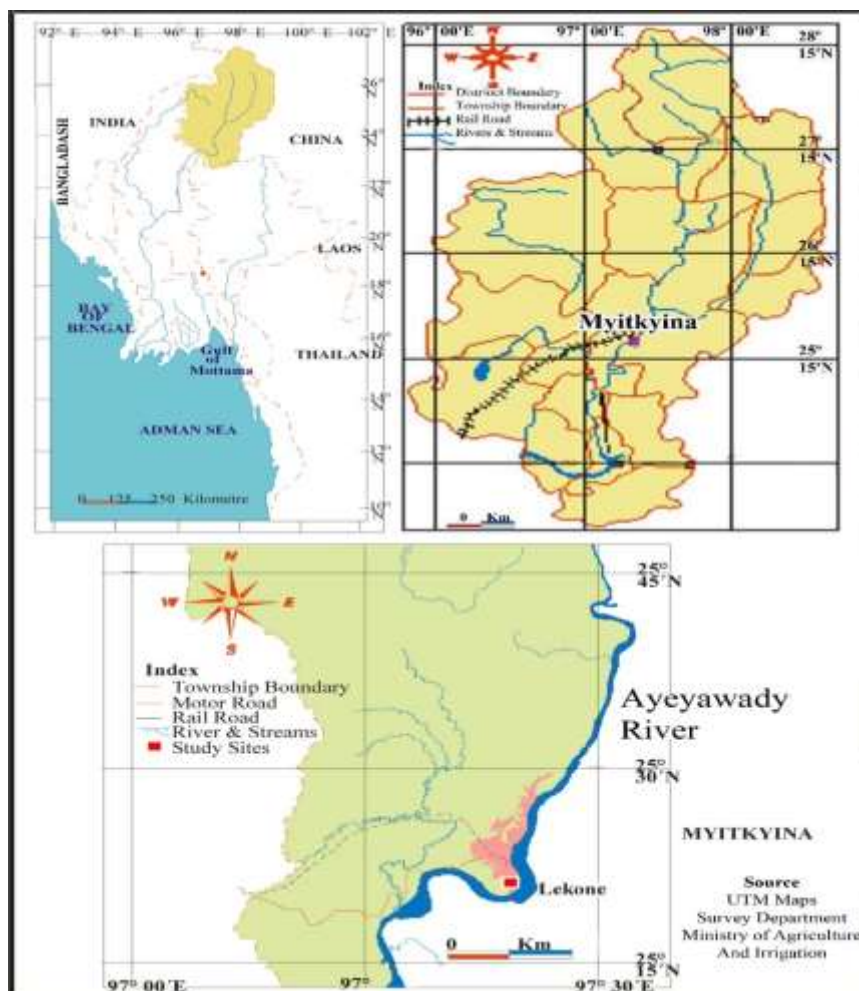
TS = the total number of stomachs analysed

**Gut index (L ratio)**

Gut index was calculated according to Smith, 1980.

**Data analysis**

Data were analysed using descriptive statistic (in percentage, mean, standard deviation). Graphics were performed by Microsoft Excel Programme.



Source: UTM Maps, Survey Department, Ministry of Agriculture and Irrigation

**Figure 1** Location map of study area showing study site



A. Fishing boat in the study site    B. Fishing in the study site    C. Fish collected by local fisherman

**Plate 1** The Ayeyawady River Segment in Lekone Quarter showing the study site

## Results

In the study period, the total of three species of fishes belonging to three genera, two families including Channidae (Order Anabantiformes) and Cyprinidae (Order Cypriniformes) were collected from the Ayeyawady River Segment at Lekone Quarter in Myitkyina Township, Kachin State shown in Table 1 and Plate 2.

### Morphology of stomach and intestine of selected fish species

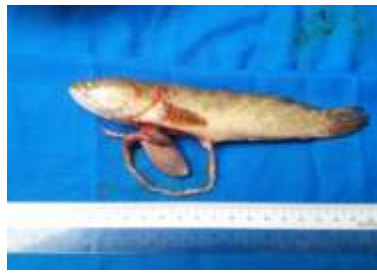
Stomach of *Channa striata* is elongated bag like (J shaped) and slightly swollen muscular stomach is present. A pair of short tubular pyloric caeca hangs from the anterior part of intestine. Intestine is originated from the fore part of the stomach and positioned at the right side of the stomach. The intestine is tubular in structure. *Cirrhinus latia* has a long tube like and coiled gastrointestinal tract while *Barilius barna* also tube like stomach and moderate elongated intestine recorded. (Table 2 and Plate 2)

**Table 1** Selected study species recorded from the study site

Sr. No	Order	Family	Scientific name	Common name	Local name	IUCN Red List
1.	Anabantiformes	Channidae	<i>Channa striata</i>	Snakehead Murrel	Nga-Yant	LC
2.	Cypriniformes	Cyprinidae	<i>Cirrhinus latia</i>	Carp	Nga-Lu	VU
3.	Cypriniformes	Cyprinidae	<i>Barilius barna</i>	Barna Baril	Nga-La-War	LC

**Table 2** Stomach shape and intestine type of fish species recorded from the study site

Sr. No	Name of species	Shape of stomach	Type of intestine	Type of consumer
1.	<i>Channa striata</i>	J Shaped	Short	Carnivore
2.	<i>Cirrhinus latia</i>	Tube Liked	Long	Herbivore
3.	<i>Barilius barna</i>	Tube Liked	Moderate	Omnivore

A. *Channa striata*

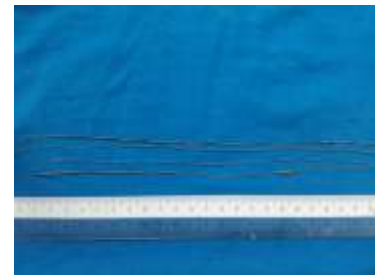
B. Gastrointestinal tract in situ



C. Extracted gastrointestinal tract

D. *Cirrhinus latia*

E. Gastrointestinal tract in situ



F. Extracted gastrointestinal tract

G. *Barilius barna*

H. Gastrointestinal tract in situ



I. Extracted gastrointestinal tract

### Plate 2 Gastrointestinal tract of studied species

#### Comparison of standard length and gastrointestinal tract length

Ten fish samples in *C. striata* (carnivore), mean of total length was 15.54 cm (9.8-19.3 cm), standard length 13.29 cm (7.9-17.7 cm) and gastrointestinal length 7.81 cm (3.4-9.2 cm) showed respectively. The gut index was recorded to be 0.59.

In recorded species *C. latia* (herbivore) mean of body length 14.4 cm (10.5- 18.7 cm), standard length 12.17 cm (9.3-15.5 cm) and digestive tract length 110.65 cm (72.0-136 cm) mean selected for this study. The gut index was calculated to be 9.25.

The species *B. barna* (omnivore) mean of body length 14.4 cm (10.5-14.9), standard length and digestive tract length showed 11.29 cm (8.7-13.9 cm) and 7.91 cm (6.0-11.5 cm) respectively. The gut index was found to be 0.71. (Table 3 and Fig.2)

#### Stomach contents of fish species recorded

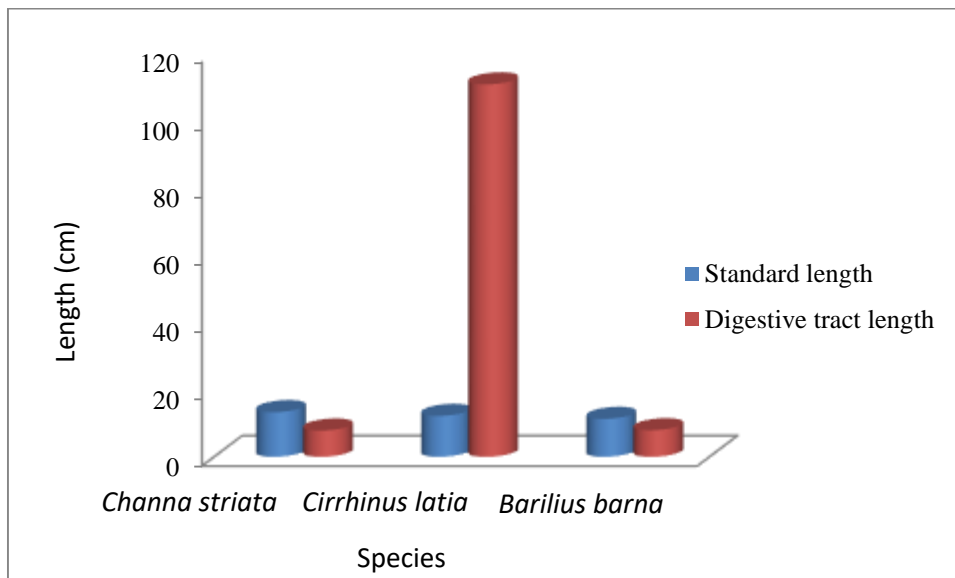
The food items in fish species recorded were examined into animal sources (insect parts, earthworm and fish), plant materials, algae and mud. Among the studied fish species, *C. striata* was designated as carnivore and its stomach involved animal source only. *C. latia* confined as herbivores and its stomach contained plant materials and mud. The stomach of *B. barna* species was found animal parts, plant parts and mud as omnivore in habit. (Table 4 and Plate 3)

**Table 3 Relationship between standard length and digestive tract length of studied fishes**

Fish species (N=10)	Mean ( $\pm$ SD)(cm)			L ratio
	Total length	Standard length	Digestive tract length	
<i>Channa striata</i>	15.54 $\pm$ 2.8 (9.8-19.3)	13.29 $\pm$ 2.77 (7.9-17.7)	7.81 $\pm$ 1.68 (3.4-9.2)	0.59 $\pm$ 0.1
<i>Cirrhinus latia</i>	14.4 $\pm$ 11.64 (10.5-18.7)	12.17 $\pm$ 2.05 (9.3-15.5)	110.65 $\pm$ 19.09 (72-136)	9.25 $\pm$ 1.87
<i>Barilius barna</i>	14.4 $\pm$ 2.9 (10.5-14.9)	11.29 $\pm$ 1.49 (8.7-13.9)	7.91 $\pm$ 1.47 (6.0-11.5)	0.71 $\pm$ 0.13

**Table 4 Stomach contents of fish species recorded from the study site**

Sr. No	Name of species	Animals source	Plant materials	Mud
1.	<i>Channa striata</i>	+		+
2.	<i>Cirrhinus latia</i>		+	+
3.	<i>Barilius barna</i>	+	+	+

**Figure 2 Comparison of standard length and gastrointestinal tract length of studied species**

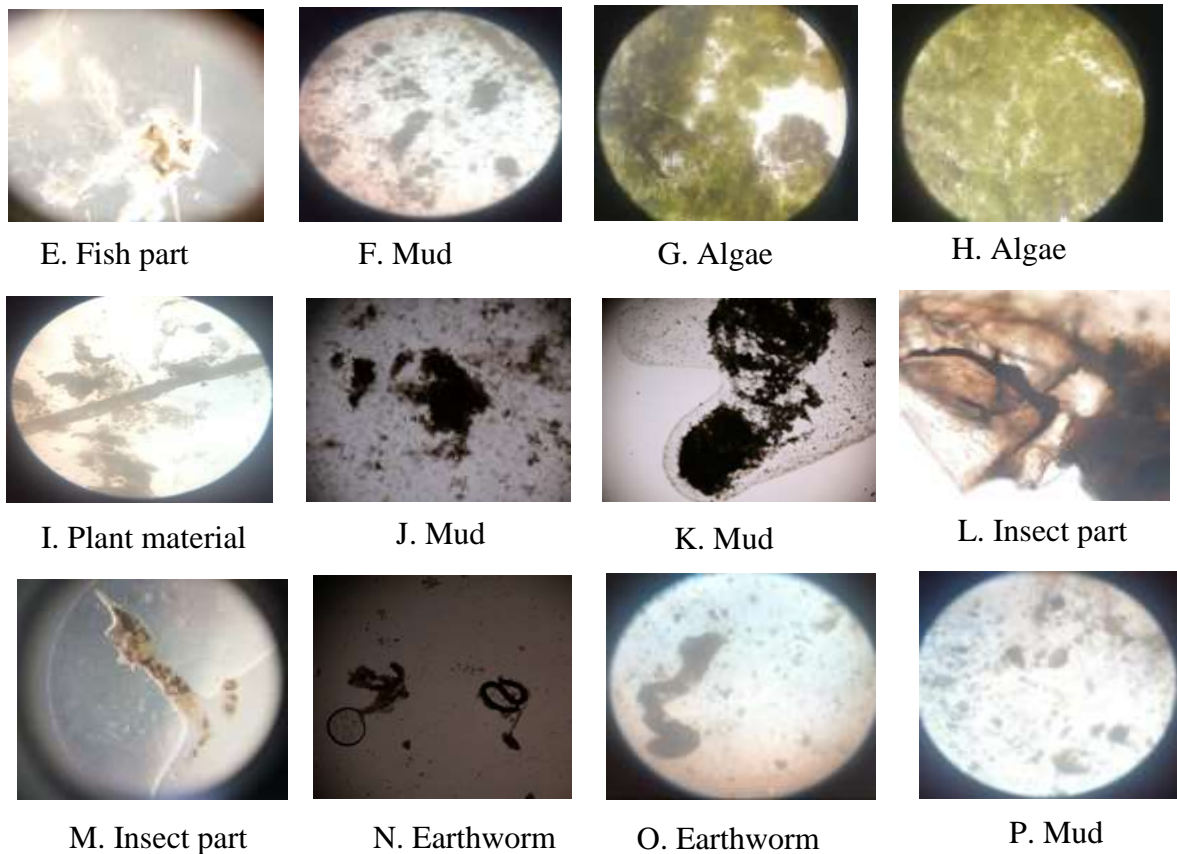
A. Insect part

B. Insect part

C. Insect part

D. Earthworm





**Plate 3** Food items of studied fish species *Channa striata* (A-F), *Cirrhinus latia* (G-K), *Barilius barna* (L-P)

**Stomach content analysis**

According to the stomach content analysis, out of the stomachs of 10 individuals analyzed, eight individuals contained (trace-full). Stomach while two individuals with empty stomach in *C. striata*. The value of Fp index showed 37.5% for earthworm followed by 25% insect parts, 25% mud and 12.5% fish respectively shown in Fig. 3.

In *C. latia*, the stomach of 10 individuals contained (trace-full). The value of Fp index showed 80% each for plant materials and mud shown in Fig.4.

The stomach of *B. barna* out of 10 individuals analyzed, eight individuals contained (trace-full) although two individuals with empty stomach. The value of Fp index showed 75% for mud, 62.5% for insect parts and 25% for earthworm and for plant materials 12.5% respectively shown in Fig.5.

**Intensity of feeding**

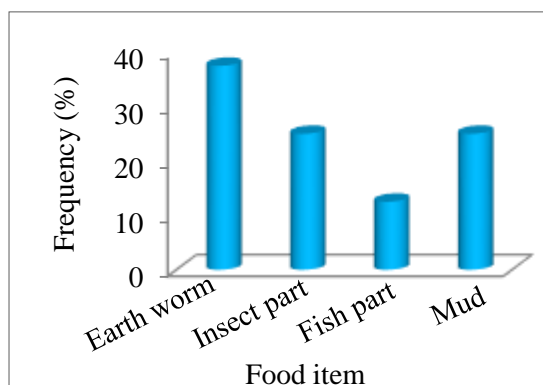
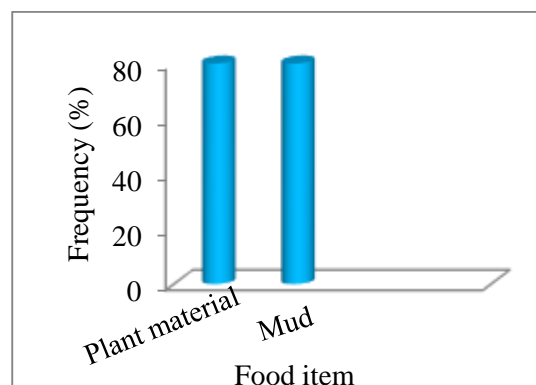
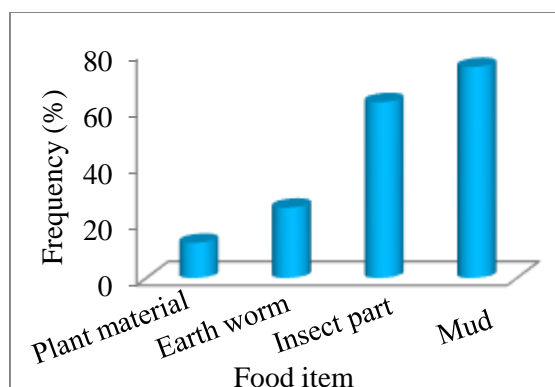
The intensity of feeding in *C. straita* was found to be 37.5% in full and ¾ full, 12.5% in ½ full and ¼ full, 0% in trace and 20% in empty. The intensity of feeding in *C. latia* was calculated to be 100% in full however 0% in ¾ full, ½ full, ¼ full, trace and empty. The intensity of feeding in, *B. barna* was examined to be 0% in full, 25% in ¾ full, 50% in ½ full, 12.5% in ¼ full and trace and 20% in empty. (Table 5)

**Vacuity index**

The result of vacuity index in *C. striata* and *B. barna* showed 20% in each and 0% in *C. latia* (Table 5).

**Table 5 Intensity of feeding in studied fish species recorded**

Fish species	Intensity of feeding (%)					Empty
	100 (full)	75 (¾ full)	50 (½ full)	25 (¼ full)	<25 (trace)	
<i>Channa striata</i>	37.5	37.5	12.5	12.5	0	20
<i>Cirrhinus latia</i>	100	0	0	0	0	0
<i>Barilius barna</i>	0	25	50	12.5	12.5	20

**Figure 3** Frequency occurrence of food items of *Channa striata***Figure 4** Frequency occurrence of food items of *Cirrhinus latia***Figure 5** Frequency occurrence of food items of *Barilius barna*

## Discussion

Three species of fish, *Channa striata*, *Cirrhinus latia* and *Barilius barna* belonging to three genera, two families of order Anabantiformes and Cypriniformes were selected from the Ayeyawady River Segment at Lekone Quarter in Myitkyina Township, Kachin State for investigating analysis of stomach contents according to their feeding habits.

Lagler *et al.* (1977) reported that the stomach shows various adaptations. In carnivorous fishes, the stomach is typically quite elongate than omnivorous species. In the present results, J shaped stomach was found in *C. striata* and tube-like stomach in *C. latia* and *B. barna*. The different shapes of the stomach may be due to their various feeding habits.

In the previous recorded, the intestine has many variations. It is shortened in essential carnivores. In the opposite fashion it is often elongated and arranged in many folds in predominantly herbivorous species (Lagler *et al.*, 1977). Zar Phyu Win (2015) stated that three



intestinal types were found such as short, moderate and long looped. In the present study agree to that the above record. Short intestine type is found in *C. striata* while moderate intestine in *B. barna* and long looped intestine in *C. latia*.

According to the gut index of *C. striata* was calculated to be 0.59 indicating the length of digestive tract was 0.59 time shorter than that of fish total length. Thus, the gut index of studied fish species was fall in the category of carnivorous fish. The gut index of *C. latia* was found to be 9.25 indicating the length of digestive tract was 9.25 times longer than that of fish length. Thus, the gut index of studied fish species was fall in the category of herbivorous fish. The gut index of *B. barna* was found to be 0.71 indicating the length of digestive tract was 0.71 time shorter than that of fish length. Thus, the gut index of studied fish species was fall in the category of omnivorous fish. The current result agrees with Smith, 1980 listed that the gut length as 0.2-2.5, 0.6-8.0 and 0.8-15.0 times of body length in carnivores, omnivores and herbivores, respectively. Thidar Aung *et al.* (2012) also observed that the gut index was 1.35 indicating *Epinephelus coioides* as carnivore.

Zar Phyu Win (2015) observed that the food items consist of fish, fish bone, shrimp, snail, frog, insect, plant materials, algae and mud. The adult fish of *C. striata* was expected to consume on fish, frogs, snakes, insects, earthworms, tadpoles, crustaceans and molluscs (Allen, 1991). However, the present study was recorded animal sources such as fish, earthworms and insects in *C. striata*, plant parts such as algae and mud in *C. latia*. Insect parts, plant materials and mud were found in *B. barna*.

In the present result of the stomach contents was observed from ten individuals of each species, the highest value of Fp index of *C. striata* showed for earthworm (37.5%), insect parts and mud (25%) and fish (12.5%). In the species *C. latia* was found the high value for plant materials and mud (80%). Moreover, the highest value of Fp index of *B. barna* showed 75% for mud and followed 62.5% for insect parts and (25%) for earthworm and (12.5%) for plant materials. In the previous study, stomach of *Epinephelus coioides* contained fish (73%), crab (11%), shrimp (8.8%), squid (3.9%), gastropod (1.7%) and bivalves (0.4%) were analyzed (Thidar Aung *et al.*, 2012). These may be due to the different species and study sites.

Mohammadi *et al.* (2007) stated that the CV index gives an estimate of the voracity of the predator fish; the more voracious fish species, the lower percentage of empty stomachs. This previous statement is similar to the present result of vacuity index, *C. striata* and *B. barna* showed 20% in each and 0% in *C. latia*. The fluctuations of vacuity index probably due to the occurrence or abundance of predation in the habitats where they lived during the study months. The finding in the present study and previous workers might be different.

## Conclusion

The study area is considered as an important resource of fish community. The result may also important to evaluate the ecological role and the food web of the ecosystems. Therefore, the study area is need to study more fish species for stomach contents analyze seasonally different of feeding habits in various species and to investigate the histology of the digestive tracts from the Ayeyawady River Segment in Myitkyina Environs.

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