STOMACH CONTENTS OF THE SPADENOSE SHARK *SCOLIODON LATICAUDUS* MULLER & HENLE 1838 IN MON COASTAL WATER

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Abstract

Stomach contents of the spadenose shark in Mon coastal water were studied by using the samples collected from the fish landing sites during October 2017 to September 2018. The present study revealed that the stomach contents of *Scoliodon laticaudus* were categorized by cephalopods (26.4%), fish (26.3%), shrimps (25.7%) and other crustaceans (21.6%) in the study period. According to the number and frequency occurrence, *S. laticaudus* is a cephalopods feeder and their feeding rate is not different in stations of the present study. The least food composition is other crustaceans for *S. laticaudus.* Seven species of fishes such as *Rastrelliger brachysoma*, *Nemipterus japonicus*, *Harpodon nehereus*, *Johnius coitor*, *Polynemus paradiseus*, *Coilia dussumieri* and *Trichiurus lepturus*, two species of cephalopods namely *Sepia* sp. and *Loligo* sp., three species of shrimps including *Penaeus indicus*, *Acetes indicus* and *Metapenaeus brevicornsis* in the stomach of this species were examined. In the stomach of *S. laticaudus*, 14 phytoplankton species and 16 zooplankton species were examined.

Keywords: food, feeding, *Scoliodon laticaudus*, shark, stomach contents, Mon coastal water

Introduction

Food and feeding habit studies of fish based upon analysis of stomach contents can provide the information in the fishery biology. Feeding is the dominant activity during the entire life cycle of fish. Food is the basic requirements for growth, development, reproduction, survival and existence of all organisms. The distribution and fluctuation of the food may affect the migration, shoaling and spawning behavior of fish stock and even the fishery. The knowledge on the relationship between the fishes and food organisms, feeding habits in relation to sexual cycle, condition of food and selectivity in feeding is an important aspect of fisheries managements (Osuna-Peralta *et al.* 2014). The spadenose shark *Scoliodon laticaudus* is an active carnivore with a mixed diet composing of small sized prawns, squilla and molluscs.

In the study area, the fish is an essential part of the diet and the main role of the fishery sector. The aim of the present study is to investigate the food items consumed by the studied fish species and to know the feeding of shark in different seasons along the Mon coastal areas including Ahlayt, Sebalar, Kyaikkhami, Setse and Zeephyuthaung.

Materials and Methods

The spadenose shark was collected from five fish landing sites of Mon coastal water during October 2017 to September 2018 (Fig. 2). Samples of *Scoliodon laticaudus* were taken from Mon coastal water to understand the food and stomach content. In the laboratory, total length and the body weight for each specimen was measured in fresh condition. The belly of fish was cut open. The methods of stomach content analysis are examined by Devadoss (1989), Atkinson and Percy (1991), Joyce *et al*. (2002) and Lopez *et al.* (2010). The stomach of each individual was removed and preserved in 5% formaldehyde-seawater solution. Then all of the contents were carefully taken out and identified under the microscope. The identification of food items were based on the

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classification system used by Allen and Cupp (1930), Aung Kyi (1976), Fischer and Whitehead (1981), Carpenter (1988), Davis (1955), Han Shein (1975), Motomura (2004), Htay Htay Mon (2009), Su Su Hlaing (2010), and Thida Nyunt (2013). After that, food items were categorized and then identified to the genus or species level. Residual liquids of stomach contents were identified for phytoplankton and zooplankton.

Figure 1 Selected species the spadenose shark *Scoliodon laticaudus*

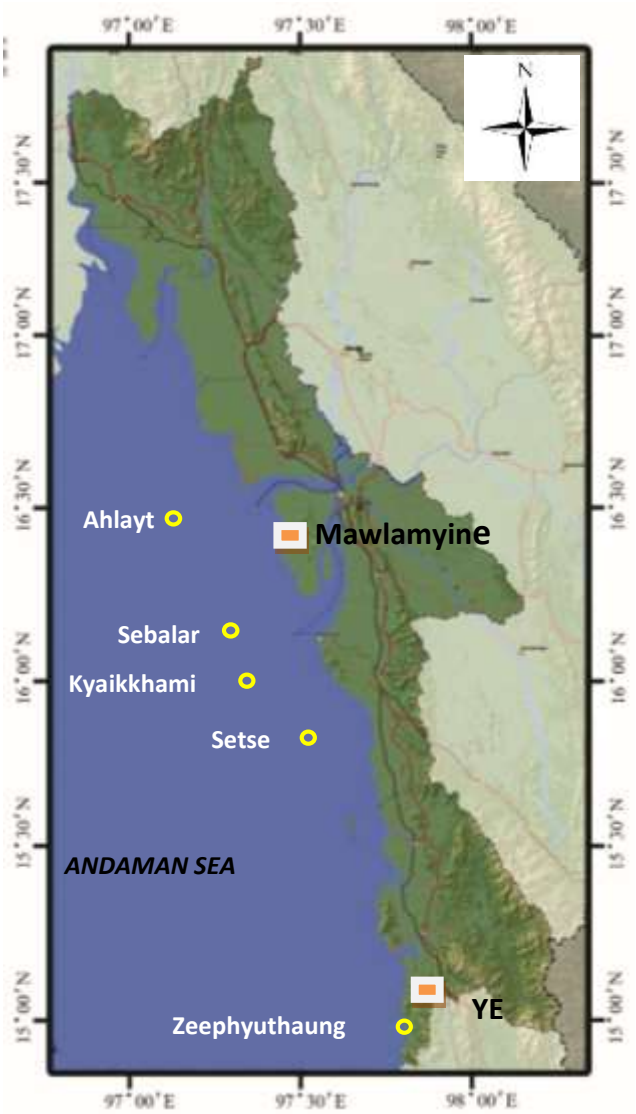

Figure 2 Map showing the sample collection sites of the study areas.

Results and Discussion

Food and stomach contents of the spadenose shark *Scoliodon laticaudus* in Mon coastal water

The composition of the foods of *S. laticaudus* was shown in Figure 3. Fish, shrimp, cephalopods and other crustaceans formed major part of the diet. Fish belonging to seven species could be identified such as *Rastrelliger brachysoma*, *Nemipterus japonicus*, *Harpodon nehereus*, *Johnius coitor*, *Polynemus paradiseus*, *Coilia dussumieri* and *Trichiurus lepturus*. Among crustaceans, prawns belonging to three species could be identified such as *Penaeus indicus*, *Acetes indicus* and *Metapenaeus brevicornsis*. Squilla and crabs formed a good portion of the diet. The molluscs were represented by species of *Sepia* and *Loligo* in good numbers and occasionally by a few molluscan shells.

Crustaceans were dominant in the diet of this shark throughout the year. Prawn, *Penaeus indicus* was found dominant. In addition to prawns, other crustaceans such as small crabs and *Squilla* spp. were represented in the diet in all months. The young sharks preferred prawn diet rather than fish and mollusks as they grow up, the feeding preference is gradually shifted to fishes and fast moving mollusks like the squids and cuttle fishes (Cordova- Zavaleta *et al.* 2018).

A total of 30 species of plankton were identified from the stomach contents of the spadenose shark *S. laticaudus* as shown in Figure 4 and 5. There are thirteen species of diatoms including *Bacteriastrum hyalina*, *Biddulphia mobilliensis*, *Chaetoceros diversus*, *Coscinodiscus lineatus*, *Ditylum sol*, *Hemidiscus cuneformic*, *Lauderia borealis*, *Nitzchia lanceolate*, *Odontella sp.*, *Pleurosigma angulatum*, *Rhizosolenia stol*, *Thalassionema nitzchoid* and *Triceratium favus*; one species of dinoflagellates such as *Ceratium furca*; one species of protozoa namely *Calcarina* sp.; five species of copepods including *Eucalanus subcrassus*, *Paracalanus purvus*, *Acartia erythrae*, *Oithona nana* and *Oithona similis*; three species of ctenophores including *Beroe cucunus*,*Sagitella sp* and *Spionoid* larva; one species of Chaetognatha namely *Sagitta crassa*; one species of Annelida; one species of amphipods namely *Elasmopus* sp; four species of other zooplankton larvae including *Mesopodopsis orientalis*, *Acetes* sp, *Lucifer penicillifer* and *Squilla alima* larva. *Acetes* sp., larvae of bivalve and gastropods were encountered in small quantities. Fish pieces, molluscan shell pieces, scale and eggs contributed in the diet of this shark.

The stomach contents of *S. laticaudus* consist of different food items and were grouped into main four categories: shrimps, fishes, cephalopods and other crustaceans. Cephalopods including octopus, *Sepia* and *Loligo* were the most dominant food items, comprising of 26.4 % of total food items, followed by fish (26.3%), shrimps (25.7%) and other crustaceans (21.6%). Table 1 showed that the variation in monthly percentage in number of main different food groups of *S. laticaudus*. The percentage in number of shrimps ranged from the minimum of 20.5% (March) to the maximum of 29.5% (August) of total items. The range of the composition of fish was lowest in July with 21.1% of total food items and highest in November with 30% of total food items. The cephalopods were found to be minimum 15.9% in August and maximum 31.7% in March. Other crustaceans constituted the lowest composition in 18.4% with July and highest in 25.1% in August.

The spadenose shark, *S. laticaudus* locally called Nga-man-tha-leik is one of the smallest carcharhinids inhabiting the shallow waters of the continental shelf of the Indo-Pacific region (Horn *et al.* 2013). The spadenose shark, *S. laticaudus* is found abundantly in the coastal waters of Mon State throughout the year. It was observed that in the juveniles (7 to 20 cm) and adolescent sharks (21 to 30 cm) and adult sharks (greater than 30 cm) were well fed.

Table 1 Monthly diet composition (%) of *Scoliodon laticaudus* in the study area

Months	Food composition (%)			
	Shrimps	**Fish**	**Cephalopods**	**Other crustaceans**
October (2017)	28.2	28.2	20.5	23.1
November	25	30	25	20
December	27.5	27.5	25	20
January (2018)	27	27	27	19
February	27.1	24.3	24.3	24.3
March	20.5	27.3	31.7	20.5
April	27.7	23.4	25.5	23.4
May	21.4	23.8	31	23.8
June	20.5	25.6	30.8	23.1
July	28.9	21.1	31.6	18.4
August	29.5	29.5	15.9	25.1
September	25.6	27.9	27.9	18.6
Average	25.7	26.3	26.4	21.6

The type of food eaten indicates normally the place where the sharks forage and the nature of its habitat. It is popularly believed that sharks swallow all that come their way. In the present study, it is seen that *S. laticaudus* exhibits a preference for a particular diet during different facets of its life history. Incidental fishing for sharks coincides with the appearance of pelagic fishes on the Mon coastal water. Driggers III *et al.* (2012) described that they found the presence of sardines in the stomach of *S. laticaudus* in the western North Atlantic Ocean during September- March period proved that they prefer to feed on these fast moving pelagic fishes but in the present study, the sardine fishes are not found in the stomach of this species.Preti, Smith and Ramon (2001) studied the feeding habits of the common thresher shark (*Alopias vulpinus*) sampled from California-based drift gill net. Their report mentioned the foods in the diet of thresher shark (big shark) but not the same of the foods of the spadenose shark in the present study.

Likewise during their early growing period after parturition when they could not move fast, they seek to bottom living fishes like small soles, silverbellies and crustaceans like shrimps and small crabs. When they grow up and have gained enough strength, they migrate to the pelagic zone and start actively preying on the pelagic fishes like *Coilia*, Bombayduck and fast moving molluscs like squid and cuttlefish (Veras *et al*. 2009). *S. laticaudus* is an active carnivore with a mixed diet composing of small sized fish, shrimps, other crustaceans and molluscs (Plumlee and Wells, 2016). Cephalopods were frequently found on all species.

In the present study, there were seven species of fishes, two species of cephalopods, threee species of shrimps in stomachs of *S. laticaudus* were examined. The small proportions of two groups: phytoplankton and zooplankton were identified. In *S. laticaudus*, 14 phytoplankton species and 16 zooplankton species were examined. Among phytoplankton observed in the diet of *Coscinodiscus* spp. and *Pleurosigma* sp. were the most dominant species in almost all months. In addition, other phytoplankton species were found occasionally in small portions of the diets. The groups of zooplankton larvae, gastropod larvae, bivalve larvae, fish larvae, Juvenile shrimp and *Acetes* sp. were also recorded in the diet. All planktons formed the minor portion of the diet of *S. laticaudus*. The small molluscan shell pieces and fish remains occurred in the diet for all months.

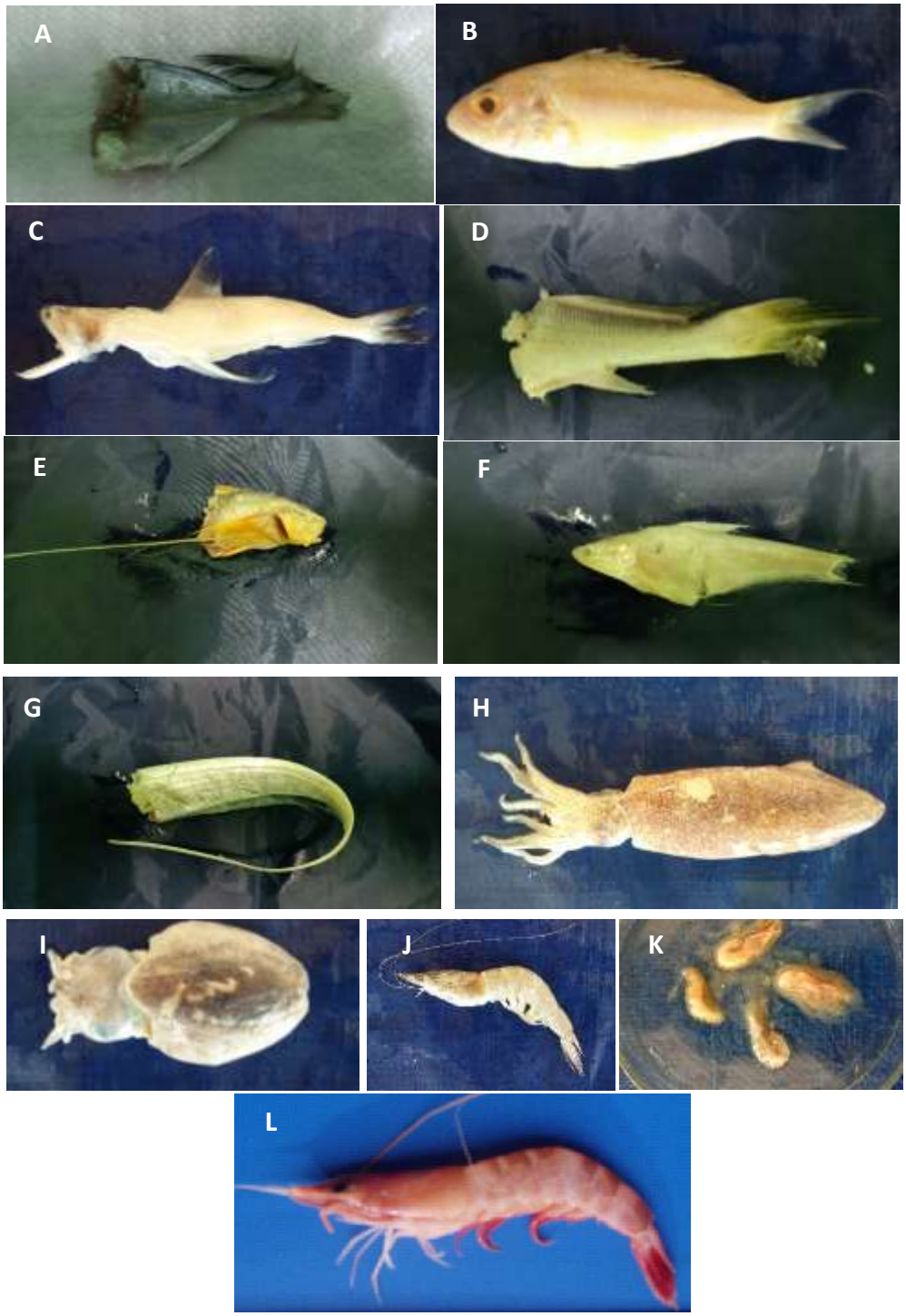

Figure 3 A-L. Food species of the spadenose shark *Scoliodon laticaudus* in study period. A) *Rastrelliger brachysoma*; B) *Nemipterus japonicus*; C) *Harpodon nehereus*; D) *Johnius coitor*; E) *Polynemus paradiseus*; F) *Coilia dussumieri*; G) *Trichiurus lepturus*; H) *Loligo* sp.; I) *Sepia* sp.; J) *Penaeus indicus*; K) *Acetes indicus* and L) *Metapenaeus brevicornsis*.

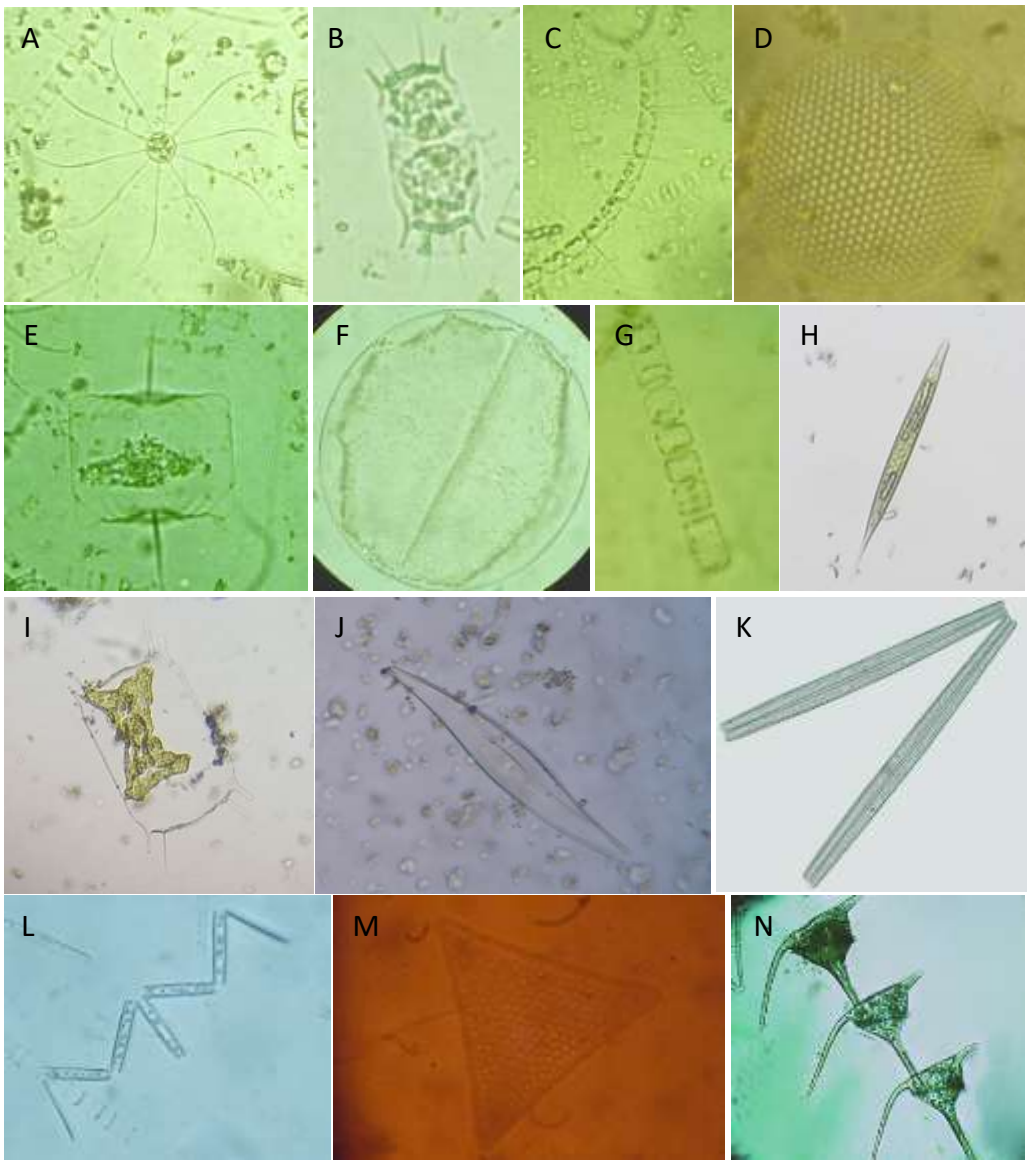

Figure 4 A-N. Some food items of phytoplankton species in the stomach of the spadenose shark *Scoliodon laticaudus*: A) *Bacteriastrum hyalina*, B) *Biddulphia mobilliensis*, C) *Chaetoceros diversus*, D) *Coscinodiscus lineatus*, E) *Ditylum sol*, F) *Hemidiscus cuneformic*, G) *Lauderia borealis*, H) *Nitzchia lanceolate*, I) *Odontella sp.*, J) *Pleurosigma angulatum*, K) *Rhizosolenia stol*, L) *Thalassionema nitzchoid*, M) *Triceratium favus* and N) *Ceratium furca.*

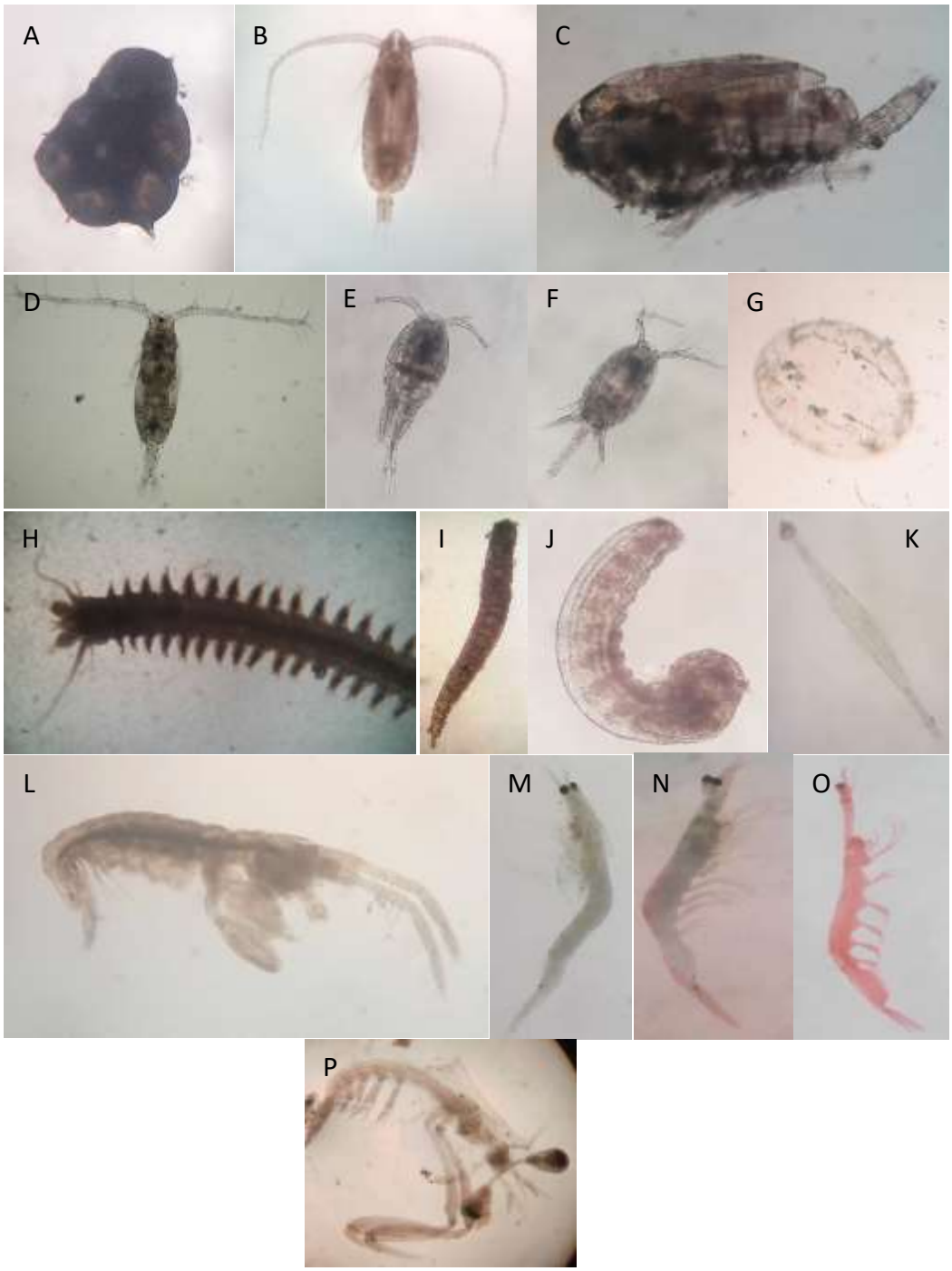

Figure 5 a-p. some food items of zooplankton species in the stomach of the spadenose shark *scoliodon laticaudus*: a) *calcarina* sp., b) *eucalanus subcrassus*, c) *paracalanus purvus*, d) *acartia erythrae*, e) *oithona nana*, f) *oithona similis*, g) *beroe cucunus*, h) annelida sp., i) *sagitella sp.*, j) *spionoid* larva, k) *sagitta enflata*, l) *elasmopus* sp., m) *mesopodopsis orientalis*, n) *acetes* sp, o) *lucifer penicillifer* and p) *squilla alima* larva.

Conclusion

Study on the feeding biology of the spadenose shark *Scoliodon laticaudus* showed that the species was the pelagic feeder. The analyses of *Scoliodon laticaudus* indicated that the feeding intensity varied with seasonality and fish size. The investigation on the diet of species showed that

most frequent food items were *Rastrelliger brachysoma*, *Nemipterus japonicus*, *Harpodon nehereus*, *Coilia dussumieri*, *Sepia* and *Loligo* in the stomachs, it may be said that this species *Trichiurus lepturus*, *Penaeus indicus*, *Acetes indicus*, *Metapenaeus brevicornsis* was pelagic and benthic carnivores. This report is the first reference of stomach contents study of sharks in Myanmar.

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