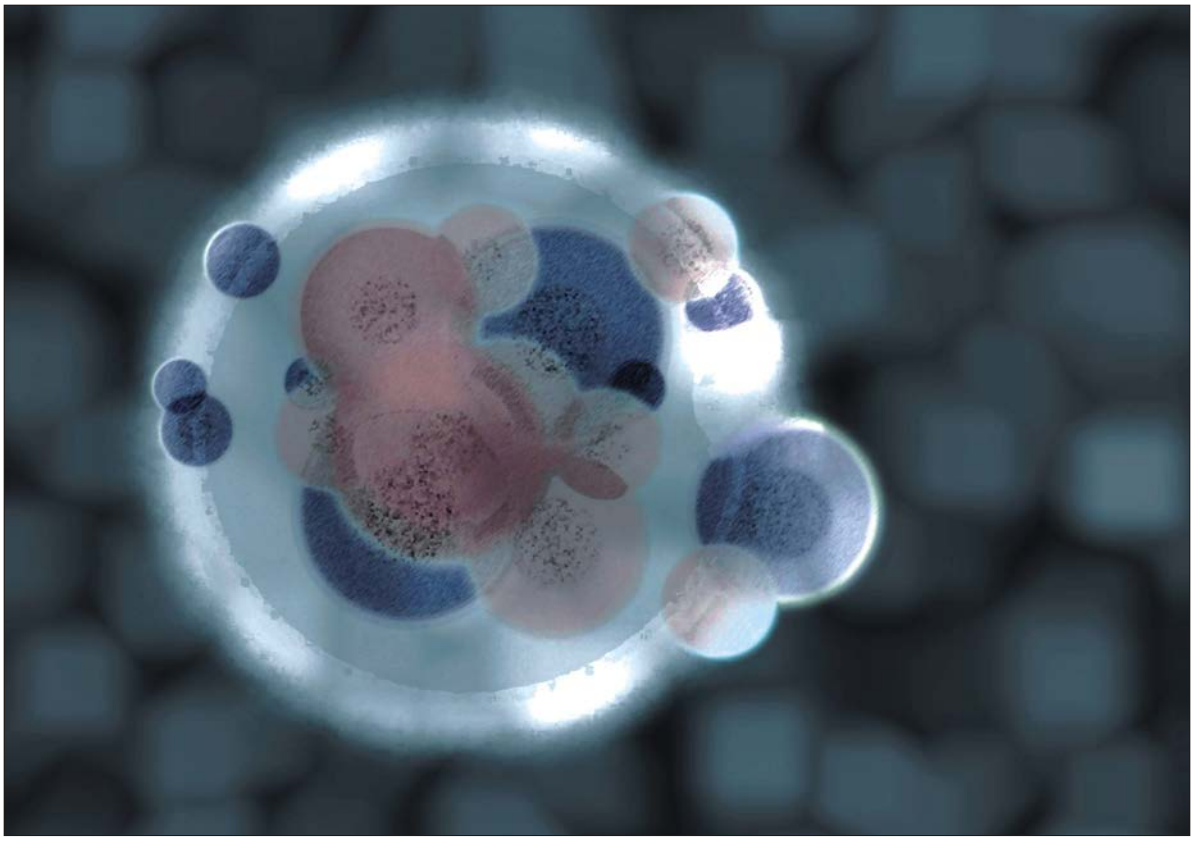

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Feeding Guild of the Dominant Trawl Species in the Southeastern Waters of Peninsular Malaysia

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Abstract: In this study, stomach content analyses were used to determine the feeding guild of dominant trawl species comprising leiognathids and priacanthids. Specimens were collected from the southeastern coastal waters of Peninsular Malaysia using commercial trawler. Five species of leiognathids and two species of priacanthids were caught throughout the study. The results showed that the mean value of trophic level for leiognathid species, *Photopectoralis bindus* was 3.22±0.49, *Gazza minuta* was 2.75±0.29, *Secutor indicius* was 2.87±0.30, *Eubleekeria jonesi* was 2.49±0.27, *Equulites stercorarius* was 2.63±0.30 and for priacanthid species, *Priacanthus macracanthus* was 3.51±0.47 and *Priacanthus tayenus* was 3.61±0.45. The results indicated that the feeding regime of *P. bindus*, *G. minuta* and *S. indicius* can be categorized as bentho-pelagic feeders that have forwardly or upwardly protractible mouth types and feed mainly on zooplankton and zoobenthos. *E. stercorarius* and *E. jonesi* with a downwardly protractible mouth type feed mainly on zoobenthos and can be classified as benthivorous. The results suggested that the forwardly or upwardly protractible mouth types leiognathids occupy a higher trophic level compared to the downwardly protractible mouth type leiognathids. Both priacanthids with upturned mouth type have similar diet composition consisting of crustaceans, polychaetes, ostracods, fish and cephalopods. They are thus mid-level carnivores since the species are able to consume organisms at trophic level 3.5. The results revealed that the value of trophic level for priacanthid species were higher than leiognathid species.

Key words: Trophic level, trophodynamic analyses, demersal fishes, leiognathidae, priacanthidae, diet composition

INTRODUCTION

Trawling is probably one of the most important marine fishing techniques and it dominates the Malaysian fishery industries economically. It has a major impact on society and the country's economic development (Musa and Nuruddin, 2005). However, it has always been the most controversial fishing method throughout the world since it involves dragging huge and heavy nets along the sea floor (Gillett, 2008). Trawling has contributed a significant portion to the catch of untargeted fish, known as by catch which is considered as low value fishes (Davies *et al*., 2009). However, the development of the surimi industry in Malaysia has increased the value of the by catch and provided market profitability. Thus the by catch now could be an important income for trawlers (Pangsorn *et al*., 2007) and help reduce wastage from trawling. Threadfin bream, lizard fish, bigeye fish, croaker and goatfish are economically important by catch species as surimi raw materials (Pangsorn *et al*., 2009).

Priacanthids and leiognathids were the dominant by catch fishes in this current study. Priacanthids (family Priacanthidae) commonly known as bigeyes, are widely distributed in the coastal water of tropical and subtropical Atlantic, Indian and Pacific oceans. This fish species is generally recognized by its extremely large eyes and upturned mouth. They are a kind of epibenthic fishes usually available in coral reefs and rock formations, although they occasionally venture in more open areas at depths of 5 to 400 m. They occur solitarily or in small aggregations but some species may form large mixed feeding schools of a few to several species. Eggs, larvae and early juvenile stage are pelagic. Most members of priacanthids are nonguarders (Starnes, 1984, 1988). Priacanthids are commercially important 'by-catch' fishes in Malaysian fisheries used as common commercial food fish. Several analyses of these fishes have been carried out focusing on taxonomy and distribution (Starnes, 1988), age and growth (Liu *et al*., 1999), food chemistry and hydrocolloids on Priacanthids skin (Jongjareonrak *et al*., 2006).

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Leiognathids (family Leiognathidae) commonly known as ponyfishes, are widely distributed in the coastal waters of sub-tropical and tropical regions (Woodland *et al*., 2001). In Malaysia, it is known as kekek, a moniker based on the chirping sound the fish makes. These fishes commonly inhabit turbid coastal waters of poor visibility such as shallow coastal waters, mangrove areas and estuaries (Sparks *et al*., 2005), although they occasionally venture into freshwater reaches of rivers. They are demersal fishes that usually form large mixed feeding schools of a few to several species on the shallow water sea floor. In some parts of Malaysia, leiognathids are sold freshly or processed into popular fish crackers and salty dried fish showed this fish have commercially important (Mazlan and Seah, 2006).

Generally by catch species has received less attention in icthyological research. Detailed accounts on the feeding regime and trophodynamic analyses of by catch species are still lacking. Feeding guild information is used to assess the trophodynamic levels of fishes in their natural environment and revealed the existing organisms at the area. Preliminary study of both fishes is in need to investigate the existing species in Malaysian waters and it will enhance the further study for these particular families. The present study is an was aimed to examine the diet composition and trophic levels of dominant trawl species present in the southeastern waters of Peninsular Malaysia.

MATERIALS AND METHODS

A series of trawl surveys were conducted in southeastern Peninsular Malaysia coastal waters. A total of 12 hauls were made throughout the study during August 2008 which covered trawled areas off Tioman Islands within N02° 54.799: E104° 06.163'-N02° 54.310': E104° 08.130', N02° 50.263': E104° 09.024'-N02° 48.334': E104° 08.041' and Sibu-Tinggi Islands N02° 15.679: E104° 00.290'-N02° 17.454': E103° 54.471', N02° 13.725': E104° 01.253'-N02° 13.105': E104° 00.508'. An otter trawl net was deployed throughout the study to catch fishes at depths ranging from 15 to 25 m. The trawl was equipped with a 1 ¼ inches mesh size cod end. Each trawl lasted about 3 h at a towing speed of 2.0-3.0 knots. The dominant trawl species caught were leiognathids and priacanthids. All catches were sorted in accordance to the standard protocol listed by Sparre and Venema (1998). Fresh sub-samples were kept on ice prior to further biological investigation at the field-laboratory station. Voucher specimens of fishes were photographed for their whole body and some detailed morphological characters such as extension of mouth and fins. All sub-samples collected were then fixed in 10% formalin during the field study and later transferred into 70% alcohol prior to the further study.

Species identification was made in accordance to the standard studies (James, 1984; Masuda *et al*., 1984; Starnes, 1984; Mohsin and Ambak, 1996; Mansor *et al*., 1998; Woodland *et al*., 2001; Nakabo, 2002; Kimura and Matsuura, 2003). In order to minimize the rigor mortis process of the gut content, gut sacs (stomach and intestine) were extracted from each species soon after identification. The guts were pre-fix in 10% formalin and later, the contents were completely emptied into labeled Petri dishes containing 70% alcohol. The labeled dishes were sealed using high-density cellophane tape and packed into a box. In the laboratory, the gut contents were sorted and observed under a dissecting microscope to record the types of food materials present (Jimmy *et al*., 2003). The stomach content was classified and the trophic level was calculated using TrophLab® software (Pauly *et al*., 2002).

RESULTS

Leiognathids and priacanthids were the dominant trawl species in this study. Five species of leiognathids namely *Photopectoralis bindus*, *Gazza minuta*, *Secutor indicius*, *Eubleekeria jonesi* and *Equulites stercorarius* and two species of priacanthids, *Priacanthus macracanthus* and *Priacanthus tayenus* were identified. The results showed that the mean value of trophic level for *P. bindus* was 3.22±0.49, *G. minuta* was 2.75±0.29, *S. indicius* was 2.87±0.30, *E. jonesi* was 2.49±0.27 and *E. stercorarius* was 2.63±0.30 (Fig. 1). Priacanthids have almost similar mean value of trophic level, *P. macracanthus* was 3.51±0.47 and *P. tayenus* was 3.61±0.45 (Fig. 2). Each species has demonstrable differences in diet composition and food consumption

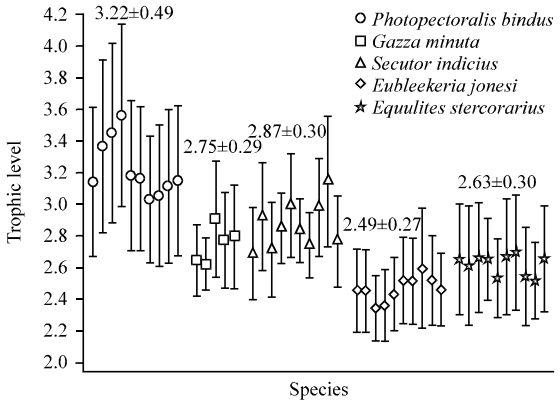

Fig. 1: Trophic level of leiognathid species

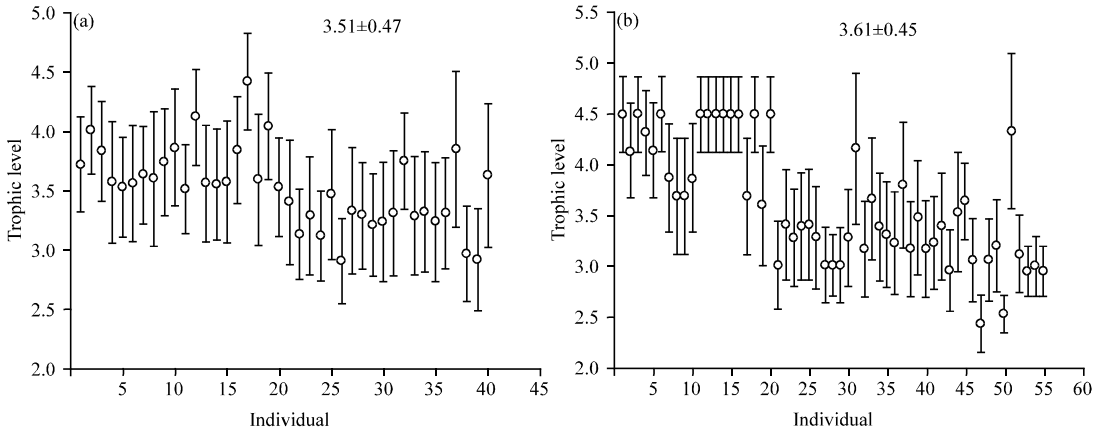

Fig. 2: Trophic level of (a) *Priacanthus macracanthus* and (b) *Priacanthus tayenus*

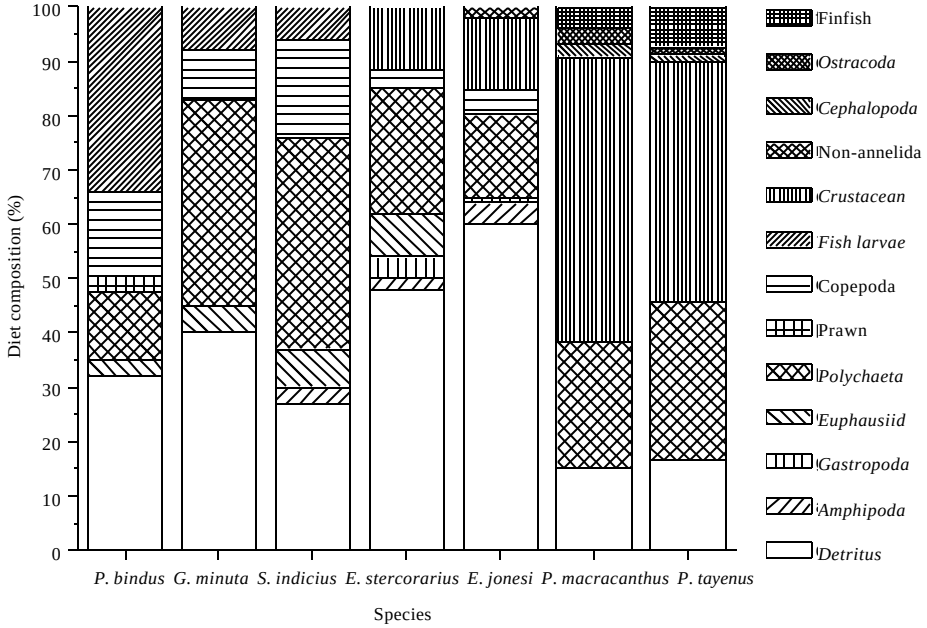

Fig. 3: The occurrence of food items in the diet of dominant trawl species

except for the priacanthid species which have similarity of food items (Fig. 3). The percentage of detritus found in leiognathids was greater than in priacanthids. Polychaeta was the only food item found in every fish species' stomach. Priacanthids consumed mainly crustaceans and polychaetes but also ate a small portion of finfish, ostracods and cephalopods. *P. bindus*, *G. minuta* and *S. indicius* have almost similar food items. They were fish larvae, copepods, polychaetes and euphausiids, whereas prawn was found in *P. bindus* and amphipods were found in *S. indicius*. *E. stercorarius* and *E. jonesi* have high amount of detritus in their diet compared to other leiognathid species. They have quite similar food items except for the occurrence of euphausiid in the diet of *E. stercorarius* and non-annelida in the stomach of *E. jonesi*.

DISCUSSION

The trophodynamic analysis values as indicated in the results showed that the leiognathid and priacanthid populations in the study areas consumed mostly benthic

organisms. The calculated trophic level values ranged between 2.4-3.5 for leiognathids and 3.0-4.5 for priacanthids, respectively. The trophic level values of leiognathids fell between omnivorous and mid-level carnivorous according to TrophLab scales, indicating different categories of feeding regimes in leiognathids in comparison to other groups of fish species. These were due to the nature and morphology of the feeding instrument (protractible mouth and teething system) in leiognathids that is particularly well-suited for picking benthic organisms such as polychaetes and copepods in the sediment (Mazlan and Seah, 2006). *P. bindus*, *G. minuta* and *S. indicius* have forwardly or upwardly protractible mouth types and feed on zooplankton and zoobenthos and thus can be categorized as bentho-pelagic feeders. *E. stercorarius* and *E. jonesi* with a downwardly protractible mouth type and villiform teeth feed mainly on zoobenthos and can be classified as benthivorous. The results suggested that the forwardly or upwardly protractible mouth types of leiognathids suit a higher trophic level compared to the downwardly protractible mouth type of leiognathids. This feeding regime defines the leiognathids' feeding habit as neither omnivorous nor mid-level carnivorous but instead can be categorized as benthivorous or bentho-pelagic feeder according to genus as they usually move around in large schools on the sea bottom while nibbling the sediments in search of benthic organisms. The trophic level values of priacanthids fell between mid-level carnivorous and high-level carnivorous. Priacanthids have an upturned mouth type and conical teeth, providing the ability to hunt nekton but consumed mainly zoobenthos. The feeding regime defines the priacanthids' feeding habit as mid-level carnivorous as they usually consumed mainly benthic organisms. The results showed that priacanthids occupy a higher trophic level compare to leiognathids.

The variations of food items of the leiognathid species found in this study are almost similar to the results reported by James (1984). However, the trophic level values reported by Froese and Pauly (2008) were different from the current study. The trophic level values for *Gazza* and *Secutor* was more than 3.4, *P. bindus* was 2.5 and other leiognathid species was 2.8 and above. The abundance of detritus in the stomach content of leiognathids at between 30-60% was the major factor affecting the trophic level values. If the field extracted stomach was not properly preserved, the food items would mix with denaturing enzymes and hydrochloric acid fluids in the stomach, fostering rigor-mortis decomposition processes that convert the solid food item into chyme. This will contribute to a common error in assessing food composition prior to trophodynamic analysis (Mazlan and Grove, 2004). However, a properly conducted study will provide promising results in estimating trophodynamics of organisms in their natural environment. Such analysis also provides clues on how the marine habitat can sustain biological functions of organisms living in it (Bray *et al*., 1981; Hobson, 1991). Crustacean was the primary food item consumed by both priacanthid species as reported by Mansor *et al.* (1998). Ibrahim *et al.* (2003) reported that 79% of the diet of *P. tayenus* comprised of crustaceans but it was only 44% in the present study. The trophic level values of *P. tayenus* was almost similar to Salini *et al.* (1994), 3.7 and Yamashita *et al.* (1987), 3.9.

CONCLUSION

The present study has revealed the feeding dynamics of the leiognathid and priacanthid fish species in the coastal waters of southeastern Peninsular Malaysia. The muddy seabed surrounding the study areas can apparently support several important genera of infauna invertebrate species such as polychaeta, crustacean and other co-existing invertebrate species found in the feeding guilds of leiognathid and priacanthid fish species.

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