Journal of Sustainability Science and Management 2009 Volume 4 (1): 85-92

NATURAL DIET OF BLUE SWIMMING CRABS FOUND IN SARAWAK COASTAL WATER

M. IKHWANUDDIN*[1], SHABDIN, M. L.[2] AND ABOL-MUNAFI A. B.[1]

[1]*Institute of Tropical Aquaculture, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu and* [2]*Faculty of Science and Resource Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak.*

* *Corresponding author : e-mail: ikhwanuddin@umt.edu.my*

Abstract: A study was carried out to determine the natural diet of blue swimming crab (*P. pelagicus*) found along the coastal waters of the Sematan Fishing District, Sarawak. Crab specimens were collected for foregut contents analysis. The study shows that the diet of *P. pelagicus* consists of sessile and slow-moving invertebrates, including bivalves, gastropods, decapods and polychaetes with bivalves as the most dominant.

KEYWORDS: Natural diet, Blue swimming crab, *Portunus pelagicus*

Introduction

Blue swimming crab (*Portunus pelagicus*) exhibits feeding biological characteristics of opportunistic, bottom-feeding carnivores and scavengers (Wassenberg & Hill, 1987). *P. pelagicus* are most active in foraging and feeding at sunset (Grove-Jones, 1987; Smith & Sumpton, 1987; Wassenberg & Hill, 1987) and they have also a wide-ranging foraging strategy (Edgar, 1990). Studies show that *P. pelagicus* diet chiefly consists of a variety of sessile and slow-moving invertebrates (Patel et al., 1979; William, 1982; Wassenberg & Hill, 1987; Edgar, 1990; Sukumaran & Neelakantan, 1997; Wu & Shin, 1998; de Lestang et al., 2000; Chande & Mgaya, 2004). *P. pelagicus* diet also largely depend upon availability of prey species (William, 1982) and cease feeding prior to and during moulting (Kangas, 2000).

Literature reviews indicate lack of studies on feeding ecology of *P. pelagicus* in Malaysian coastal waters. Thus, the main objective of this research was to determine the natural diet of *P. pelagicus* found within the near-shore marine embayment of Sarawak. The study on the natural diet focused on the crab foregut fullness and dietary compositions.

Materials and Methods

The study was carried out along the coastal waters of the Sematan Fishing District, Sarawak of the South China Sea. The Sematan Fishing District is located at the most western part of Sarawak, Malaysia stretching from Tanjung Dato to Sampadi (Figure 1).

The crab samples were collected from shallow water biotopes within Talang-talang Island, centring at 1º53'N, 109º48'E within 2.0 km radius of the coastal water of Sematan Fishing District. The sampling work stretched from 26 March till 30 August 2005, during the time when *P. pelagicus* was most abundant. Personal observation and communication with the Talang-talang Satang National Marine Park Officers indicated that the shallow water biotopes of this commercial fishing grounds for *P. pelagicus* of not more than 10 m water deep, with about 50% sea bed substrate comprising of sand and the sea grass. The study was not extended to a one year period because of the monsoon season.

Crabs were harvested by means of gill nets (Figure 3.1). The nets are of the type commonly used by the local crab fishermen in Sematan Fishing District. The gill nets specification used in this study and these commonly used by the local crab fishermen are shown in Figure 2. A total of 71 crabs were collected comprising of crabs in the intermoult stages. The criteria proposed by Warner (1977) and Williams (1982) were used to identify the following shell states: premoult (old shell splitting, brittle sutures), newly moulted (soft shell with minimal calcification), recently moulted (flexible shell with some calcification) and intermoult (hard shell with calcification essentially complete). Immediately after catching the specimens, crabs were placed in an ice-chest and transferred to a freezer for storage. All crabs were frozen for at least 48 hours before dissection.

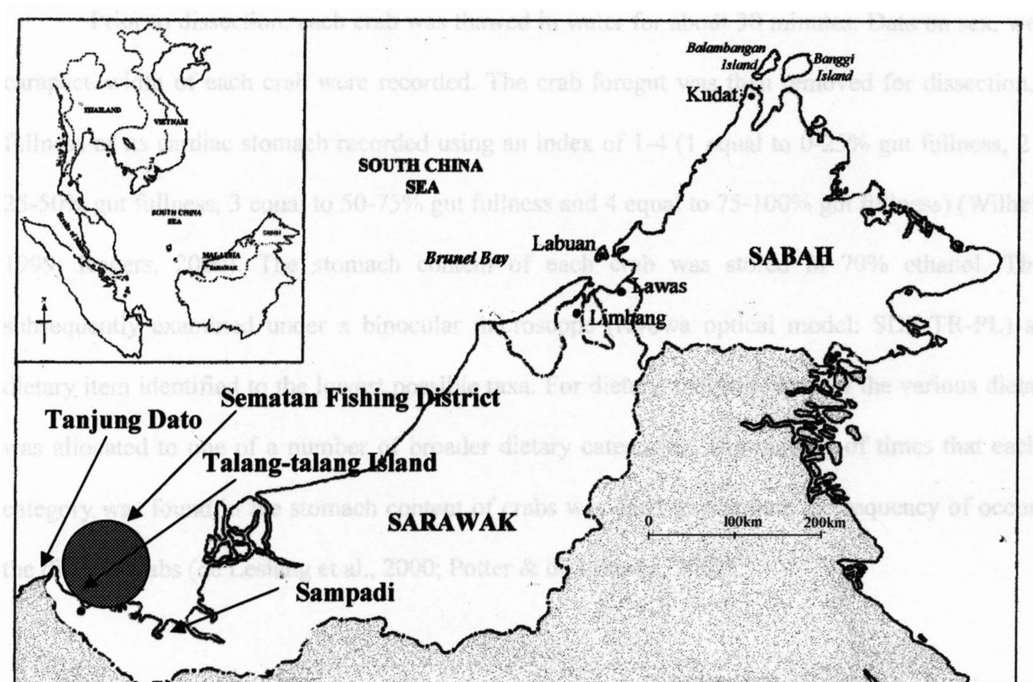

Figure 1. Location of the study site at Talang-talang Island, Sematan Fishing District, Sarawak coastal water of South China Sea.

Prior to dissection, each crab was thawed in water for about 30 minutes. Data on sex, weight and carapace width of each crab were recorded. The crab foregut was then removed for dissection, and the fullness of its cardiac stomach recorded using an index of 1-4 (1 equal to 0-25% gut fullness, 2 equal to 25-50% gut fullness, 3 equal to 50-75% gut fullness and 4 equal to 75-100% gut fullness) (Wilhelm et al., 1999; Rogers, 2000). The stomach content of each crab was stored in 70% ethanol. They were subsequently examined under a binocular microscope (Kyowa optical model: SDZ-TR-PL) and each dietary item identified to the lowest possible taxa. For dietary analyses, each of the various dietary items was allocated to one of a number of broader dietary categories. The number of times that each dietary category was found in the stomach content of crabs was used to calculate its frequency of occurrence in the diets of crabs (de Lestang et al., 2000; Potter & de Lestang, 2002).

Data are presented as mean ± standard deviation. Test for Independence in a Contingency Table of Chi-Square Test were used to test the frequencies of crab foregut fullness.

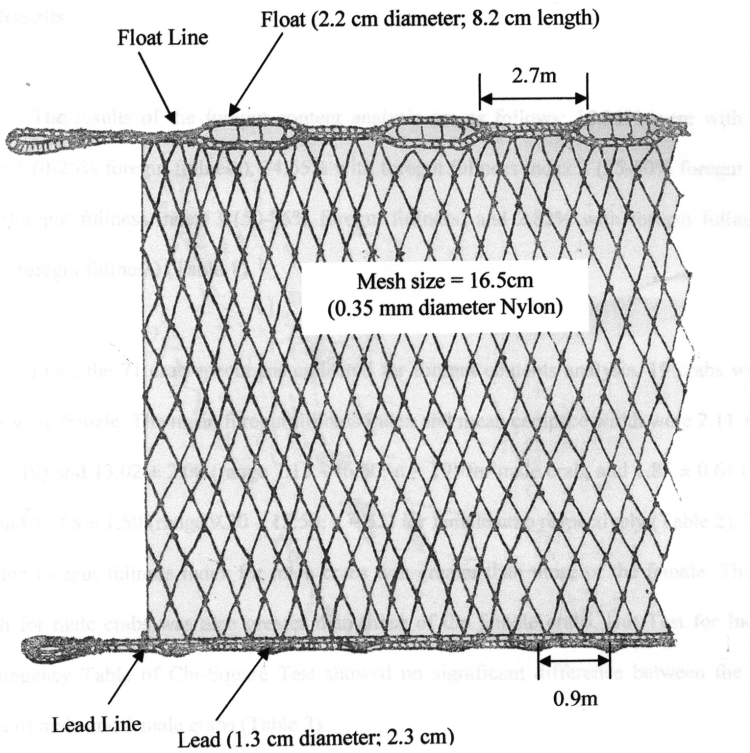

Figure 2. Gill nets specification used in the present study.

Results

The results of the foregut content analysis are as follows: 18.31% were with foregut fullness index 1 (0-25% foregut fullness), 74.65% with foregut fullness index 2 (25-50% foregut fullness), 4.23% with foregut fullness index 3 (50-75% foregut fullness) and 2.82% with foregut fullness index 4 (75-100% foregut fullness) (Table 1).

From the 71 crab specimens collected for foregut contents analysis, 19 crabs were male and 52 crabs were female. The mean foregut fullness index and mean carapace width were 2.11 ± 0.46 (range 2 – 4; n = 19) and 13.02 ± 2.00 (range 7.13 - 16.50; n = 19) for male crab, and 1.85 ± 0.61 (range 1 – 4; n = 52) and 12.68 ± 1.50 (range 9.30 – 15.50; n = 52) for female crab respectively (Table 2). The results show that the foregut fullness index for male crabs was greater than those of the female. The mean carapace width for male crabs was also greater than those of the female crabs. But Test for Independence in a Contingency Table of Chi-Square Test showed no significant difference between the foregut fullness index of male and female crabs (Table 3).

Out of 71 crab specimens collected for foregut content analysis only 58 crab specimens having the foregut fullness index of 2, 3 and 4 were used to examine the dietary composition. Crab specimens with foregut fullness index 1 (0 – 25% foregut fullness) were considered as the crab specimens with empty foregut and they were not examined for dietary composition.

The results show that there were 10 different dietary categories (Table 4). The number of time that each dietary category was found in the stomach content of crabs was used to calculate its frequency of occurrence in the diets of crabs.

The study shows that unidentified material and bivalves are two most dominant dietary categories found in the crab samples where 82.76% of the crab sampled content unidentified material and 75.86% of the crab sampled content bivalves shells (Table 4).

Overall, the foregut content analyses revealed that crabs consume mostly mollusks (bivalves and gastropod) with 14 mollusks genera recorded from the foregut content (Table 5).

Table 1 Foregut fullness index percentages from 71 crab specimens of *P. pelagicus* collected from coastal waters of the Sematan Fishing District, Sarawak.

Foregut fullness index	Number	Percentage (%)
1	13	18.31
2	53	74.65
3	3	4.23
4	2	2.82
Total	71	100.00

Table 2 Mean foregut fullness index and carapace width (CW) of male and female crabs from 71 crab specimens of *P. pelagicus* collected from coastal waters of the Sematan Fishing District, Sarawak.

	Male		Female	
	CW (cm)	Foregut fullness index	CW (cm)	Foregut fullness index
Mean	13.02	2.11	12.68	1.85
Max	16.50	4.00	15.50	4.00
Min	7.13	2.00	9.30	1.00
Sd	2.00	0.46	1.50	0.61
N	19.00	19.00	52.00	52.00

Table 3. Test for Independence in a Contingency Table of Chi-Square Test for the frequencies of crab foregut fullness classified according to two categories, crab foregut fullness index and crab sexes.

		Tabular X^2	
Degree of Freedom	Computed X^2	5%	1%
3	7.8[ns]	7.81	11.34

[ns] = not significant@hyphotheses of independence between crab sexes and crab foregut fullness index cannot be rejected.

Table 4. Frequency of occurrence of different dietary categories and percentage of crab sampled from 58 crabs' foregut content of *P. pelagicus*.

No.	Dietary categories	Frequency of occurrence (Number of crab)	Percentage of crab sampled (%)
1	Bivalves	44	75.86
2	Gastropod	11	18.97
3	Teleosts	15	25.86
4	Decapods	15	25.86
5	Plant material	16	27.59
6	Copepoda	8	13.79
7	Polychaeta	16	27.59
8	Echinoderms	1	1.72
9	Foraminifera	1	1.72
10	Unidentified material	48	82.76

Table 5. Molluscs recorded from the foregut content of *P. pelagicus* collected from the study site.

No.	Molluscs family	Molluscs species*
1	Arcidae	*Anadara* spp.
2	Articidae	*Artica* spp.
3	Potamididae	*Cerithidae* spp.
4	Cerithiidae	*Cerithium* spp.
5	Donaciade	*Donax* spp.
6	Ostreidae	*Lopha* spp.
7	Matricae	*Mactra* spp.
8	Veneridae	*Marcia* spp.
9	Neritidae	*Nerita* spp.
10	Pinnidae	*Pinna* spp.
11	Veneridae	*Pitar* spp.
12	Strombidae	*Strombus* spp.
13	Tellinidae	*Tellina* spp.
14	Mitridae	*Vexillum* spp.

*Note:*The small pieces of the molluscs shell in the foregut content were identified to the lowest possible taxa under a binocular microscope.*

Discussion

The present study shows that *P. pelagicus* diet consists of a variety of sessile and slow-moving invertebrates, including bivalves, gastropods, decapods and polychaetes and, to a lesser extent, teleosts, plant material and copepod. This dietary composition is almost similar to the dietary composition reported by Patel et al. (1979), William (1982), Wassenberg and Hill (1987), Edgar (1990), Sukumaran and Neelakantan (1997), Wu and Shin (1998), de Lestang et al. (2000) and Chande and Mgaya (2004). Recent study by Chande and Mgaya (2004) in Tanzania, pointed that *P. pelagicus* main food items included molluscs (51.3%), crustaceans (24.1%), fish bones (18%) and unidentified food items (6.6%). The present study also exhibits that molluscs are most dominant dietary categories found in the crab samples where the percentage of crab sampled are 75.86% for bivalves.

William (1982) found that diet composition changed little with the size of crab although within broad taxonomic groups, prey species change with crab size. But Edgar (1990) discovered an absence of size-related change in the diets of crabs. de Lestang et al. (2000) and

Potter and de Lestang (2002) also found that the diets of small and larger crabs differed. The contribution made to the diet by small benthic and epibenthic crustaceans, such as amphipods and tanaidacean, declined with increasing body size, while the reverse trend occurred with larger prey, such as nereid polychaetes, small decapods and teleosts (de Lestang et al., 2000; Potter & de Lestang, 2002). The increased in amount of polychaetes, decapods and teleosts with increasing crab body size, implies that larger crabs are more efficient in capturing larger and more mobile prey. This has also been reflected in the present study where all of the crab samples for the dietary composition analysis were larger crab with mean carapace width of 13.02 cm for male crab and 12.68 cm for female crab. They also consumed larger amount of polychaetes, decapods and teleosts with percentage of crab sampled are 27.59%, 25.86% and 25.86% respectively.

Wassenberg and Hill (1987, 1990) discovered that fish and squid discarded from prawn trawlers may be important sources of food for *P. pelagicus* at the trawling fishing ground. The sampling site of the present study is a commercial fishing area for *P. pelagicus* and gill nets are the major fishing gear used. From personal observations during the study period, the socking time for these commercial gill nets ranged from 24 to 48 hours. The nets also caught teleosts and crustaceans and, this teleosts and crustaceans died and started to rot after long socking time. This may be consumed by *P. pelagicus* as indicated by Wassenberg and Hill (1987) who found out that *P. pelagicus* are opportunistic, bottom-feeding carnivores and scavengers. The percentage of crab sampled of 25.86% for teleosts may have been contribute by this discarded fishery.

The study concluded that *P. pelagicus* diet consists mainly of a variety of sessile and slow-moving invertebrates with bivalves is most dominant dietary categories found in the crab samples. About 76% of crabs sampled content bivalves.

Acknowledgement

We would like to thank the Inland Fisheries, Agriculture Department, Sarawak for their financial support, the Faculty of Science and Resource Technology, Universiti Malaysia Sarawak for their technical support and, Mr. Mohd. Razali Kee, Mr. Aken Jetom and other staffs of Sematan Fisheries Centre, Agriculture Department, Sarawak for assisting in the laboratory and field works.

References

Chande, A.I., Y. D. Mgaya. (2004). Food habits of the blue swimming crab *Portunus pelagicus* along the coast of Dar es Salaam, Tanzaniajpeg. West. Indi. Ocea. J. Mar. Sc. 2:75-84.

de Lestang, S., M. E. Platell, I. C. Potter. (2000). Dietary composition of the blue swimmer crab *Portunus pelagicus* L., Does it vary with body size and shell state and between estuaries? J. Exp. Mar. Biol. Ecol. 246:241-257.

Edgar, G. J. (1990). Predatory-prey interactions in seagrass beds. II. Distribution in diet of the blue manna crab, *Portunus pelagicus* (L.) at Cliff Head, Western Australia. J. Exp. Mar. Biol. Ecol. 139:23-32.

Grove-Jones, R. (1987). Catch and effort in the South Australian blue crab (*Portunus pelagicus*) fishery. In Discussion paper, 45pp. South Australian Department of Fisheries.

Kangas, M. I. (2000). Synopsis of the biology and exploitation of the blue swimmer crab, *Portunus pelagicus* Linnaeus, in Western Australia. Fisheries Research Report No. 121. Fisheries Western Australia. 22pp.

Patel, N. M., N. D. Chhaya, M. Bhaskaran. (1979). Stomach contents of *Portunus pelagicus* (Linn.) from AD Net Catches. Indi. J. Mar. Sc. 8:48-49.

Potter, I. C., S. de Lestang. (2002). Blue swimming crab, *Portunus pelagicus* in Leschenault Estuary and Koombana Bay, south-western Australia. J. Roy. Soc. West. Aus. 83:221-236.

Rogers, L. (2000). The feeding ecology of the invasive Chinese Mitten Crab, Eriocheir sinensis: Implications for California's freshwater communities. http://socrates.berkeley.edu/~es196/projects/2000final/rogers.pdf. Accessed date: February 22, 2006.

Smith, G. S., W. D. Sumpton. (1987). Sand crabs a valuable fishery in southeast Queensland. Queensland Fisherman. 5:13-15.

Sukumaran, K. K., B. Neelakantan. (1997). Age and growth in two marine portunid crabs, *Portunus* (Portunus) *sanguinolentus* (Herbst) and *Portunus* (Portunus) *pelagicus* (Linnaeus) along the southwest coast of India. Indi. J. Fish Sc. 44:111-131.

Warner, G.F. (1977). The biology of crabs. Paul Elek (Scientific Books), London. 202pp.

Wassenberg, T. J., B. J. Hill. (1987). Feeding by the sand crab *P. pelagicus* on material discarded from prawn trawlers in Moreton Bay, Australia. Mar. Biol. 95:387-393.

Wassenberg, T. J., B. J. Hill. (1990). Partitioning of material discarded from prawn trawlers in Moreton Bay. Aus. J. Mar. Fresh. Res. 41:27-36.

Wilhelm, F. M., B. R. Parker, D. W. Schindler. (1999). The seasonal food habits of bull trout from a small alpine lake in the Canadian Rocky Mountains. Tran. Amer. Fish. Soc. 128:1,176-1,192.

Williams, M. J. (1982). Natural food and feeding in the commercial sand crab *P. pelagicus* Linnaeus, 1766 (Crustacea: Decapoda: Portunidae) in Moreton Bay, Queensland. J. Exp. Mar. Biol. Ecol. 59:165-176.

Wu, R. S. S., P. K. S. Shin. (1998). Food segregation in three species of portunid crabs. Hydro. 362:107-113.