World Applied Sciences Journal 20 (3): 416-422, 2012
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2012.20.03.1969

The Dietary Compositions of the Blue Swimming Crab, *Portunus segnis* (Forskal, 1775) from Persian Gulf, South Iran

[1]*Jamileh Pazooki,* [1]*Mehdi Hosseini and* [2]*Amir Vaziri Zadeh*

[1]Department of Marine Biology, Faculty of Biological Science,
Shahid Beheshti University, Tehran, Iran
[2]Department of Marine Ecology, Persian Gulf Research Center, Boushehr, Iran

Abstract: This investigation was carried out to determine the feeding habits of blue swimming crab, *Portunus segnis* from around waters Boushehr, Coast of Persian Gulf, South Iran. Sampling was performed trawl net during winter and spring seasons (January 2011 to June 2012) as processed 426 crabs was collection. After freezing, the samples were transferred to the laboratory in order for further analysis. The first, the biometry features (body weight (BW) and carapace width (CW) were measured then the stomach of each sample was surveyed. The results showed that 131 stomachs were filled, 209 of them were semi-filled and 86 of them were empty. During microscopy decomposition, the observed materials and food in the stomachs were classified into 7 groups including crustaceans (46.08 %), Molluscs (19.6%), fishes (23.4%), seaweeds (2.03%), benthos (1.7%), Mixed (4.7 %) and unidentified (2.49%). There was significant differences between the different food items ($P<0.05$), there was no significant difference between the contents of male and female stomachs ($P>0.05$). There were significant differences in the preference for food items in the different season ($P<0.05$). There were also significant differences in the preference for food items in the different size groups of the crab ($P<0.05$). The vacancy index of stomach (CV) during sampling was 20.02, this finding indicates that this species is an overeater. The result also showed that *P. segnis* is an omnivorous species and a clear preference for crustaceans.

Key words: Feeding habit · Carapace · *Portunus segnis* · Persian Gulf

INTRODUCTION

The Persian Gulf is a body of water in the Middle East between the Arabian Peninsula and Iran. This inland sea is connected to the Gulf of Oman by the Strait of Hormuz [1]. Crabs belong to a group of animals knows as decapods crustaceans. Most of the marine crabs occurring along the Persian Gulf coasts belong to the family Portunidae. The marine crabs belonging to the family Portunidae are bottom dwellers commonly found in tropical, subtropical estuarine and near shore habitats [2]. Blue swimming crab, *P. segnis*is distributed from the eastern Mediterranean to east Africa in the Indian Ocean and to Pakistan, Red Sea and Persian Gulf [3]. *P. segnis* live in a wide range of inshore and continental shelf areas, including, sandy, muddy or algal and sea grass habitats, from the intertidal zone to at least 50 m depth [4-5]. The species is often considered a benthic carnivore and eats mainly sessile mollusk and other invertebrates [6-7]. The natural diet of *P. segnis* has been widely studied by examining the food remains in gastric mills of this species [7-11]. The results indicate that *P. segnis*is primarily a carnivore feeding on a wide variety of benthic animals, although lesser quantities of marine plants and seagrass are also consumed. *P. segnis*is considered to be an opportunistic predator and the diet of which depends on local availability of food items [5]. Crabs occupy many different niches and inhabit many different habitats in a variety of geographical areas and this is reflected in the variety of food consumed by them [12, 13, 14]. *P. segnis,* feeds on macroscopic food and its mouthparts and gastric mill ossicles reduce the food to fragments, making the identification and estimation of its quantities difficult. Researchers therefore use the contents of the foregut to

Corresponding Author: Jamileh Pazooki, Department of Marine Biology, Faculty of Biological Science,
Shahid Beheshti University, Tehran, Iran.

identify the food consumed [9-15]. Potter and Lestang (2000) working in Australiareported pieces of crabs, gastropods and bivalveshells and sometimes fish to be its main food types, while Chande *et al*., (2003) in India, reported benthic invertebrates suchas bivalves, polychaetes and crustaceans as its diet. Hence, the present study has been undertaken to investigate the feeding habits of *P. segnis* along the coasts of Persian Gulf south Iran and probably the results of this study will be useful for developing successful farming techniques for this species in the future.

MATERIALS ANDMETHODS

The study was carried out in the Persian Gulf coasts (Boushehr province) in south Iran (Fig. 1). The Persian Gulf lies on the South Iran, (48°25' and 56°25"). It has an estimated area of 260 km^2 and extends 600 km offshore to a depth average of about 30-40 m (ROPME, 1999). Specifically, the Buoshehr coasts lies (50°6' and 52°58') and it is about 60 km long.

For food and feeding studies, specimens of *P. segnis* were collected from the commercial catches of shrimp trawlers in the Persian Gulf Coasts. Samples were collected during winter and spring seasons (January 2011 to June 2012) continuously. Studies on food and feeding were carried out following a method adapted from Sukumaran (1995): after recording the carapace width (CW) of the crab, the dorsal side of the body was cut open and the foregut was removed carefully. The fullness of the stomach was visually examined and assessed as 0, 25, 50, 75, or 100%. The foreguts were preserved in 70% formalin for a week, prior to being cut open and their contents transferred into Petri dishes with distilled water. The food components of the gut contents were separated and identified under a compound microscope.

The foregut contents were emptied into Petri dishes containing freshwater. The individual food organisms were sorted and identified to the lowest possible taxonomic level. As fish, molluscs and crustaceans were macerated, they could only be identified and grouped as fish, prawns, crabs and other crustaceans using bones for fish and appendages for the crustaceans. The frequency of occurrence method was used for the analysis of food items [9]. The method is widely used in dietary studies of fish and crabs and it gives a measure of the regularity with which food has been taken up in the sample or populationand "it is specifically recommended when differentfood items contribute to the diet" [14]. This method entailed recording the number of stomachs containing individuals of each food category, expressed as percentage of all the stomachs examined according to the formula:

$$\text{Percentage occurrence} = \frac{\text{No. of stomachs with particular food group}}{\text{Total no. of stomachs with food}} \times 100$$

The Vacuity Index examined according to the formula [16]:

$$Cv = \frac{Es}{Ts} \times 100$$

where Es is the number of crab stomachs that had a food item and Ts is the number of crab stomachs dissected, excluding those that were empty. The food item with the highest value was taken as the most important one.

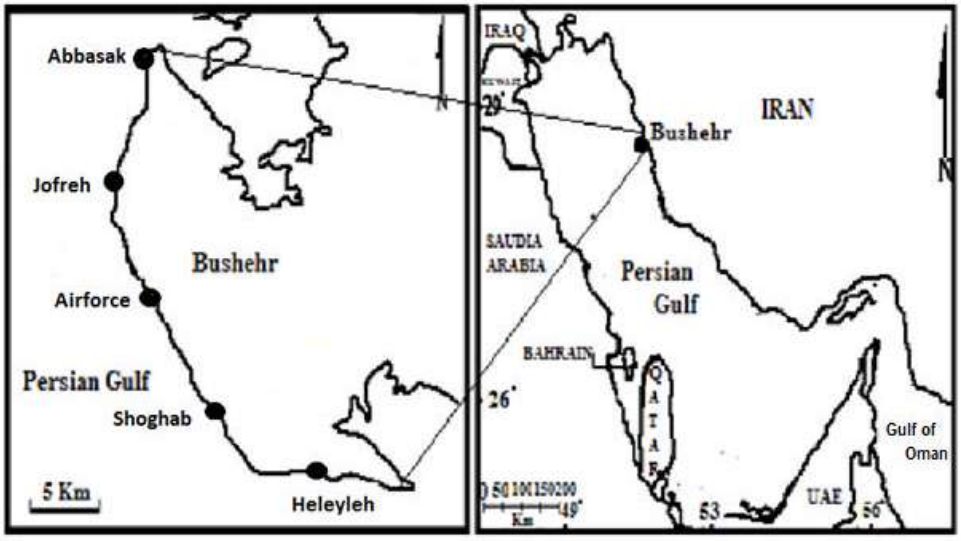

Fig. 1: Map of Persian Gulf coasts showing sampling stations and the study site.

To estimate the volume of the food by food-group, points were assigned to each group as suggested by Stehlik (1993): to quote one example, a food group that formed 50% of the total food content of a stomach that was 50% full, was assigned 25 points (50 points × 0.50). Percentage points were thus estimated as:

$$Fp = \frac{Nsj}{Ns} \times 100$$

Nsj = Number stomachs that had a food item J
Ns = Total stomachs of all food groups

RESULTS

A total of 426 crabs were examined out of which 77. 55% had stomachs with food items. Out of the 426 stomachs examined, 19.79% were 100% full; 15.27% were 75% full; 26.62% were 50% full; 15.85% were 25% full; and 22.45% were empty. The results showed that 131 stomachs were filled, 209 of them were semi-filled and 86 of them were empty. During microscopy decomposition, the observed materials and food in the stomachs were classified into 7 groups including crustaceans (46.08 %), Molluscs (19.6 %), fishes (23.4 %), seaweeds (2.03 %), benthos (1.7 %), Mixed (4.7 %) and unidentified (2.49 %).

The points of the major food groups (by size and by season) are given in Figs. 1 and 2. In percentage of points, Crustaceans was the most apparent food group and was found in 54.5% of the stomachs with food items. This fraction consisted primarily of decapods (parts of shrimps, parts of exoskeleton, appendages; and crab exoskeleton, appendages) and another contained the remains of copepods and barnacles, by followed Molluscs (bivalvia and gastropoda) and fishes (bone, scale, fin and eye lens).

The second dominant food item was molluscan, mainly comprising shell fragments of bivalves and gastropods. The minimum percentage was observed in the 70-90 mm group and the maximum percentage was observed in the 150-170 mm group.

Fish formed the third most important food item. These were present in 23% of the stomachs. Fish food dominated in the stomach contents of the larger size groups of the crab (130-150 and 150-170 mm). The minimum percentage was observed in the 70-90 mm group.

Seaweeds and sea grasses are one of the casual items. This group was present in the 4.92% of the stomachs. The maximum percentage was observed in the 130-150 mm group and the least percentage was observed in the 70-90 mm group.

Table 1: Percentage of points and frequency of occurrence of major food groups in *P. segnis*

Items	Points	% of points	% of frequency of occurrence
Crustacean	5443	55.5	73.7
Molluscan	5006	53	70.3
Fish	3221	31	61.3
Seaweed	756	9.92	15.5
Benthos	1452	12.8	31.7
Mixed	1913	12.5	42.6
Unidentified	1321	10.5	21.5

Table 2: Comparison Vacuity index between ovigerous and non-ovigerous females of *P. segnis*

Season	Number of Non–ovigerous	Number of Ovigerous	Vacuity index in Non–ovigerous	Vacuity index in Ovigerous
Spring	70	41	13	43.4
Winter	89	36	15.7	47.2
Total	179	77	14.35	45.3

Table 3: Comparison Prey occurrence index (Fp) between different sexes of *P. segnis* during different season

		Food items (%)				
Season	Sexes	Crustacean	Molluscan	Fish	Benthos	Seaweed
Spring	Male	82	78	76	3.5	11
	Female	91	88	64	9.6	4
Winter	Male	92.5	75	79	3.4	1.5
	Female	56	70	43	6.5	8.6
Total	Both sexes	75.5	71	63	6.8	4.9

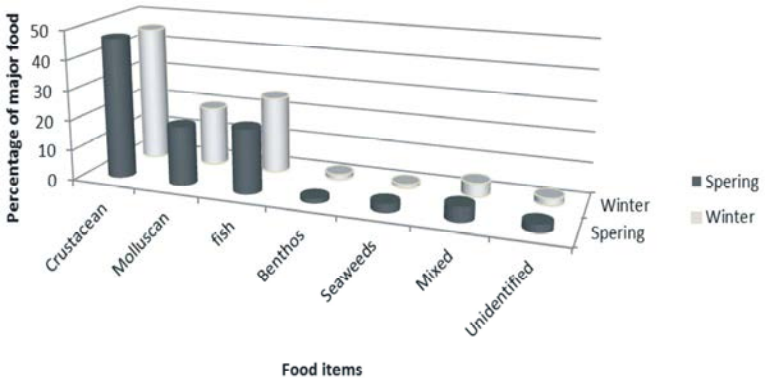

Fig. 2: Points of major food groups during various seasons in *P. segnis*

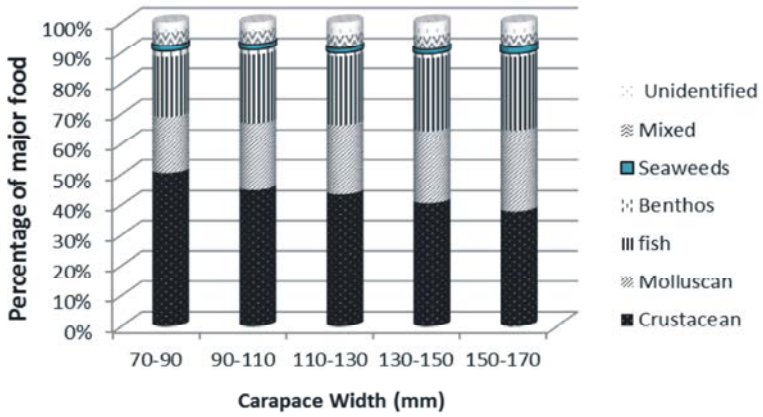

Fig. 3: Percentage of points of major food groups in various size groups of carapace width (CW) of *P. segnis*

Benthos is one of the casual items another that present in 6.8% of the stomachs. The maximum percentage was observed in the 70-90 mm group and the least percentage was observed in the 150-170 mm group.

Juvenile crabs (<90 mm CW) appeared to prefer crustaceans (47.5%) followed by molluscan (22.5%), Fish (16.5 %) and different items (13.5%). In the subadult group (91-110 mm CW), crustaceans (44.2%) were the major food item followed by molluscan (24.3%), Fish (21.6%) and different items (9.9%). In adults (111-150 mm), crustaceans were the principal food item (41.5%), followed by fish (27.7%) molluscan (23.3%) and different items (7.5%). In the larger size group of adults (151-170 mm) crustaceans (37.6%) followed by fish (28.3%), molluscan (22.6%) material constituted the main items of food and different items (11.5%). Figure 3 showed the Points of major food groups in various size groups of *P. segnis*.

A comparison of the food habits of ovigerous and non-ovigerous females is presented in Table 2. The results showed that both groups fed on the same food items, but the frequency of occurrence of the food items was lower for ovigerous females and many stomachs were empty. The vacancy index of stomach (CV) in ovigerousfemales was 45.3 and in non-ovigerous females 14.35. The result showed that percentage of empty stomachs in ovigerous females was higher than non-ovigerous females. There was significant difference in the food habits in the frequency of occurrence and the percentage of empty stomachs ($P<0.05$).

DISCUSSION

Changes in the food habits of *P. segnis* appear to be associated to the season and sexes. The highest stomachs with food itemswere in male crabs during winter season, the highest stomachs empty were in female crabsduring spring season. The reduction in stomachs contents was probably due to the decreasing availability of organic matter from winter through spring. This trend has at least three probable causes; one is the upwelling which seems to be stronger or have its maximum intensity during the winter and spring. However, Chelton (1981) suggested that the variability in food items biomass is

not the results upwelling only, but influenced mainly by the marine currents.In general, an increase in prey occurrenceis associated with a decrease in water temperature, the two potential source of cold water being from upwelling and advection [17].

The results showed that *P. segnis* is opportunistic omnivorous with a preference for animal prey, but within that framework only rarely feed on more mobile prey such as fish and prawns [9-10]. Warner (1977) was also of the opinion that crabs are opportunistic omnivores with a preference for animal food in conjunction with a definite predatory propensity [18]. In the present study, it is observed that crustaceans constitute the most favoured item in this species' diet, followed by molluscs and fish. This conforms with the findings of Patel *et al.*, (1979), while also Sukumaran and Neelakantan (1997) reported that *P. segnis*from the Mangalore coast preferred crustaceans, but in that location followed by fishes and molluscs, respectively [8-19]. Chande and Mgaya (2004) reported that molluscs, particularly the bivalve *Arcuatulaarcuatula* (Hanley 1843), were the most important food items in the stomachs of *P. segnis* along the coast of Dar es Salaam, Tanzania. Al-Behbehani (2007), also reported that molluscs and crustaceans were the dominant food items in the stomachs of *P. segnis* from Kuwait waters [13]. Tadi *et al*., (2012) also reported that *P. segnis*from the Persian Gulf coasts (Hormozgan coast) preferred crustaceans, followed by fish and molluscs, respectively [19]. This species consume mixed diets of crustaceans, molluscs and fishes [20, 21, 22, 23]. The presence of detritus (79.59%) in the stomachs examined suggests that these crabs are also detritivorous, consuming both fresh and decaying flesh of all kinds of animals, as observed in the present study. Menon (1952), Jose (2011) and Patel *et al*., (1979) have reported the presence of fair amounts of organic matter mixed with sand, mud, flue and other bottom particles, which indicates the species' bottom feeding habits in its bottom habitat [11, 25, 26]. The considerable amount of detritus in their guts has shown that *P. segnis*is also an opportunistic deposit feeder, just as reported by Prasad and Neelakantan (1988) for *Scylla serratae*. In the present study,the adults of *P. segnis* the stomach contents adult crabs contained semi-digested plant material, like remains of seaweeds and sea grasses. There was no difference observed in the quantity of the food consumed by males and females, as also reported earlier by Williams (1981), Jewett and Feder (1982), Sumpton and Smith (1990) and Wieczorek and Hooper (1995) [9, 24, 27, 28].

Comparison of ovigerous and non-ovigerous females revealed that both groups fed on the same food items, but the frequency of occurrence of the food items was lower for ovigerous females and many stomachs were empty. This is partly explained by the fact that ovigerous females spend more time grooming their eggs than feeding [27] with ovigerous *P. segnis* spent approximately 50% of their active time grooming their eggs. During this period they most likely utilise materials reserved in the hepatopancreas as a source of energy. The vacancy index of stomach (CV) during sampling was 19.28, this finding indicates that this species is an overeater. The result also showed that *P. segnis* is an omnivorous species and crustaceans made the main part of its food. The same research from Persian Gulf coasts (Hormozgan coast) showed that the vacancy index of stomach (CV) was 34, this finding indicates that this species is an overeater somedeal [20].

Analysis of seasonally variation in food habits of the crab showed that crustaceans, molluscs and fishes were the most commonly ingested items throughout the period one year sampling. Thus, the present study, as earlier related studies, suggests that, despite the diversity in crab diets and feeding habits, Portunid crabs are opportunistic omnivores with a preference for animal food, also along the coast of Persian Gulf, Iran. The result showed that *P. segnis* is an omnivorous species and crustaceans, molluscsand fish made the main part of its food. This study also shows, blue swimming crab *Portunus segnis* consume a variety of food items it is suggested that a major reduction inavailability of one prey group would not have a major effect on the crab population.

ACKNOWLEDGEMENTS

Special thanks are due to Prof. Bahram Hasanzadeh Kiabifor help with statistical analysis and Ali Mansoorifor field assistance. This work was funded by Shahid Beheshti University Tehran, of Iran.

REFRENCES

1. ROPME, 1999. Overview on Land-based Sources and Activities Affecting the Marine Environment in the ROPME Sea Area. UNEP/GPA Coordination Office and ROPME, pp: 127.

2. Carmona-Suarez, C. and F.E. Conde, 2002. Local distribution and abundance of swimming crabs (*Callinectes*spp. and *Arenaeuscribrarius*) on a tropical arid beach, Ensenada de la vela, Veezuela. Fisheries Bulletin, 100: 11-25
3. Joelle, C. and Y. Lai, 2010. A revision of the *Portunuspelagicus* (Linnaeus, 1758) species complex (Crustacea: Brachyura: Portunidae), with the recognition of four species, The Raffles Bulletin of Zoology, 58(2): 199-237.
4. Edgar, G.J., 1990. Predator-prey interactions in sea grass beds. II. Distribution and diet of the blue manna crab *Potunuspelagicus* Linnaeus at Cliff Head, Western Australia. Journal Experimental Marine Biology and Ecology, 139: 23-32.
5. Williams, M.J., 1982. Natural food and feeding in the commercial sand crab *Portunuspelagicus* Linnaeus, 1766 (Crustacea: Decapoda: Portunidae) in the Moreton Bay, Queensland. Journal of Experimental Marine Biology and Ecology, 59: 165-176.
6. Batoy, C.B., J.F. Sarmago and B.C. Pilapil, 1987. Breeding season, sexual maturity and fecundity of the blue crab, *Portunuspelagicus* (L.) in selected coastal waters in Leyte and vicinity, Philippines. Annals of Tropical Research, 3/4: 127-142.
7. Potter, I.C. and D.S. Lestang, 2000. The biology of the blue swimmer crab *Portunuspelagicus* in the Leschenault Estuary and Koombana Bay in south-western Australia. Journal of the Royal Society of Western Australia, 83(264): 443-458.
8. Razek, F.A.A., 1999. Some biological studies on the Egyptian crab *Portunuspelagicus* (Linnaeus 1766). The Egyptian Journal of Aquatic Research, 29(1/2): 133-143.
9. Williams, M.J., 1981. Methods for analysis of natural diet in portunid crabs (Crustacea: Decapoda: Portunidae). Journal of Experimental Marine Biology and Ecology, 52: 103-113.
10. Wassenberg, T.J. and B.J. Hill, 1987. Feeding by the sand crab *Portunuspelagicus*on material discarded from prawn trawlers in Moreton Bay, Australia. Marine Biology, 95: 387-393.
11. Patel, N.M., N. Chhaya and D. Bhaskaran, 1979. Stomach contents of *Portunuspelagicus* (Linn.) from AD Net Catches. Indian Journal of Marine Science, 8: 48-49.
12. Bryceson, I. and A. Massinga, 2002. Coastal resources and management systems influenced by conflict and migration: Mecufi Mozambique, 31: 512-517.
13. Chande, A.I. and Y.D. Mgaya, 2003. The fishery of *Portunuspelagicus* and species diversity of portunid crabs along the coast of Dar es Salaam. Western Indian Ocean Journal of Marine Scince, 2: 75-84.
14. Dahdouh-Guebas, F., M. GiuggioliI, A. Oluoch, M. Vannini and S. Cannicci, 1999. Feeding habits of non-ocypodid crabs from two mangrove forests in Kenya. Bulletin of Marine Science, 64: 291-297.
15. Cannicci, S., F. Dahdouh-Guebas, D. Anyona and M. Vannini, 1996. Natural diet and feeding habits of Thalamitacrenata (Decapoda, Portunidae). Journal of Crustacean Biology, 50: 113-120.
16. Biswas, S.P., 1993. Manual of method in fish biology. South Asian Publisher, Newdehli India, pp: 190.
17. Chelton, B.D., 1981. Interannual variability of the California Current Physical factors, Journal of Crustacean Biology, 22: 34-38.
18. Warner, G.F, 1977. The biology of crabs: 1-202. (Van Nostrand Cy, New York).
19. Sukumaran, K.K. and B. Neelahantan, 1998. Food and feeding of *Portunussanguinolentus* (herbst) and *Portunuspelagicus* (Linnaeus) (Branchyuran: Portunidae) along Karanataka coast (India). Journal of Marine Science, pp: 35-38.
20. Tadi, F., J. Pazooki and M. Safaei, 2012. Food and feeding habits of blue swimming crab *portunus segnis* along Persian Gulf (Hormozgan coast). International conference Biology of Iran.
21. Hill, B.J., 1976. Natural food, foregut clearance-rate and activity of the crab Scylla serata. Marine Biology, 34: 109-116.
22. Ropes, J.W., 1968. The feeding habits of the green crab, *Carcinusmaenas* (L.). Fishery Bulletin U.S. Fish Wildlife Service, 67: 183-203.
23. Prasad, P.N. and N. Neelakantan, 1988. Food and feeding of the mud crab *Scylla serrata* (Forskal) (Decapoda: Portunidae) from Karwar waters. Indian Journal of Fisheries, 35(3): 164-170.
24. Jeweet, S.C. and H.M. Feder, 1982. Food and feeding of king crab *Paralithodescamatschatica* near Kodiak Island, Alaska. Marine Biology, 66: 243-250.
25. Menon, M.K., 1952. A note on the bionomics and fishery of the swimming crab *Neptunus sanguinolentus* (Herbst) on the Malabar coast. Journal of the Zoological Society of India, 4(2): 177-184.

26. Jose Josleen, 2001. Food and feeding of the blue swimmer crab *Portunuspelagicus* (Linnaeus, 1758) (Decapoda, Brachyura) along the coast of Mandapam Tamil Nadu, India. Crustaceana, 84(10): 1169-1180.
27. Sumpton, W.D. and G.S. Smith, 1990. Effect of temperature on the emergence activity and feeding of male and female sand crabs (*Portunuspelagicus*). Australian Journal of Marine and Freshwater Research, 41(4): 545-550.
28. Wieczorek, S.K. and R.G. Hooper, 1995. Relationship between diet and food availablity in the snow crab *Chionoecetesopilio*(O. Fabricus) in Bonne Bay, Newfoundland. Journal of Crustacean Biology, 15(2): 236-247.