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Sex Ratio, Size Distribution and Seasonal Abundance of Blue Swimming Crab, *Portunus pelagicus* (Linnaeus, 1758) in Persian Gulf Coasts, Iran

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Abstract: The sex ratio, size distribution and seasonal abundance of blue swimming crab, *Portunus pelagicus* was studied for one year along the Persian Gulf coasts, Iran. Sex ratio during a year of study was M: F = 1: 0.88 which should be the relative frequency of males. The crab's carapace widths ranged were from 60 to150_mm for males and 50 to145_mm for females. The crab's carapace lengths were from 35 to 80_mm for male and 30 to 70_mm for female. The total weight ranged from 48.0-275.50_g for males and 39.50-255.20_g for females. The highest abundance and largest size for the male crabs was record in Summer season and for females were observed in Autumn season. The results of this study show that at the same size, weight and the parameters of carapace length and carapace width male *Portunus pelagicus* are higher than females in Persian Gulf coasts.

Key words: Seasonal abundance · Sex ratio · Size distribution · *Portunus pelagicus* · 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. The Persian Gulf is one of the unique ecosystems due to its geographic distribution and its isolation from the international water and has unique specifications such as ecological, biological specifications and different varieties. It has a great biological diversity in the form of various marine flora and fauna. It includes marine sensitive ecological zones such as estuary, rivers, coral reef, mangrove forest, marsh and stone and mud coasts [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. In this study, blue swimming crab *Portunus pelagicus* as one of the marine crustaceans which is sparser in northern areas of Indian Ocean (Persian Gulf and Oman Sea) is investigated. The marine crabs belonging to the family Portunidae are bottom dwellers commonly found in tropical, subtropical estuarine and near shore habitats [2]. *P. pelagicus* is distributed from the eastern Mediterranean to east Africa in the Indian Ocean and to Japan and Tahiti in the western and south Pacific Ocean [3]. *P. pelagicus* 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].They are usually found in large numbers in shallow bays with sandy bottom [6] and are important commercial species is India and South East Asia [7-9]. The species is often considered a benthic carnivore and eats mainly sessile mollusk and other invertebrates [10, 11]. *P. pelagicus* supports substantial commercial fishery in the Persian Gulf and is an important component of many recreational fisheries in Iran and other parts of the world and the major species crab caught in trawl nets. Growth speed, high reproductive and strength against temperature, pH and salinity changes make the blue crab a proper species for aquaculture in the world. *P. pelagicus* lives in association with other portunid crabs whose contribution to the total crab catches is important both economically and ecologically. This study showed that commercial fishing of *P. pelagicus* is seasonal and the largest catches are landed between August and September which represented the summer season months.

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Their carapace (shell) is rough in texture [12], broad and flattened, with nine teeth on each side, the last teeth very pronounced as horns (Figure 2, 3). It is the hard cover or exoskeleton which protects the internal organs of the head, thorax and gills. They have five pair of legs (ten legs), some of the legs are pointed and others flat. The pointed once are used for crawling and the flat once are used like paddles for swimming. The first pair of legs, which are modified as claws, called chelipeds. The cheliped are long, elongated ridged, catch and hold food and bring it to the mouth, digging, cracking open shells and warning off would be attackers. Males of this species are blue with white dots on the shells and females are green-brown [12]. Differences are observed between the weight-carapace width relationships for male and female *P. pelagicus* [7]. At the same size, males are heavier than females in the Persian Gulf coasts.

Both temperature and salinity are important factors influencing the distribution, activity and movement of *P. pelagicus*. In the south-west, in summer they are caught easily as they are active, but in winter they are present but inactive [13]. *P. pelagicus* has a preference for salinities of 30 to 40 ppt [13]. the above changes in distribution are apparently related to the marked seasonal variation in salinity which results from the very seasonal pattern of rainfall. There is a decline in numbers of crabs in south-west waters during winter when salinities and water temperatures decline to their lowest levels [14]. In spite of the other crabs, this species cannot survive a long time out of the water and its food, shelter and growth are dependant to estuaries.

Morphology, abundance and size distribution form the basis for fish stock assessment. Several physiological and biological processes, such as feeding habits, growth, age, reproduction, moulting and migration may influence distribution in crabs. Fish stock assessment evaluates the effect of fishing on a fishery as a basis for fishery decision. Sex and size distribution provides information on productivity, longevity, period of maturity, recruitment of various classes and determination of potential yield. Consequently, several studies have been carried out in this regard for finfish species and crustaceans from other water bodies. The present study reports the data on the morphological characteristics, sex and distribution on *P. pelagicus* from Persian Gulf coasts in south Iran.

MATERIALS AND METHODS

Study Area: The study was carried out in the several adjoining coasts in the Persian Gulf such as Khuzestan province (including coasts Abadan and Bahrekan), Boushehr province (including coasts Boushehr and Khark) and Hormozgan province including coasts Bandar Abbas and Jask (Figure 1). The Persian Gulf lies on the South Iran, between longitudes 48°25' and 56°25" East and latitudes 24°30" and30°30' North. It has an estimated area of 260Km^2 and extends 600Km offshore to a depth average of about 30-40 meter [1].

Sampling Stations: Six sampling stations were established along a spatial grid of the Persian Gulf coasts covering a distance of about 909 kilometers. The sampling stations were selected based on ecological particularity, vegetation and human activities in the area.

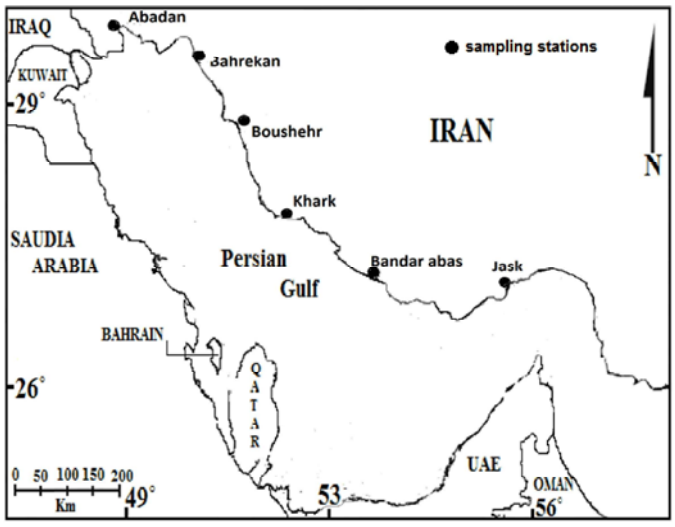

Fig. 1: Map of Persian Gulf coasts showing Sampling stations and the Study Site.

Fig. 2: The dorsal view of male blue swimming crab, *Portunus pelagicus*

Fig. 4: The ventral view of male blue swimming crab, *Portunus pelagicus*

Fig. 3: The drosal view of female blue swimming crab, *Portunus pelagicus*

Fig. 5: The ventral view of Female blue swimming crab, *Portunus pelagicus*

Station 1: This station is located at Abadan area.Abadan area is located at the head of the Persian Gulf near the city of Abadan in south of Khuzestan province. Mainly fishers occupy the area. The human activities here include boat traffic and fishing with living houses on the shoreline. Mangrove Vegetation is sparse with mainly *Avicenia* sp.

Station 2: This station is located at Bahrekan area. This station is located at the head of the Persian Gulf near the city of Mahshahr in South Khuzestan province. It is located downstream of Station 1.This area is coastal mudflat ecosystems of the Persian Gulf,playing a significant hydrological and ecological role in the natural functioning of the northern Gulf. Human activities here include fishing, badges and boat building. Major sources of contamination in this area include the agricultural use of fertilizers, herbicides, pesticides, hazardous substance spills from various refineries and petrochemical factory.

Station 3: This station is located at Boushehr area. This station is located at the head of the Persian Gulf near the city of Boushehr in Boushehr province. They support an extremely diverse coastal fauna and flora and thus play an important role in maintaining the genetic and ecological diversity of the region [15]. There are industrial human and activities here and the major activities included jetty operations, oil and fishing.

Station 4: This station is located at Khark area. This station is located at the head of the Persian Gulf near the city of Khark in Boushehr province. There are no industrial activities here. The shoreline fringes have mainly *Rhizophora* mangle. The main activity is fishing and boat ferrying. The area is shallow and at low tide, the greater part of the bottom sandy coast is exposed.

Station 5: This station is located at Bandar Abbas area. This station is located at the head of the Persian Gulf near the city of Bandar Abbas in Hormozgan province. There are industrial human and activities here and the major activities included jetty operations and fishing.

Station 6: This station is located at Jask area. This station is in Hormozgan province. There are no industrial activities here. Human activities here including fishing and boat building. The coastal zone has mainly *Rhizophora* mangle and *Avicenia* sp.

Sample Collection: Sampling was performed in Persian Gulf coasts within the 6 sampling stations. The crabs for study were collected for one year period from January 2011 to December 2011. Sampling was performed trawl net from a research ship. The trawl net, which contained 25 mm mesh in the bunt, was towed by boat at a speed of 3-4 km/h. After sampling, samples were taken to the laboratory in a cooler and stored in a deep freezer for further analysis. Random samplings were with crabs of the several size ranges were obtained. Then the crabs are washed for removing the mud and algae's and barnacles stuck to the external skeleton. Crabs were identified to species level carried out using photo cards and available identification keys [16, 17]. Therefore each crab was sorted into species. The first sex and their morphological characteristics (body weight, carapace width and carapace length) were taken. Male blue swimming crab have a V-shaped abdomen(Figure 4) and female crab have an abdomen broad and rounded (Figure5) [18]. The carapace length (CL) of the crab was measured to the nearest centimeter from the edge of the frontal region to the tip of the carapace back wall using a vernier caliper. The carapace width (CW) was taken from the tip of the left dorsal spine to the tip of the right dorsal spine. The body weight (BW) of the crab was taken on a sartorius top loading balance to the nearest tenth of a gram. The CW and CL were measured with a 0.5 mm precision vernier caliper to the nearest millimeter (mm) while BW measurement was done using a 0.001g precision Adam (PGW series) weighing balance to the nearest grams (g).

RESULTS

The abundance of the different sexes of *P. pelagicus* at the various stations of the Persian Gulf coasts is presented in Figure 6. The highest abundant of male crabs was recorded in station Boushehr (29 %) followed closely by station Bandar Abas (21%), station Bahrakan (17%), station Khark (14%) then station Jask (11%) and station Abadan (8%). Similarly, the females were most abundant in station Boushehr (26%), followed by station Bahrakan (23%), station Jask (18%), station Bandar Abbas (15%) then station Khark (12%) and station Abadan (6%) the least in abundance. The length frequency distribution according to sex and size of the crabs are shown in Figure 7. The size classes 110 to 130_ mm were the highest in number for both sexes. The least number was recorded for size class 130 to 150_mm.The results showed the statistical relation of carapace length, carapace width and width of sixth abdomen band with weight and significant difference was no obtained between weight and all other

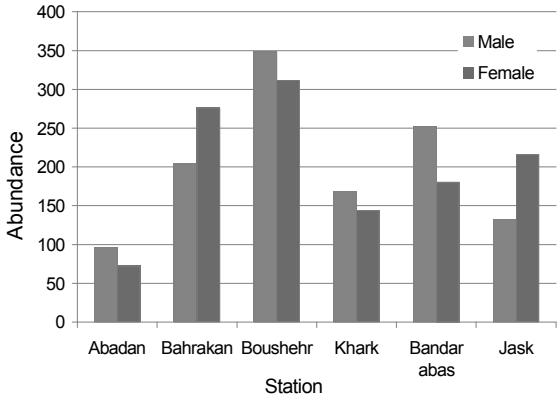

Fig. 6: Abundance/no. of crabs with different sexes of *P. pelagicus* at different sampling stations.

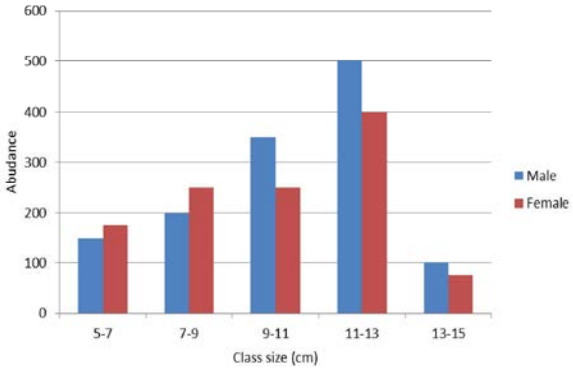

Fig. 7: Crabs abundance distribution between different sizes and sexes if *P. pelagicus*

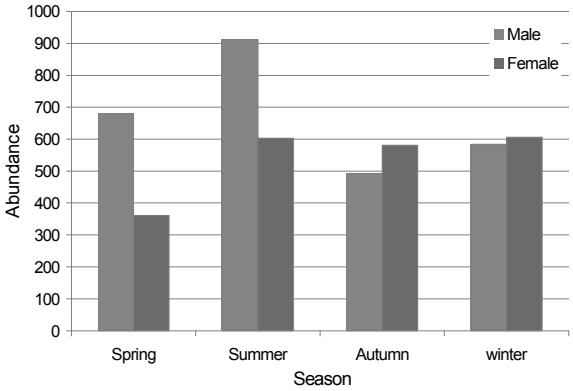

Fig. 8: Abundance with different sexes of *P. pelagicus* at different seasons.

factors. Sex ratio during a year of study was M: F= 1: 0.88 which should be the relative frequency of males. The abundance of the different sexes of *P. pelagicus* at the various seasons of the Persian Gulf coasts is presented in Figure 8. The male blue swimming crab has the larger part of the population and results show that in Summer and

Table 1: The class size (Carapace width (CW), Carapace length, Body weight (BW) between different sexes of *P. pelagicus*

Sexes	Carapace width (CW)	Carapace length (CL)	Body weight (BW)
Male	60-150_mm	35-80_mm	48-275.50_ g
Female	50-145_mm	30-70_mm	39.50-255_ g

Spring seasons the percentage of males was higher and in Autumn and Winter seasons females has the higher percentage of the population. Indeed, the maximum frequencies and largest size of males were observed in Summer and maximum frequencies and largest size of females were observed in Winter. The least abundance and smallest size of the male in autumn season and for female were recorded in summer season. The crabs CW ranged were from 60 to 150_mm for males and 50 to 145_mm for females. The crabs CL were from 35 to80_mm for male and 30 to 70_mm for female. The BW ranged from 48.0 to 275.50_ g for males and 39.50 to 255_g for females (Table 1). The results of this study show that at the same size, BW and the parameters of CL, CW and claw male *P. pelagicus* are higher than females in Persian Gulf coasts.

DISCUSSION

The abundance of the different sexes of *P. pelagicus* across the stations was varier widely. This may be due to the fairly stable water quality as well as the composition of the sediments, which is characteristically sandy. The distributions of *P. pelagicus* in the Persian Gulf coasts is that sometimes found on mud and gravel but is most abundance on sandy bottoms. The distributions of *P. pelagicus* in Southern Australia estuaries occurs in a wide range of algal and sea grass habitats and on both sandy and muddy substratum, from the intertidal zone to at least fifty meters of depth [19]. In coastal waters, smaller crabs are found in shallow waters, while adults are found in comparatively deeper waters. The research same show that the distributional *P. pelagicus* seems to prefer the river and to some extent mud substrates compared to the mangroves, but the largest specimens was found on the mud on Inhaca Island, Mozambique [20]. The research same show that the distributional patterns of portunids in Fertaleza Bay (Brazil) are driven mainly by the granulometric composition of the sediments [21, 22]. The size distributions with CW ranged were from 60 to 150_ mm for males and 50 to 145_mm for females. The crabs CL were from 35 to 80_mm for male and 30 to 70_mm for female. The BW ranged from 48g to 275.50_g for males and 39.50to 255.20_g for females. The results of this study showed that there is a positive correlation between BW and CL and CW of *P. pelagicus* and the mean BW of male blue crabs were more than females. Performed studies in Persian Gulf coasts [23, 24] had the same results. The research same show that different size with CW ranging from 80 to159_ mm for female and 78 to137 _ mm for male and mean BW of males was considerably more than females from Moreton Bay, Eastern Australia [25]. The research same show that CW ranging from 45 to 165_mm, CL from 19 to 70_mm and BW 55 to183.3_ g for the same species from Bardawil lagoon, Northern Egypt [26, 27].Results of this study showed that during a year, the sex ratio of blue crab population was as M: F= 1: 0.88 which this ratio shows the male proportional frequency to females in the population of this species. The present study shows the similar results that the more ratio of females to males of this species in Khuzestan coasts, Iran [24]. Researches in Australian coasts show that a double ratio of females to males of this species [28]. The season situation, migration and changes of the weather and can affect the sex ratio in the population of this species [29]. There are seasonal effects on crab abundance due to different climate conditions such as rainfall and temperature fluctuations following different seasons. The male crabs were largest, more abundant and caught during the summer season. The present study also shows the similar results that lower abundant and caught were found during their winter season for the same species, the largest crabs, which were females from South Africa [30]. The variation in size of crabs used for this study and other previous studies may be indicative of high fishing mortality at the Persian Gulf coasts. They reported that direct fishing mortalities from illegal harvest of blue crabs and indirect fishing mortality have important management implications because many juveniles approaching crabs size are impacted and probably resulted in reduced catch of larger size crabs. This is explained in Fielder (1972) Williams (1982) and Kumar (1998) [31-33]. Secondly, the lower proportion of adult *P. pelagicus* in the crab population suggests a drastic adjustment, probably of a density-dependent compensatory nature, in the size of the crab cohort, during the early life history stages.

REFERENCES

1. Ampf, J.K. and M. Sadrinasab, 2006. The circulation of the Persian Gulf. Journal Ocean Science, 2: 27-41.
2. Carmona-Suarez, C. and F.E. Conde, 2002. Local distribution and abundance of swimming crabs (*Callinectes* spp. and *Arenaeus cribrarius*) on a tropical arid beach, Ensenada de la vela, Veezuela. Fisheries Bull., 100: 11-25.

3. Stephenson, W. and B. Campbell, 1959. The Australian portunids (Crustacea: Portunidae). The genus *Portunus*. Australia Journal Marine Freshwater Research, 10: 84-124.
4. Edgar, G.J., 1990. Predator-prey interactions in sea grass beds. II. Distribution and diet of the blue manna crab *Potunus pelagicus* Linnaeus at Cliff Head, Western Australia. Journal Experimental Marine Biology and Ecology, 139: 23-32.
5. Kumar, M., G. Ferguson, Y. Xiao, G. Hooper and S. Venema, 2000. Studies on reproductive biology and distribution of blue swimmer crab (*Portunus pelagicus*) in South Australian Waters. Research Report Series, 47: 1324-2083.
6. Dai, A.Y. and S.L. Yang, 1991. Crabs of the China Seas. China Ocean Press, Beijing, pp: 682.
7. Prasad, P.N., J. Reeoy, N. Kusuma, B. Neelakantan, 1989. Width-W eight and Length-Weight Relationships in Three Portunid Crab species Uttar Pradesh. Journal Zoology, 9: 116-120.
8. Potter, I.C. and D.S. Lestang, 2000. The biology of the blue swimmer crab *Portunus pelagicus* in the Leschenault Estuary and Koombana Bay in south-western Australia. Journal of the Royal Society of Western Australia, 83(264): 443-458.
9. Hill, B.J., M.J. Williams and P. Dutton, 1982. Distribution of juvenile, subadult and adult *Scylla serrate* (Crustacea: Portunidae) ontidal flats in Australia. Marine Biology, 69(95): 117-120.
10. Batoy, C.B., J.F. Sarmago and B.C. Pilapil, 1987. Breeding season, sexual maturity and fecundity of the blue crab, *Portunus pelagicus* (L.) in selected coastal waters in Leyte and vicinity, Philippines. Annals of Tropical Research, (3/4): 127-142.
11. Potter, I.C., P.J. Chrystal and N.R. Loneragan, 1983. The biology of the blue manna crab *Portunus pelagicus* in an Australian estuary. Journal Marine Biology, 78: 75-85.
12. Marshall, S., B. Warburton, B. Paterson and D. Mann, 2005. Cannibalism in juvenile blue-swimmer crabs *Portunus pelagicus* (Linnaeus, 1766): effects of body size, moult stage and refuge availability. Applied Animal Behaviour Science, 90(1): 65-82.
13. Romano, N. and C. Zeng, 2006. The effects of salinity on the survival, growth and haemolymph osmolality of early juvenile blue swimmer crabs, *Portunus pelagicus*. Aquaculture, 260: 151-162.
14. Dittel, A. and C.E. Epifanio, 1982. Seasonal abundance and vertical distribution of crab larvae in Delaware Bay. Estuaries, 5: 197-202.
15. Scott, D.A., 1995. Islamic Republic of Iran. A Directory of Wetlands in the Middle East. IUCN and IWRB, Gland and Slimbridge, pp: 43-221.
16. Schneider, W., 1990. FAO species identification sheets for fishery purposes. Field guide to the commercial marine resources of the Gulf of Guinea. Prepared and published with the support of the FAO Regional office for Africa Rome, FAO 1990, pp: 268.
17. Fischer, W., (Ed.), 1978. FAO species identification sheets for fisheries purposes Western Central Atlantic (Fishing area 31), (6): 278.
18. Kumar, M., 1997. Proceedings of the First National Workshop on Blue Swimmer Crab *Portunus pelagicus*. Research Report Series, pp: 16-129.
19. Potter, I.C., P.J. Chrystal and N.R. Loneragan, 1983. The biology of the blue manna crab *Portunus pelagicus* in an Australian estuary. Marine Biology, 78: 75-85.
20. Johan, F., 2008. Size, sex and quantity of *Scylla serrata* and *Portunus pelagicu*s on Inhaca Island, Mozambique. Department of Marine Ecology, University of Gothenburg perss, pp: 530-545.
21. Kurata, H. and T. Midorikawa, 1975. The larval stage of the swimming crabs, P. pelagicus and *P. sanguinolentus*, reared in the laboratory. Bulletin Nansei Regional Fisheries Research Laboratory, 8: 29-38.
22. Haefner, A., 1998. Distribution, reproductive and molting of the crab of mid Atlantic in Fertaleza Bay. Nature, 430: 72-78.
23. Ghorbani, N., J.S. Sayfabadi, F. Oufi and B. Abtahi, 2002. Relationships carapas width-lentgh with weigh of blue swimmer, crab *Portunus pelagicus* in coasts boushehr waters. Archive of SID, 2: 59-66.
24. Jazayeri, A., F. Papan, A. Savari and T. Sakinejad, 2011. Biological Investigation of Persian Gulf blue swimmer crab (Portunus pelagicus) In Khuzestan coasts, Iran. Journal of American Science, 7(2): 7-1.
25. Gaddes, S.W. and W.D. Sumpton, 2004. Distribution of barnacle epizoites of the crab Portunus pelagicus in the Moreton Bay region, Eastern Australia. Marine and Freshwater Research, 55: 241-248.
26. Razek, F.A.A., 2006. population biology of the blue crab from lagoon northern sina Egypt. National Institute of Oceanography and Fisheries Egypt, 1(32): 401-418.
27. Razek, F.A.A., 1999. some biological studies on the Egyptian crab *Portunus pelagicus* (Linnaeus 1766)the Egyptian Journal of Aquatic Research, 29(1/2): 133-143.

28. Kangas, M.I., 2000. Biology and exploitation of the blue crab in Western Australia, Australian fishery Society, 15: 301-315.
29. Smith, S.S. and W.D. Sumpton, 1989. Behavior of the commercial sand crab *Portunus pelagicus* (L.) at trap entrances. Asian Fisheries Science, 3: 101-113.
30. Robertson, W.D. and A. Kruger, 1994. Size at maturity, mating and spawning in the Portunid crab *Scylla serrata* (Forskål) in Natal, South Africa. Estuarine, Coastal and Shelf Science, 39: 185-200.
31. Fielder, D.R. and A.J. Eales, 1972. Observations on courtship, mating and sexual maturity in *Portunus pelagicus* (L., 1766) (Crustaceas, Portunidae). Journal of Natural History, 6: 273-277.
32. Williams, M.J., 1982. Natural food and feeding in the commercial sand crab *Portunus pelagicus* Linnaeus, 1766 (Crustacea: Decapoda: Portunidae) in Moreton Bay, Queensland. Journal Experimental Marine Biology and Ecology, 59: 165-176.
33. Kumar, M., 1998. Research programs on the blue swimmer crab *Portunus pelagicus.* Research Report Series, pp: 16-129.