EDELWEISS PUBLICATIONS
OPEN ACCESS

Volume 2 Issue 1 | PDF 151 | Pages 7

Edelweiss Applied Science and Technology

Review Article ISSN: 2576-8484

Multiformity and Economic Importance of True Brachyuran Crabs

Saroj Rana*

Affiliation: Zoology Department, Amrit Science Campus, Tribhuvan University, Amrit Science Campus, Lainchaur, Kathmandu, Nepal

***Corresponding author:** Saroj Rana, Zoology Department, Amrit Science Campus, Tribhuvan University, Amrit Science Campus, Lainchaur, Kathmandu, Nepal, Tel: +977-9851083971, E-mail: sarojranabista@gmail.com

Citation: Rana S. Multiformity and economic importance of true brachyuran crabs (2018) Edelweiss Appli Sci Tech 2: 253-259

Received: Sep 16, 2018
Accepted: Sep 20, 2018
Published: Sep 29, 2018

Abstract

The brachyuran crabs are diversified and widely distributed habitant throughout the world, apart from Antarctica, they are reported from all the niches of network. They are dominant in all over estuaries and found in unfathomable depths of the Ocean down to 6000m and in the high mountains up to 3500 m above the sea level.Numerous species have evolved to lead terrestrial habitats. Mostly are in fresh water, and some of these crabs have evolved to survive as phytotelms, inside empty shells of the snails, within corals "symbiotically" or "commensally" and reported from alpine, caves and desert as well. Their sizes range from 2mm to 5.5mm; the weight ranges from few milligrams up to 19 kg. The fishery of the spanner crab, (*Ranina ranina*) has been thriving since World War II. People use crabs to cure different diseases: stomachache; liver and lungs diseases; healing wound; osteoporosis; and epilepsy and reproductive malfunction in women. This review aimed to find diversity and economic importance of crabs, which resulted positive and negative approaches. The crabs are multi-useful with diversified habitats, sizes and utility. Hence, it is suggested that the government should incorporate this in health care system into the existing one to ensure proper development and binding ethno-medicine in Nepal.

Keywords: Diversity, Phytotelms, Protein, Herpes Zoster, Asthma.

Introduction

Beside vertebrates, aquatic resources are occupied by many macro and micro-crustaceans. Among crustaceans, crabs are one of most multifarious groups of the Phylum Arthropoda, included in the Infra-order Brachyura of the Sub-class Malacostraca, Supper-order Eucarida, and Sub-order Pleocyemata in the Section Eubrachyura. The crabs are found in a wide variety of habitat (Hartnoll, 1988) of the world except for Antarctica, (Ng, *et al*., 2008); and they are reported from almost all the niches of bio-network. The crabs are found at abyssal depths of the Ocean down to 6000 m (Ng, *et al*., 2008) are becoming dominant in all most all estuaries where temperature and salinity fluctuate drastically daily. Real aquatic or fully aquatic species are those which are dependent completely on aquatic habitats to complete their life cycle and cannot survive without water, traces of water present in air (humidity in air) and rain dew.

This study has included both real aquatic species and semi-terrestrial or terrestrial species that are generally found in and around traditional freshwater environments as streams, rivers, lakes, ponds, swamps or marine water environments as river mouth, swamps, mangroves, seashore, deep sea. Freshwater-dependent species, includes both as completely aquatic as well as the more terrestrial species in which the adults are not primarily found in and around or associated with traditional freshwater environments, but are nevertheless dependent on wet/humid terrestrial environments for survival e.g. tree-climbing crabs, forest floor dwellers, dry cave dwellers and even desert dweller, all of these include many so-called terrestrial crabs those have juvenile stages that can occur in water or fringes of humidity of rain etc., (Ng *et al*., 2008; Yeo, *et al*., 2008).

Some of these crabs have become to live in momentary water sources; and many of them have become completely freshwater dwellers, (Cumberlidge and Vannini, 2004). Some of the brachyuran crabs possess only six appendages. Huang, et al., (2008) described a new genus and a new species of Hexapodidae crab *Latohexapus granosus* that differed from *Hexapus* and *Hexapinus* with prominently granulated and well-defined regions in carapace. The thoracic sternum with a deep transverse groove between thoracic sternites 3 and 4, and first male gonopods that extend beyond the male telson, reported from 10- 20 m deep sea. Highly poisonous Indo-West Pacific xanthid crabs *Lophozozymus* spp. has been reported from the sea of Australia (Ng and Chia, 1997).

Their sizes also vary from very small about 2mm to huge up to 5.5m with extended appendages and 40cm across carapace width or carapace length. Among arthropods, the biggest crustaceans are the brachyuran crabs. The giant spider crab of Australia grows up to 3.6m with extended chela with spindly legs and the carapace width/carapace length across reaches about 43cm weighing 14kg in weight, which is not uncommon known as *Pseudocarcinus gigas*, (Warner 1977).

Despite the disagreeable nature and strange looks, many researchers, recreational, naturalist, commercial fishers and consumers hold crabs as an important species. From scientific point of view, crabs act as bio-accumulative creatures, (Cantelmo, *et al.*, 1982) and can tolerate a wide range of environmental variations, (Wolcott, 1988). The ecological role through their important position in the food web in more than one level cannot be ignored. They provide prey for many

invertebrates and vertebrates and in turn feed on a variety of plant materials as a competitor to the other small herbivores, small fishes, prawns and invertebrates (Gherardi, *et al*., 1989). Crabs have recreational values, such as- fishing large and small crabs and keeping colorful crabs in aquarium and using as bait. In most part of the world, crab fishery is one of the most thriving industries, and it is in continuous demand due to scrumptious food item. Crabs are not only the enriched sources of carbohydrates, protein, lipids, vitamins and minerals etc, their continued demand in the market has also enabled their business to flourish as that of the luxury food items with the thriving fishery dominating the scene all over the world. These creatures are very much important ethnomedicinally as well.

Diversity

The crab fauna has a more diversified habitat and are very widely distributed all over the world. With the exception of Antarctica, they have been reported from almost all the niches of ecosystem. They have been found at the plumb-less depths of the Ocean down to 6000 m (Ng *et al.*, 2008) and on the high mountains up to 3500 m above the sea level (Brandis and Sharma, 2005); they are dominant in estuaries where temperature and salinity fluctuate drastically daily.

Habitat and Size variation

Damhougy *et al*., (2018) reported the coral gall crab, *Hapalocarcinus marsupialis* Stimpson, 1859 (Crustacea: Cryptochiridae) from Gulf of Aqaba, Red Sea, Egypt with minimum size at maturity of female is 2mm up to 2.49mm. Takeda and Moosa, (1991) reported crabs of small to very small size collected from 145-769 m deep from the sea. Marin (2016) found pea crab of the genus *Pinnixa* is found symbiotically or commensally within the mantle cavity of Mollusks, within the tubes of polychaetes and in the burrows of echiuroids and hemichordates. Similarly, *Pinnixa tumida* is reported from the intestine of the burrowing holothurians *Paracaudina chilensis*, *P. rathbuni*, in burrows of the echiuroid *Urechisuni cinctus* and *P. banzu*, in tubes of the polychaete *Chaetopterus cautus* in Peter the Great Bay, the Sea of Japan.

Canario et al., (2014) reported new species of *Troglocarcinus hirsutus* a new sprcies symbiont crab found associated with colonies of *Mussismilia* from Bahia State, northeastern region of Brazil. Mohammed and Yassien (2013) reported assemblages of two gall crabs within coral species Northern Red Sea, Egypt. *Quadrella* spp, *Trapezia* spp and *Tetralia* spp were found as symbiotic in the corals and other colonial anthozoans, from the Philippines, New Guinea and Vanuatus (Castro, 2009). The crab of genus *Aphanodactylus* was found from the Philippines and is known as commensal of tube-dwelling terebellid polychaetes of the genus *Loimia* (Ng and Naruse, 2009) Whereas, Wei, *et al.*, (2006) also recorded new species of coral gall crabs (Decapoda, Cryptochiridae) from Orchid Island, Taiwan, northwestern Pacific.

Yamauchi and Konishi, (2005) recorded the third rare commensal crab, *Pinnixa penultipedalis* Stimpson, 1858, from Oki Island, Japan whose range extended further northeast. Ho, *et al*., (2004) relayed that 604 species of the known brachyuran crabs in Taiwan have been reported to date. They reported 31 species of crabs not previously recorded from Taiwan and 13 new genera and two new families, the Homolodromiidae and the Cymonomidae. Wolodarsky and Loya (1980) described population dynamics of *Trpezia* crabs inhabiting the coral *Styllophora pistillata* in the north Gulf of Aqaba.

Terrestrial crab, *Geosesarma aedituens* had been recorded from the island of Bali, Indonesia (Naruse and Jaafar 2009). Similarly, the terrestrial crab of genus *Cymonomus* was recorded from Philippines (Ahyong and Ng 2009). Ahyong and Brown, (2003) identified two new species of *Cyomonomus* A. Milne Edwards, *C. kapala* new species, from New South Wales and *C. soela* new species, from Tasmania, closely resembled *C. curvirostirs* Sakai, 1965 and *C. bathamae* Dell, 1971 from Japan and New Zealand. Both the species differed from each other in having six abdominal somites. Yeo and Ng (1999) reported a new species of terrestrial grapsid crab of the genus *Geosesarma albomita* from Pulau Tioman Peninsular Malaysia. Some crabs are also found along the fringes of deserts. These desert dweller crabs have been nown to aestivate (summer sleep) within the burrows plugged by clay for up to six years, waiting for the rain to come (Ng. *et al*., 2008).

Kumar, et al., (2017) Described a new genus and new species of a completely arboreal crab (Decapoda: Brachyura: Gecarcinucidae) from the Western Ghats in India, with notes on the ecology of arboreal crabs. Ng, (2017) described the identities of the highland vampire crabs, *Geosesarma foxi* (Kemp, 1918) and *G. serenei* Ng, 1986, with description of a new phytotelmic species from Penang, Peninsular Malaysia (Crustacea: Decapoda: Brachyura: Sesarmidae). Ng, Ng, (2018) reported 7 species of the freshwater crabs from Danum Valley Conservation Area in Sabah, East Malaysia, then confirmed that *Arachnothelphusa terrapes* is to be a phytotelmic species and provided key to all species.

Grinang, et al., (2015) reported a new species of tree-hole dwelling freshwater crab of the genus *Arachnothelphusa* Ng, 1991 (Crustacea: Decapoda: Brachyura: Gecarcinucidae) from northern Sarawak, Malaysia, Borneo. Ng, et al., (2015) provided the taxonomy and ecology of *Labuanium politum* (De Man, 1887) (Crustacea: Decapoda: Sesarmidae), an obligate arboreal crab on the nipah palm, *Nypa fructicans* (Arecales: Arecaceae). Cumberliddge (2007) recorded *Microthelphusa meansi* from a remote isolated cloud forest on a tabletop mountain in western Guyana, South America. Tree climbing crabof genus *Scandarma splendidum* is recorded from the Sarawak, Malaysia, Borneo (Naruse and Ng, 2007).

Similarly, *Malagasyaan atongilensis* and *Labuanium gracilipes* are reported as tree climbing phytotelmic sesarmid crab in rainforest of Masoala Penisula, Madagascar (Cumberlidge, et al., 2005). *Potamonautes raybouldi is* a small phytotelmic crab reported from the temporary bodies of water in the tree holes of East Usambara Mountains, harbor (Cumberllidge and Vannini, 2004). The fresh water crab of genus *Socotra* has been recorded from the semi-arid highlands of Socotra Island, Yeman (Cumberlidge and Wranik, 2002).*Gecarcinautes goodmanni* and *Gecarcinautes gouaoi* have been reported as tree climbing crabs from the *Panadnus* leaf axial in Madagascar (Yeo *et al*., 1999). Freshwater crabs of the genus *Demanietta* have been reported from waterfalls whereas, *D. khirikhan*, was collected from comparatively slow-moving water and these species generally found in fast-flowing to torrential mountains streams and cascades (Yeo, *et al*., 1999).The freshwater crab *Geothelphusa haituan* has been reported from 2000 m high alpine region of Taiwan (Chen, *et al*., 2007).

The freshwater crab *Barytelphusa lugubris* has been reported from very High Mountain up to 3500m (Brandis and Sharma, 2005). Christensen, (2015) reported that *Arachnothelphsua rhadamanthysi* has been reported by naturalists in the forested area outside Gomantong caves where it was first found and suggested that this is only a facultative cave dweller. McFarlane and Lundberg, (2012) reported the status of the Niah cave crab, *Adeleana chapmani* from Sarawak, Malaysia. *Alox tormos* was describes as cave dwellers in Balicasag Island, Philippines (Galil and Ng, 2009) Semi-terrestrial crabs, *Sesarmoides kraussi*, *S. longipes* and *S. borneensis* are recorded in marine caves from Indo-West Pacific intertidal mangrove and Estuary (Davie and Ng, 2007). The cave-dwelling crab *Neoliomera cerasinus* is described from marine caves in Christmas Island and Ryukyuns (Ng, 2002). Takeda and Ng, (2001) diagnosed freshwater crab of the genus *Sundathelphusa hades* from the cave of Mindanao in Philippines. Similarly, Ng, *et al*., (1994) described a new species of remarkable

sesarmine crab, *Sesarmiodes ultrapes* from caves in the Solomon Islands with the longest-leg than any known terrestrial brachyuran cave crabs yet reported.

Different size variations in crabs ranging from a few millimeters (2mm to 5.5m) to many meters were also reported by many carcinologists. The average CW (CW = carapace width, CL = carapace length) of fresh water crab *Macrophthalmus boscii* (Audouin, 1826) at Inhaca Island, Southern Mozambique was 2-12mm (Litulo, 2005). Cheryl, *et al*., (1993) described very small and new species of camptandriine crab *Baruna sinensis* from Taiwan; male (CL 2.7mm X CW 3.3 mm.) have been described from the sandy seashore and estuary are slow moving species.

Ahyong and Brown (2002) described two species of *Cymonomus curvirostris* and *C. bathamae* New South Wales with average CL 3mm and CW 3.2mm for ovigerous female. Naruse and Ng (2006) reported Male of crab *Alox uru* having CL 4.4 mm CW 5.8 mm and Ovigerous female crab of *Ebalia stellaris* having CL 2.4 mm, CW 3.6 mm from) from the Ryukyu Islands, Japan. Alox was recorded from 2-6m in coral reef and *Ebalia* from 16m depth of sea. The Japanese spider crab (*Pseudocarcinus gigas*) has the longest leg span than of any other arthropod, reaching up to 5.5 meters (18 ft.) from claw to claw and the body may grow to a size of 40-43 cm (16- 20inches) across carapace width/carapace length and the whole crab can be weighed up to 19kg, (Burton and Burton, 2002; Warner, 1977).

Economic Importance of crabs

From the historical perspective, crabs in general have been treated with disdain and indignation and often dubbed as unpleasant and bellicose animals. Similarly, the Latin word for crab is cancer, the world's most deadly disease, but it has more economic values with different aspects in the world. Regardless of its distressing nature and weird and wonderful looks, many naturalist, scientist, recreationalist, commercial fishers and patrons hold crabs as an important species. Crabs can tolerate a wide range of environmental variations and are considered as plastic (Wolcott, 1988). Although, the South Indian edible freshwater crab *Oziotelphusa senex senex* is an inhabitant of rice fields and irrigation canals, originally limited to freshwater, can also survive in 100 % sea water, (Reddy and Reddy, 2006). Many physiologists, biologists and researchers have been using crabs as a biological model due to their ready availability and plastic in nature, (Reinecke, et al., 2003; Burggern and McMahon, 1988; Gangotri, et al., 1978; Warner, 1977).

The ecological role through their important position in the food web in more than one level cannot be ignored. They provide prey for many invertebrates and vertebrates and in turn feed on a variety of plant materials as a competitor to the other small herbivores, small fishes, prawns and invertebrates (Gherardi, et al., 1989). In Central and West Africa crabs are predated by a diversity of organisms, chiefly otter but also fish, young crocodiles, monitor lizards, mongooses, civets, drills and birds such as storks and kingfishers (Rathbun 1921; Voelker & Sachs 1977; Purves et al. 1994; Butler & Marshall 1996). There is a difference in the size of crabs eaten by these species, trout feeding on the smaller individuals while otters (and other predators such as eels) catch larger individuals from the stream bed (Butler and Marshall 1996).

Crabs have recreational values, such as- fishing large and small crabs and keeping colorful crabs in aquarium. More colorful Indo-Chinese potamid crabs of the genus *Demanietta* are sold in the market for aquariums, (Yeo, et al., 2008). Crabs are one the most diversified crustaceans in the world. Excluding few poisonous crabs of the sea, many of them are eaten by humans as well as other living beings and also, they become food for many organisms. They play a significant role in the fishery wealth of many nations and are an important protein source. Crabs are consumed in many parts of the world. True brachyuran crabs' (*Ranina ranina*) fishery has been thriving commercially since World War II (Brown, 1985). The most important and valuable are the edible crabs of the British and European coasts (*Cancer pagurus*) and, in North America, the blue crab (*Callinectes sapidus*) of the Atlantic coast and the Dungeness crab (*Cancer magister*) of the Pacific coast (Zannatul *et al.*, 2010). In the local periodical market of Terai of Nepal, freshwater crabs are sold in very cheap price, but the marine crabs which are imported from the neighboring countries are sold in the departmental stores and local market at a high price i. e. about 8 to 10$/ kg (1$ = N. Rs 103 (Rana, 2016).

In India, the crab fishery is fast developing with a vast scope for the meat due to its delicacy and nutritional richness. The commercially important portunid crabs found along Parangipettai coast are *Scylla serrata*, *S. tranquebarica*, *Portunus sanguinolentus*, *P. pelagicus*, *Podophthalamus vigil*, *Charbdis feriata*, *C. lucifera*, *C. natator*, *C. granulata* and *C. truncata* (John Samuel *et al*., 2004). All these species are exploited in aquaculture. In some parts of the world, crabs are used in the form of staple food (Warner, 1977). In South Indian region of India, due to the speedy growth rate, high meat yield, and excellent palatability and resistance to the pathogens has led to the development of rapidly increasing aquaculture industry of different species of crabs (Reddy and Reddy, 2006).

Freshwater crabs are an important protein source and are sold in many parts of the world (Dalu *et al*., 2016). Grinang *et al.*, (2017) found that muscles of the freshwater crab contain a substantial amount of nutrients in particular water content (male = 79.31 ± 2.30%, female = 77.63 ± 0.56%), protein (male = 77.47 ± 6.11%, female = 63.28 ± 3.62%), magnesium (male = 51.48 ± 16.10 mg/g, female = 39.73 ± 6.99 mg/g) and calcium (male = 25.50 ± 6.98 mg/g, female = 39.73 ± 6.99 mg/g). Similarly, Varadharajan and Soundarapandian (2014) recorded protein, carbohydrate, lipid, moisture and ash and minerals of calcium, magnesium, potassium, sodium, iron, copper and zinc were maximum in cephalothorax and minimum in swimming and walking legs of fresh water crab *Spiralothelphusa hydrodroma*. Soundarapandian and Ravichandran (2013) recorded maximum protein content in females (23.47%) when compared to males (21.53%) and berried females (20.93%); the carbohydrate content was significantly higher in berried females (2.76%) and lesser in males (2.09 %) and females (2.06%). The lipid contents were significantly higher in females (1.09%) and berried females (1.05%) than males (0.32%).

The protein, carbohydrate and lipid contents were found to be higher in hard shell than that of soft-shell crabs of *Portunus sanguinolentus* (Sudhakar *et al*., 2009) and reported 10 essential amino acids in *Portunus sanguinolentus a*mong which, 8 individual essential amino acids are were from hard the shell crabs and 7 amino acids in soft shell crabs. (Adeyeye, 2002) recorded cheliped muscle recorded the highest value for protein and the lowest value for the total ash in both sexes of west African fresh water crab (*Sudananautes africanus africanus*). Du Preez and McLachlan (1983) found mean values for protein (35.0%), lipid (2.9%), carbohydrate (11.53%) and ash (49.55%) in the three-spot swimming crab *Ovalipes punctatus*. But, Radhakrishnan and Nataraian (1979) found the higher value of carbohydrate and fat in the bigger size group, while protein and moisture contents decreased slightly in crab *Podophthalmus vigil*. Crabs are consumed not only to fulfill the nutrient requirements but also to cure diseases.

Ethno-medicine

Crabs are also ethno-zoologically as well as medicinally important creatures. Kashyap, (2017) believed that the meat of Crab *Paratalphusa spp*. is a promoter of strength and is a good remedy for the disease of the blood. Bagde and Jain (2016) *Cancer pagurus* commonly called Kekda Soup is considered for cough and cold and dry animal ground, boiled with water is used for joint pain. Padghane *et al.*, (2016) reported that crab curry is used to treat typhoid and cold. In

Nepal, Pahari ethnic groups use *roasted freshwater crabs* (*Himalapotamon atkinsonianum*) to stop bed-wetting in children, whereas Danuar uses *cooked crabs* as reconstitutes and neutraceuticals for asthma and wound healing (Lohani, 2016 and 2012). Das (2015) reported that patient suffering from Asthma consume *whole body flesh* food of *Carcinous spp* for about three months. Rai and Singh (2015) reported that Rai community from Bhojpur of eastern Nepal use freshwater crabs in the treatment of people suffering from Herpes Zoster and measles viral diseases causing skin infection.

Pushpangadan, (2014) the flesh of dead or killed crab *Cancer pagurus* and *Scylla serrata* crabs are used both as food and medicine. The crabs are mostly used for curing diseases like whooping cough, bronchitis, pneumonia, asthma, osteoporosis, wounds, boils, womb disorders, tuberculosis, earache, burns and epilepsy, (Roy, 2014). Betlu (2013) described that *whole or dried or fresh parts of freshwater crab Paratelphusa sp*. (Alcok, 1919) are used singly or in combination with others for the treatment of Jaundice i.e., *crabs (especially small ones) are crushed to pulp when fresh and dried*. The juice extracted is mixed with a little water and boiled till it becomes half of the quantity and then taken. It is often cooked along with banana flower. There are no side effects reported and Fidelity level (%) and no dosage for the treatment, (Betlu 2013).

Tribal people from Mizoram and Arunachal Pradesh use crab *Scylla serrata* to cure diabetes in old age people and in curing skin disease, (Chinlampianga, *et al*., 2013). Lohani, (2011; 2010) reported that *Himalayapotamon atkinsonianum* Woodmason, 1871 the freshwater crabs are used in several ways. These are administered *orally* to small children to stop bed-wetting (enuresis). Cooked or roasted crabs are eaten to sharpen memory and to treat gastritis with immense food value: Crab serves as good source of protein. Medicinal use: Whole body is crushed into fine powder and mixed with water to get a smooth paste. The mixture is taken orally to cure dysentery. *Crushed crab powder* is also applied at the bleeding wound and Asthma patients eat roasted crab for relief. Similarly, the Magar and tamang tribes of Nepal uses crab *Barytelphusa lugubris* and *Himalayapotamon atkinsonianum* to increase the memory (Lohani, 2011; 2010).

Seralaphrul and Price, (2007) reported that the most important wild animal foods for the children are the freshwater paddy field crab, *Puuna* (*Somannianthelphusa* spp.) in the rural village of Northeast Thailand. Padmanabhan and Sujana (2008) fund *boiled flesh* of *Cancer pagurus* to relieve cough in the Attappady hills of Western Ghats, India. . Padmanabhan, (2007) described that *boiled flesh* of crab *Cancer pagurus* is eaten to relieve cough, fat is used burns and placed in decaying teeth, flesh and eggs are used to increase lactation in breast feeding women. *Fried crab* is used to treat whooping cough, whereas, Mahawar and Jaroli (2007) said that the whole body of the same species of crab is commonly used to treat cough, asthma and also T. B. Even *ash of crab* is used in lung diseases as cough, asthma, T. B. etc. Jamir and Lal (2005) delivered that whole body of freshwater crab is used for the treatment Jaundice and other liver disorders by tribes of Nagaland. According to the traditional belief in Bangkok, *medicinal liquor* prepared by baking the shell of the freshwater crab *Ranguna (Ranguna) phuluangensis* enriches the calcium supply and reduces cholesterol and triglyceride level in the blood of human body (Sriphuthorn, 2000).

In Bangkok, the tonic derived by pounding the whole body of freshwater crab *Ranguna (Ranguna) phuluangensis* in a mortar is used to detoxify the blood (Sriphuthorn, 2000). Crab curry is used to treat cold, asthma and typhoid and is also given as tonic to convalescing patients (Agarwal, 1987).

One of the most interesting is the role of *Potamonautes raybouldi*, the tree hole freshwater crab of the East Usambara Mountains in Tanzania and the Shimba Hills in Kenya, prevents the problem of frequent miscarriage in women for which both the crab and alkaline water of tree hole is to be administered (Dobson 2010). In Egypt, Obe (1931) reported that the whole crabs are eaten by childless women in the belief of becoming pregnant.

Negative impacts

Every coin has pros and cons i.e., there is always dark and bright or positive and negative sides of all the things. In the same way, the crabs also possess some negative impacts. Such as a few crabs carry parasites of various diseases within their body, as a secondary host and those parasites do not affect the crabs. The freshwater crab is considered a human health concern as it causes Paragonimiasis and Oncocerciasis (Cumberlidge, 1999). Human infection by the lung fluke *Paragonimus westermani* is widely distributed in Africa, Asia, and South America. Transmission of the parasite to humans primarily occurs through the consumption of raw or undercooked crabs. Clinical features of recently diagnosed pulmonary Paragonimiasis showed that patients present were diagnosed with a variety of clinical and radiological findings, which frequently mimics tuberculosis and lung cancer, (Sunanda, *et al.*, 2016).

Infection may be asymptomatic or include fever, cough, haemoptysis and dyspnoea. Sudden death owing to bilateral pneumothorax has also been reported. Ectopic infections may produce subcutaneous nodule formation, lymphadenopathy, lymphadenitis and cellulitis. Similarly, Magalhaes and Rodriguez (2002) described *Potamocarcinus reflexofrons* and *P. fittkaui* as vectors of paragonimiasis in the amazon and Atlantic Guianas River basins. Cumberlidge, (1994) described *Sudanautis aubryi*a freshwater crab from West Africa which serves as a second intermediate host of the human lung fluke (*Paragonimus)* in Nigeria and Central Africa. Sachs and Cumberlidge, (1991; 1990) reported first record of the spiny river crab and the dwarf river crab *Liberonautes chaperi* (A. Milne Edwards, 1887) *Liberonautes latidactylus nanoides* Cumberlidge and Sachs, 1989 as new second intermediate hosts of *Paragonimus uterobilateralis* in Liberia. Patients showed no relief who were erroneously treated with anti-tubercular drugs, but those treated with praziquantel given at dose of 25 mg/kg given orally 3 times daily for 3 consecutive days resulted excellent clinical responses, (Sunanda, *et al*., 2016).

Public Health England, (2017) reported that Onchocerciasis (commonly known as river blindness disease) is zoonotic helminthes disease which is transmitted from animals to humans that affect the human eye. It is caused by the filarial parasite *Onchocerca volvulus*. This parasite is transmitted specially by black flies, but freshwater crabs are also considered as secondary host of this parasite cumberlidge, (1999). It causes an itchy dermatitis, subcutaneous nodules, keratitis and chorioretinitis in the anterior chamber of eye a human patient, affecting more than 17.7 million people inducing visual impairment and blindness elicited by microfilariae that migrate to the eyes after being released by female adult worms in the subcutaneous tissues in America, Europe and Asia. Onchocerciasis and is increasing in number profoundly, (Otranto Domenico and Eberhard Mark 2011). Till now five species have been associated with the eye; involved the conjunctiva and involved the cornea.

The species causing infections of the eye have tentatively been attributed to *Onchocerca gutturosa* or *Onchocerca cervicalis*, *Onchocerca reticulata*, *Onchocerca spp*, and, *Onchocerca lupi* is of particular interest because it affects dogs and it induces acute or chronic ocular disease characterized by conjunctivitis, photophobia, lacrimation, ocular discharge and exophthalmia. Keeping dog as pet is increasing in the world enthusiastically. So, case reports of canine ocular onchocerciasis by O. lupi have also increased in Europe, including in Greece, Portugal, Germany, Hungary, and Switzerland. The dogs serve as reservoir of the parasite deserves to be investigated further to establish both the primary definitive hosts as well as the vectors that serve to transmit infection naturally and to humans.

Trottier and Jeffs (2015) found pea crab, *Nepinnotheres novaezelandiae* parasitized into New Zealand green-lipped mussels *Perna canaliculus* and confirmed the significant impact on the growth of the mussels. Similarly, Tan *et al.*, (1984) documented omnivorous Mitten crab being carnivores when they get matured; it was suspected that such a large population of mitten crabs could change the assembly of the food web. They disturb the abundance and growth rates of various species through competition and predation (Veldhuizen and Stanish, 1999) as well.

In China and Korea, the crab was reported to damage rice crops by feeding on young rice shoots, (Ng, 1988). Similarly, the new seedling of different fruits and vegetables were sniffed off by crabs, (Ali, 1955). Burrowing Impacts of crab is one the major problem associated with the crab, which results bank lurching and erosion (Rudnick *et al.*, 2005 Ali, 1955). There is also alarm that mitten crabs may bio accumulate toxins (Veldhuizen and Stanish, 1999). Crabs accumulate toxic substances such as heavy metals, insecticides, pesticides and detergents present in aquatic habitats through their food, (Ayaki, *et al*., 2005; Reinecke, *et al.*, 2003). Andersen et al., (2005) also reported Aluminum, Arsenic, Cadmium, Chromium, Copper, Nickel, Selenium and Zinc from the gut content analysis of different crab species showing bioaccumulation through Food web Pathways.

Conclusion

Besides having few negative impacts, crabs are multi-useful and diverse decapods. On the one hand, people form developed countries eat crabs as delicacies; on the other hand, the people living below poverty level are consuming crab for maintaining good health, advance precaution for cardiac heart disease, healing many diseases and a good supplementary balanced diet. The social and religious constraint on eating of crabs (in Nepal) is also conveyed as a problem that hampers the business and prevents obtaining accurate prices in the domestic market of freshwater crabs. It is suggested that the government should integrate this health care system into the existing one to ensure proper development and harnessing ethno-medicine in Nepal.

Acknowledgements

The author is highly thankful to Mr. Jay Raj Pinadi for his immense help and assistance during manuscript preparation and to Ms. Neesha Rana, who provided support in many ways.

References

1. Adeyeye EI. Determination of the chemical composition of the nutritionally valuable parts of male and female common West African fresh water crab *Sudananautes africanus africanus* (2002) Int J Food Sci Nutri 53: 189-196.
2. Ahyong ST and Brown DE. New species of *Cymonomus* from southeastern Australia (Brachyura, Cymonomidae) with a key to the Indo-West Pacific species (2002) Crustaceana 75: 1363-1374.
3. Agarwal SK and Kumar S. Western Himalaya: Environment, Problems and Development (ed) Joshi SC and Pangtey YPS (1987) 275-280.
4. Ahyong ST and Ng PK. The Cymonomidae of the Philippines (Crustacea: Decapoda: Brachyura: Pinnotheroidea), with descriptions of four new species. The (2009) Raffles Bulletin of zoology, 20: 233-246.
5. Ali JA. Hunting the land crab *Paratelphusa guerini* (1955) J Bombay Nat His Society 52: 941-945.
6. Andersen LE, Revill AT and Storey AW. Metal Bioaccumulation through Food web Pathways in Port Curtis (2005) Centre for Environmental Management.
7. Bagde Neelima and Jain Shampa. Ethnozoological Practices of Arthropod Animals by Tribes and Rurals of Chhindwara District of Madhya Pradesh, India (2016) World J Pharma Pharmaceuti Sci. 5: 1155-1167.
8. Betlu Albert Lalduhawma Sajem. Indigenous knowledge of zootherapeutic use among the Biate tribe of Dima Hasao District, Assam, Northeastern India (2013) J Ethnobiol Ethnomedi 9: 56.
9. Brandis D and Sharma S. Taxonomic revision of the freshwater crab fauna of Nepal with description of a new species (Crustacea: Decapoda: Brachyura; Potamoidea and Gecarcinucoidea) (2005) Senckenbergiana biologica 85: 1-30.
10. Burton R. International Wildlife Encyclopedia (3rd Ed) (2002) Marshall Cavendish, Marshall 2475-2476.
11. Canario R, Badaro MFS, Ridrigo J and Neves EG. A new species of Troglocarcinus (Decapoda: Brachyura: Cryptochiridae) symbiotic with the Brazilian endemic coral Mussismilia (Anthozoa: Scleractinia: Mussidae) (2014) Marine Biol Res 11: 76-85.
12. Castilho GG, Ostrensky A, Pie MR and Boeger WA. Morphology and histology of the male reproductive system of mangrove land crab (2008) Ucidescordatus. Act Zoologica 89: 157-161.
13. Christensen K. Borneo caving.
14. Castro P. Shallow water Trapezevaiidae and Tetraliidae (Crustacea: Brachyura) or the Philippines (Panglao 2004 expedition), New Guinea, and Vanuatu (Santo 2006 expedition) (2009) Raffles Bulletin zoo 20: 271 -281.
15. Chen WJ, Hsu MJ and Cheng JH. A new species of alpine freshwater crab (Brachyura, Potamidae) from Saingyang National forest recreation area, Taiwan (2007) Crustaceana 80: 897-907.
16. Cheryl G, Tan S and Huang JF. *Baruna sinensis*, a new camptandriine crab from Taiwan (Crustacea: Decapoda: Brachyura: Ocypodidae) (1993) Raffles Bulletin zoo 43: 447-452.
17. Chinlampianga V, Ranjay M, Singh K and Shukla AK. Ethnozoological Diversity of Northeast India: Empirical Learning with Traditional Knowledge Holders of Mizoram and Arunachal Pradesh (2013) Ind j traditional knowledge 12: 18-35.
18. Cumberlidge N. The freshwater crabs of West Africa: family Potamonautidae (1999) IRD editions, Institute de Recereche pour le Developpement: Collection Faune et Flore Tropicales Paris, 1-382.
19. Cumberlidge N. A new species of freshwater crab of the genus *Microthelphusa* (Brachyura: Pseudothelphusidae) from a remote isolated cloud forest on a tabletop mountain in western Guyana, South America (2007) Zootaxa 1447: 57-62.
20. Cumberlidge N and Vannini M. Ecology and taxonomy of a tree-living freshwater crab (Brachyura: Potamoidea: Potamonautidae) from Kenya and Tanazania, East Africa (2004) J Natural History 38**:** 681-693.
21. Cumberlidge, N. and Wranik W. A new genus and new species of freshwater crab (Potamoidea, Potamidae) from Socotra Island, Yemen (2002) J Natural History 36**:** 51-64.
22. Cumberlidge N, Fenolio DB, Walvoord ME, and Stout J. Tree-climbing Crabs from Phytotemic Microhabitats in Rainforest Canopy in Madagascar (2005) J crustacean Bio 25**:** 302-308.
23. Dalu T, Sachikonye MTB, Alexander ME, Dube T, Froneman WP et al. Ecological Assessment of Two Species of Potamonautid Freshwater Crabs from the Eastern Highlands of Zimbabwe, with Implications for Their Conservation (2016) PLOS ONE 11.
24. Das D. Ethnozoological Practices Among Tribal Inhabitants In Khowai District Of Tripura, North-East India (2015) J Global Biosci 4: 3364-3372.
25. Davie PJF and Ng PKL. A new genus for cave dwelling crabs previously assigned to Sesarmoids (Crustacea: Decapoda: Brachyura: Sesarmidae) (2007) Raffles Bulletin Zoo 16: 227-231.
26. Du Preez HH and Mc Lachlan A. Seasonal changes in biochemical composition and energy content of the three-spot swimming crab *Ovalipes punctatus* (De Haan) (Crustacea: Brachyura) (1983) J experiment marine bio ecolog 72: 189-198.

27. Galil BS and Ng PKL. A new species of *Alox* Tan and Ng1995 (Decapoda: Brachyura: Leucosiidae) From Balicasag Island, The Philippines) (2009) Raffles Bulletin Zoo 20: 267-170.
28. El-Damhougy KA, El-Sayed SS, Maged MAF and Al-Hammady Montaser AMM. The growth and reproductive biology of the coral gall crab, *Hapalocarcinus marsupialis* Stimpson, 1859 (Crustacea: Cryptochiridae) from Gulf of Aqaba, Red Sea, Egypt (2018) J Basic Appli Zoo 79: 2
29. Grinang J, Tyan PS, Tuen AA and Das I. Nutrient Contents of the Freshwater Crab, *Isolapotamon bauense* from Sarawak, Malaysia (Borneo) (2017) Tropical life sci res 28: 75-79.
30. Hartnoll RG. Evolution, systematics, and geographical distribution: In biology of the land crabs (ed) Burggren WW and McMahon BR (1988) Cambridge University, New York 45-67.
31. Huang JF, Hsuch PW and Ng PKL. Crabs of the family Hexapodidae (Decapoda: Brachyura) from Taiwan, with description of a new genus and new species (2008) Journal of Crustacean Biology 23: 651-660.
32. Jongkar Grinang J, Min PY and Ng PKL. A new species of tree-hole dwelling freshwater crab of the genus *Arachnothelphusa* Ng, 1991 (Crustacea: Decapoda: Brachyura: Gecarcinucidae) from northern Sarawak, Malaysia, Borneo (2015) Raffles Bulletin Zoo 63: 454–460.
33. Jamir S and Lal P. Ethnozoological practices among Naga tribes (2005) Ind J traditional Knowledge 4: 100-104.
34. Jeyalakshmi Kala KL and Chandran M. Chemical composition of brachyuran crabs from various environments (2014) Int J Pharm Bio Sci 5: 612-620.
35. John Samuel N, Thirunavukkarasu N, Soundarapandian P, Shanmugam A, and Kannupandi T. Fishery potential of commercially important portunid crabs along Parangipettai coast (2004) Proceedings of International conference and exposition on marine living resources of India for food and medicine Aquaculture Foundation of India, Chennai 165-173.
36. Khaled A El-Damhougy, El-Sayed SE Salem, Maged MA Fouda and Montaser AMM Al-Hammady. The growth and reproductive biology of the coral gall crab, *Hapalocarcinus marsupialis* Stimpson, 1859 (Crustacea: Cryptochiridae) from Gulf of Aqaba, Red Sea, Egypt (2018) J Basic Appli Zoo 79: 2.
37. Kumar AB, Raj S, and Ng PKL. Description of a new genus and new species of a completely arboreal crab (Decapoda: Brachyura: Gecarcinucidae) from the Western Ghats in India, with notes on the ecology of arboreal crabs (2017) Journal of Crustacean Biology 37: 157-167.
38. Litulo C. Population structure and breeding biology of the hairy crab *Pilumnus vespertilio* (Fabricius, 1793) (Crustacean: Brachyuran: Pilumnidae) in southern Mozambique (2005) J Natural Hist 39: 1359-1366.
39. Lohani U. Healing with animals in Nepal (2016) J Nepal Sci Olympiad 1: 41-47.
40. Lohani U. Zootherapeutic Knowledge of Two Ethnic Populations from Central Nepal (2012) Ethno-Medi 6: 45-53.
41. Lohani U. Traditional Uses of Animals among Jirels of Central Nepal (2011) Ethno Medi 5: 115-124.
42. Lohoni U. Eroding Ethnozoological Knowledge among Magars in Cental Nepal (2011) Ind J Traditional Knowledge 10: 466-473.
43. Lohani U. Man Animal Relationship in central Nepal. (2010) J Ethnobiol Ethnomedi 6:31.
44. Lohani U. Zootherapeutic Knowledge of the Jirels of Dolakha District, Central Nepal, (2010) J Natural Hist Museum 25: 353-365.
45. McFarlane DA and Lundberg J. The status of the Niah cave crab, *Adeleana chapmani* (Decapoda: Gecarcinucidae) Sarawak, Malaysia (2012) Speleobiol Notes 4: 29-33.
46. Magalhães C and Rodríguez G. The Systematic and Biogeographical status of *Fredius reflexifrons* (Ortmann, 1897) and *Fredius fittkaui* (Bott, 1967) (Crustacea: Brachyura: Pseudothelphusidae) from the Amazon and Atlantic Guianas river basins (2002) Acta Amazonica 32: 677-677.
47. Magalhaes C. Familias Pseudothelphusidae E Trichodactylidae, In GAS Melo (Org.) Manual De Identificacao Dos Crustacea Decapoda De Agua Doce Do Brasil (2003) (Ed) Loyola, Sao, Paulo, SP, Brazil 143-287.
48. Mahawar MM and Jaroli DP. Traditional knowledge on zootherapeutic uses by the Saharia tribe of Rajasthan (2007) Ind J Ethnobio Ethnomed 3: 25
49. Marin IN. The species composition and ecological features of pea crabs of the genus *Pinnixa* White, 1846 (Brachyura: Pinnotheridae) in Peter the Great Bay, the Sea of Japan (2016) Russian J Marine Bio 42: 139-145.
50. Mohammed TAA and Yassien MH. Assemblages of two gall crabs within coral species Northern Red Sea, Egypt (2013) Asian J Scienti Res 6: 98-106.
51. Nagahashi R, Kitaura J, Kawane M, Wada K and Van D. The rare shore crab *Pseudogelasimus loii* (Brachyura, Thoracotremate) rediscovered in Vietnam and genetic support for its assignment in the family Dotillidae. (2007) Crustacean Research 36: 37-44.
52. Naruse T and Jaafar Z. *Geosesarma aeditues*, a new terrestrial crab (Crustacea: Decapoda: Brachyura: Pinnotheroidea) from Ball, Indonesia (2009) The Raffles Bulletin of zoology 57: 183-187.
53. Naruse T and Ng PK. *Scandarma splendidum*, a new species of tree-climbing crab (Decapoda: Brachyura: Sesarmidae) from Sarawak, Malaysia, Borneo (2007) Raffles Bulletin Zoo 55: 337-341.
54. Naruse T and Ng PK. Two new species of leucosiid crabs (Decapoda: Brachyura) from the Ryukyu Islands, Japan (2006) Crustacean research 35: 108-116.
55. Ng PK. On a new species of *Cavernicolous neoliomera* (Crustacea: Decapoda: Brachyura: Xanthidae) from Christmas Island and Ryukyus, Japan (2002) Raffles Bulletin zoo 50: 95-99.
56. Peter KL, Ng PKL, Ng PYC. The freshwater crabs of Danum Valley Conservation Area in Sabah, East Malaysia, with a description of a new species of *Thelphusula* Bott, 1969 (Crustacea, Brachyura, Gecarcinucidae, Potamidae, Sesarmidae) (2018) Zoo Keys 760: 89-112.
57. Ng PK and Naruse T. On the identity of *Pinnixa brevipes* H. milne Edward, 1853, and a new species of *Aphanodactylus tesch*, 1918 (Crustacea: Decapoda: Brachyura: Pinnotheroidea) from the Philippines (2009) Raffles Bulletin zoo 20: 283-290.
58. Ng, P. K. L. and Chia, D. G. B. (1997): Lophozozymus erinnys, a new species of poisonous crab from Australia, with a notes on L pictor (Fabricius, 1798), L. incises (H. Milne Edwards, 1834) and L. edwardsi (Odhner, 1925) (Crustacea: Decapoda: Brachyura: Xanthidae) Raffles Bulletin Zoo 45: 419-443.
59. Ng PKL, Guinot D and Davie PJF. Systema Brachyurorum: Part I. An annotated checklist of extant brachuyuran carbs of the world (2008) Raffles bulletin Zoo 17: 1-286.
60. Ng PK, Guinot D and Iliffe TM. Sesarmoides ultrapes new species, a remarkable sesarmine crab from caves in the Solomon Islands (Decapoda: Brachyura: Grapsidae) (1994) Crustacean 23: 12-22.
61. Ng PKL. The Freshwater Crabs of peninsular Malaysia and Singapore (1988) Department of Zoology, University of Singapore, Shing Lee Publisher Pte., Ltd., Singapore 156.
62. Otranto Domenico and Eberhard Mark L. Zoonotic helminths affecting the human eye (2011) Parasites Vectors 4: 41.
63. Padmanabhan P and Sujana KA. Animal products in traditional medicine from Attappady hills of Western Ghats. (2008) Ind J Traditional Knowledge 7: 326-329.
64. Padmanabhan P. Ethnozoological Studies on The Tribals of Palakkad and Malappuram Districts of Kerala, South India (2007) KFRI Research Report 147.
65. Public Health England. UK Standards for Microbiology Investigations - Investigation of specimens other than blood for

parasites (2017) Issued by the Standards Unit, Microbiology Services 1 of 60.
66. Pushpangadan P, George V, Sreedevi P, Ijinu TP and Ninawe A. Ethnozoological knowledge of Indian scheduled tribe, scheduled caste and rural communities (2014) Ind j traditional knowledge 13: 735-741.
67. Pushpangadan P, George V, Sreedevi P, Ijinu TP and Ninawe A. Ethnozoological knowledge of Indian scheduled tribe, scheduled caste and rural communities (2014) Ind J traditional knowledge 13: 735-741.
68. Radhakrishnan CK and Natarajan R. Nutritive value of the crab Podophthalmus vigil (Fabricius) (1979) Fishery Technology 16: 37-38.
69. Rai R and Singh NB. Medico-ethnobiology in Rai Community: A Case Study from Baikunthe Village Development Committee, Bhojpur, Eastern Nepal (2015) J Inst Sci Technol 20: 127-132.
70. Rana, S. (2016). Ecology of terraced bog paddy field of Sangla Kunch Pwakal Village development committee. Journal of Nepal Science Olympiad, 1(1): 19-28.
71. Reddy P R and Reddy PS. Isolation of peptide hormones with pleiotropic activities in the freshwater crab, Oziotelphusa senex senex (2006) Aquaculture 259: 424-431.
72. Roy MD. Crustacean bio-resources of ethno-medicinal value, traditional knowledge (2014) Proceedings of the National Seminar on traditional knowledge and social practices Promoting Biodiversity Conservation, Annandale Hall, ZSI, Kolkata 127-136.
73. Rudnick DA, Chan V and Resh VH. Morphology and impacts of the burrows of the Chinese mitten crab, Eriocheir sinensis H. Milne Edwards (Decapoda, Grapsoidea), in South San Francisco-Bay, California, USA. (2005) Crustaceana 78: 787-807.
74. Sachs and Cumberlidge. First record of the spiny river crab Liberonautes chaperi (A. Milne Edwards, 1887) as second intermediate host of Paragonimus uterobilateralis in Liberia (1991) Tropical Medi Parasitol 85: 479-471.
75. Sachs and Cumberlidge. The dwarf river crab, Liberonautes latidactylus nanoides Cumberlidge and Sachs, 1989, a new second intermediate host of Paragonimus uterobilateralis in Liberia (1990) Annals Tropical Med Parasitol 85: 435-436.
76. Setalaphruk C and Price LL. Children's traditional ecological knowledge of wild food resources: a case study in a rural village in Northeast Thailand (2007) J Ethnobiol Ethnomed 3: 33.
77. Soundarapandian P, Ravichandran S and Varadharajan D. Biochemical composition of edible crab, Podophthalmus vigil (Fabricius) (2013) J Mar Sci Res Dev 3: 119-122.
78. Sudhakar M, Manivannan K and Soundrapandian P. Nutritive value of hard and soft shell crabs of (Herbst). (2009) Int J Ani Veterinary Adv 1: 44-48.
79. Sunanda H, Shivalingaiah B, Paley T, Asoka W. Demographic characteristic and analysis of pulmonary paragonimiasis in patients attending RIMS, Manipur (2016) Lung Ind 33: 140-143.
80. Takeda M and Ng PKL. The freshwater crab fauna (Crustacea, Brachyura) of the Philippines vi. new cavernicolous crab from Mindanao (2001) Zoologi Sci 18: 1123-1127.
81. Tropical Council for Companion Animal Parasites (2017) Guidelines for the Diagnosis Treatment and Control of Canine Endopararasites in the Tropics.
82. Varadharajan D and Soundarapandian P. Proximate composition and mineral contents of freshwater crab Spiralothelphusa hydrodroma (Herbst, 1794) from Parangipettai, South East Coast of India. (2014) J Aquaculture Res Develop 5: 1-6.
83. Kashyap RV. Ethno-Zoological study in Gondwana Vindhyan Region (Madhya Pradesh), India. (2017) Int J Zoo Studies 2: 66-67
84. Veldhuizen TC and Stanish S. Overview of the life history, distribution, abundance, and impacts of the Chinese mitten crab, Eriochier sinensis (1999) Aquatic Invaders national aquatic nuisance species clearing house 1-6
85. Warner GF. The Biology of Crabs (1997) First published in Great Britain, Paul Elek (Scientific Books Ltd), London 54-58.
86. Wei TP, Hwang JS, Tsai ML and Fang LS. New records of gall crabs (Decapoda, Cryptochiridae) from Orchid Island, Taiwan, North-western Pacific (2006) Crustaceana 78: 1063-1077.
87. Wolodarsky Z, and Loya Y. Population dynamics of Trpezia crabs inhabiting the coral Styllophora pistillata in the north Gulf of Aqabam (1980) Israel J Zoo 2: 204-205.
88. Yeo DCJ, Ng PKL, Cumberlidge N, Magalha˜es C, Savel R et al. Global diversity of crabs (Crustacea: Decapoda: Brachyura) in freshwater Hydrobiologia (2008) Freshwater Animal Diversity Assessment 595: 275-286.
89. Yeo DCJ and Ng PKL. A new species of Geosesarma (Crustacea: Decapoda: Brachyura: Grapsidae) from Pulau Tioman, Peninsular Malaysia (1999) Raffles Bulletin Zoo 6: 189-196.
90. Zannatul F, Zhang X and Hasan MR. Mud crab (*Scylla sp.*) marketing system in Bangladesh (2010) Asian J Food Agro-Industry 3: 248-265.