

Multiformity and Economic Importance of True Brachyuran Crabs

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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.

1. 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, Super-order Eucarida, and Sub-order Pleocyemata in the Section Eubrachyura. The crabs are found in a wide variety of habitat [1] of the world except for Antarctica, [2]; 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 [2] 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., [2, 3].

Some of these crabs have become to live in momentary water sources; and many of them have become completely freshwater dwellers, [4]. Some of the brachyuran crabs possess only six appendages. Huang, et al. [5] described a new genus and a new species of Hexapodidae crab *Latohexapus granosus* that differed from *Hexapus* and *Hexapimus* 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 [6].

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*, [7].

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, [8] and can tolerate a wide range of environmental variations, [9]. 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 [10]. 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.

2. 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 [9] and on the high mountains up to 3500 m above the sea level [11]; they are dominant in estuaries where temperature and salinity fluctuate drastically daily.

2.1. Habitat and Size Variation

El-Damhougy, et al. [12] 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. Osawa, et al. [13] reported crabs of small to very small size collected from 145-769 m deep from the sea. Marin [14] 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 cautilus* in Peter the Great Bay, the Sea of Japan.

Canário, et al. [15] reported new species of *Troglocarcinus hirsutus* a new species symbiont crab found associated with colonies of *Mussismilia* from Bahia State, northeastern region of Brazil. Mohammed and Yassien [16] 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 Vanuatu [17]. The crab of genus *Aphanodactylus* was found from the Philippines and is known as commensal of tube-dwelling terebellid polychaetes of the genus *Loimia* [18]. Whereas, Wei, et al. [19] also recorded new species of coral gall crabs (Decapoda, Cryptochiridae) from Orchid Island, Taiwan, northwestern Pacific.

Nishio, et al. [20] recorded the third rare commensal crab, *Pinnixa penultipedalis* Stimpson, 1858, from Oki Island, Japan whose range extended further northeast. Ho, et al. [21] 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 Cyononimidae. Wolodarsky and Loya [22] described population dynamics of *Trapezia* crabs inhabiting the coral *Stylophora pistillata* in the north Gulf of Aqaba.

Terrestrial crab, *Geosesarma aedituens* had been recorded from the island of Bali, Indonesia [23]. Similarly, the terrestrial crab of genus *Cyonomus* was recorded from Philippines Ah Yong and Ng [24]. Ah Yong and Brown [25] identified two new species of *Cyonomus* A. Milne Edwards, *C. kapala* new species, from New South Wales and *C. soela* new species, from Tasmania, closely resembled *C. curvirostris* 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 [26] 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 known to aestivate (summer sleep) within the burrows plugged by clay for up to six years, waiting for the rain to come [2].

Kumar, et al. [27] Described a new genus and new species of a completely arboreal crab (Decapoda: Brachyura: Gecarcinidae) from the Western Ghats in India, with notes on the ecology of arboreal crabs. Ng [28] described the identities of the highland vampire crabs, *Geosesarma foxi* [29] and *G. sereni* [30], with description of a new phytotelmic species from Penang, Peninsular Malaysia (Crustacea: Decapoda: Brachyura: Sesarmidae). [31] 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. [32] reported a new species of tree-hole dwelling freshwater crab of the genus *Arachnothelphusa* [33] (Crustacea: Decapoda: Brachyura: Gecarcinidae) from northern Sarawak, Malaysia, Borneo. Ng, et al. [34] provided the taxonomy and ecology of *Labuanium politum* [35] (Crustacea: Decapoda: Sesarmidae), an obligate arboreal crab on the nipah palm, *Nyba fructicans* (Arecaceae). [36] recorded *Microthelphusa meansi* from a remote isolated cloud forest on a tabletop mountain in western Guyana, South America. Tree climbing crab of genus *Scandarma splendidum* is recorded from the Sarawak, Malaysia, Borneo [37].

Similarly, *Malagasya atongilensis* and *Labuanium gracilipes* are reported as tree climbing phytotelmic sesarmid crab in rainforest of Masoala Peninsula, Madagascar [38]. *Potamonautes raybouldi* is a small phytotelmic crab reported from the temporary bodies of water in the tree holes of East Usambara Mountains, harbor [4]. The fresh water crab of genus *Socotra* has been recorded from the semi-arid highlands of Socotra Island, Yeman [39]. *Gecarcinautes goodmanni* and *Gecarcinautes gouaoui* have been reported as tree climbing crabs from the *Panadnus* leaf axial in Madagascar [40]. 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 [40]. The freshwater crab *Geothelphusa haituan* has been reported from 2000 m high alpine region of Taiwan [41].

The freshwater crab *Barytelphusa lugubris* has been reported from very High Mountain up to 3500m [11]. Christensen [42] reported that *Arachnothelphusa 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 [43] reported the status of the Niah cave crab, *Adeleana chapmani* from Sarawak, Malaysia. *Alox tormos* was describes as cave dwellers in Balicasag Island, Philippines [44]. Semi-terrestrial crabs, *Sesarmoides kraussi*, *S. longipes* and *S. borneensis* are recorded in marine caves from Indo-West Pacific intertidal mangrove and Estuary [45]. The cave-dwelling crab *Neoliomera cerasinus* is described from marine caves in Christmas Island and Ryukyus [46]. Takeda and Ng [47] diagnosed freshwater crab of the genus *Sundathelphusa hades* from the cave of Mindanao in Philippines. Similarly, Ng, et al. [48] described a new species of remarkable sesarmine crab, *Sesarmoides 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 bosci* [49] at Inhaca Island, Southern Mozambique was 2-12mm Litulo [50]. Cheryl, et al. [51] 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.

Ah Yong and Brown [25] described two species of *Cyonomus curvirostris* and *C. bathamae* New South Wales with average CL 3mm and CW 3.2mm for ovigerous female. Naruse and Ng [52] 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 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, [7, 53].

2.2. 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 naturalists, 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 [9]. 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, [54]. Many physiologists, biologists and researchers have been using crabs as a biological model due to their ready availability and plastic in nature, [7, 55-57].

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 [10]. 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 [58-61]. 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 [61].

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, [3]. Crabs are one of 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 [62]. 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 [63]. 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 [64].

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*, *Podophthalmus vigil*, *Charbdis feriata*, *C. lucifera*, *C. nator*, *C. granulata* and *C. truncata* [65]. All these species are exploited in aquaculture. In some parts of the world, crabs are used in the form of staple food [7]. 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 [54].

Freshwater crabs are an important protein source and are sold in many parts of the world Dalu, et al. [66]. Grinang, et al. [67] found that muscles of the freshwater crab contain a substantial amount of nutrients in particular water content (male = $79.31 \pm 2.30\%$, female = $77.63 \pm 0.56\%$), protein (male = $77.47 \pm 6.11\%$, female = $63.28 \pm 3.62\%$), 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 [68] 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, et al. [69] 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* [70] and reported 10 essential amino acids in *Portunus sanguinolentus* among which, 8 individual essential amino acids are were from hard the shell crabs and 7 amino acids in soft shell crabs. Adeyeye [71] 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 [72] found mean values for protein (85.0%), lipid (2.9%), carbohydrate (11.53%) and ash (49.55%) in the three-spot swimming crab *Ovalipes punctatus*. But, Radhakrishnan and Natarajan [73] 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.

2.3. Ethno-Medicine

Crabs are also ethno-zoologically as well as medicinally important creatures. Kashyap [74] believed that the meat of Crab *Paratathysa spp.* is a promoter of strength and is a good remedy for the disease of the blood. Bagde and Jain [75] *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. [76] reported that crab curry is used to treat typhoid and cold. In Nepal, Pahari ethnic groups use roasted freshwater crabs (*Himalayapotamon atkinsonianum*) to stop bed-wetting in children, whereas Danuar uses cooked crabs as reconstitutes and neutraceuticals for asthma and wound healing Lohani [77]; Lohani [78]. Das [79] reported that patient suffering from Asthma consume whole body flesh food of *Carcinous spp* for about three months. Rai and Singh [80] 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, et al. [81] 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 [82]. Betlu [83] described that whole or dried or fresh parts of freshwater crab *Paratathysa sp.* [84] 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, [83].

Tribal people from Mizoram and Arunachal Pradesh use crab *Scylla serrata* to cure diabetes in old age people and in curing skin disease, Chinlapianga, et al. [85]. Lohani [86] and Lohani [87] reported that *Himalayapotamon atkinsonianum* [88] 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 [89, 90].

Crabs [91] 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 [92] fund boiled flesh of *Cancer pagurus* to relieve cough in the Attappady hills of Western Ghats, India. Padmanabhan [93] 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 [94] 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 [95] 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) phluuangensis* enriches the calcium supply and reduces cholesterol and triglyceride level in the blood of human body [96].

In Bangkok, the tonic derived by pounding the whole body of freshwater crab *Ranguna (Ranguna) phluuangensis* in a mortar is used to detoxify the blood [96]. Crab curry is used to treat cold, asthma and typhoid and is also given as tonic to convalescing patients [97].

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 [98]. In Egypt, Pfeiffer, et al. [99] reported that the whole crabs are eaten by childless women in the belief of becoming pregnant.

2.4. 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 [100]. 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, [101].

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, Magalhães and Rodríguez [102] described *Potamocarcinus reflexofrons* and *P. fittkai* as vectors of paragonimiasis in the Amazon and Atlantic Guianas River basins. Cumberlidge [103] described *Sudanautis aubryi* 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 [104] and Sachs and Cumberlidge [105] reported first record of the spiny river crab and the dwarf river crab *Liberonautes chaperi* [106] *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, [101].

Public Health England [107] 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 [100]. 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, [108]. 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. Trotter and Jeffs [109] found pea crab, *Nepinnotheres novaeseelandiae* parasitized into New Zealand green-lipped mussels *Perna canaliculus* and confirmed the significant impact on the growth of the mussels. Similarly, Tan and Tashjian Jr [110] 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 [111] as well.

In China and Korea, the crab was reported to damage rice crops by feeding on young rice shoots, [112]. Similarly, the new seedling of different fruits and vegetables were sniffed off by crabs, Ali [113]. Burrowing Impacts of crab is one the major problem associated with the crab, which results bank lurching and erosion [113, 114]. There is also alarm that mitten crabs may bioaccumulate toxins [111]. Crabs accumulate toxic substances such as heavy metals, insecticides, pesticides and detergents present in aquatic habitats through their food, Ayaki, et al. [115] and Reinecke, et al. [55]. Andersen, et al. [116] 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.

3. Conclusion

Besides having few negative impacts, crabs are multi-useful and diverse decapods. On the one hand, people from 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.

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