MORPHOLOGICAL DESCRIPTION AND POPULATION STRUCTURE OF AN OBLIGATE ARBOREAL CRAB (*Labuanium politum*) AT KAMPUNG TANJONG ASSAM, SPAOH, SARAWAK

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Morphological Description and Population Structure of an Obligate Arboreal Crab (*Labuanium politum*) at Kampung Tanjong Assam, Spaoh, Sarawak

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DECLARATION OF AUTHORSHIP

I, AKMA IDDIN BIN MASINI declare that the final year project report entitled: **MORPHOLOGICAL DESCRIPTION AND POPULATION STRUCTURE OF AN OBLIGATE ARBOREAL CRAB (*Labuanium politum*) AT KAMPUNG TANJONG ASSAM, SPAOH, SARAWAK.**

and the work presented in the report are both my own, and have been generated by me as the result of my own original research. I confirm that:

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Signed: 

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LIST OF ABBREVIATION

L.	*Labuanium*
CW	Carapace Width
CL	Carapace Length
EtOH	Ethanol

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ABSTRACT

Labuanium politum is an obligate arboreal crab that inhabits the nipah palm tree population in the mangrove area. *L. politum* also locally known as 'Geramak Apong'. This crab is nocturnal species. Morphological descriptions and population structure of *L. politum* were studied on 17 September 2015 at Kampung Tanjong Assam, Spaoh. Meanwhile, the captivity behaviour study was also conducted on 23 March 2016 at Kampung Tanjong Assam, Spoah. These crabs were caught using a special hook. Samplings covered six plots that involved disturbed and undisturbed area. Eleven samples have been kept alive in a plastic container and two samples also kept in an aquarium to observe their behaviour in captivity. This crab exhibited with squarish carapace, same size of chela and reddish brown in colour. The range size of *L. politum* collected was from 17.53 mm – 35.99 mm for carapace width (CW) and 19.54 mm – 40.10 mm for carapace length (CL). The size of an egg is approximately 330 µm. The population of *L. politum* were documented higher in undisturbed area compared to disturbed area. The findings indicated that male crabs found were bigger in size class compared to female. The mean of carapace size (CW and CL) of *L. politum* showed bigger size in undisturbed area compared to disturbed area and the statistical analysis (2 sample independent t-test, p = 0.05) showed significant differences in the mean size of carapace. The findings of the studies also indicated that the size of males dominated the biggest size class which at range class size 38 mm – 41 mm. The sex ratios of *L. politum* documented mostly were skewed towards female and 20 % of the females were found berried. The overall evaluation based on densities indicates that Kampung Tanjong Assam populations of *L. politum* declining caused by exploitation from local people. The sex ratio was reported skewed towards female that might related to densities of nipah palm tree and territorial behaviour of male crabs.

Keyword: *Labuanium politum*, obligate arboreal crab, morphology, population structure, behaviour

ABSTRAK

Labuanium politum adalah ketam pemanjat pokok yang mendiami populasi pokok nipah di kawasan bakau. L. politum juga dikenali dengan nama tempatan sebagai 'Geramak Apong. Ketam ini hanya keluar pada waktu malam. Diskripsi morfologi dan struktur populasi L. politum dikaji pada 17 September 2015 di Kampung Tanjong Assam, Spaoh. Sementara itu, kajian tingkah laku dalam kurungan juga telah dijalankan pada 23 Mac 2016 di Kampung Tanjong Assam, Spoah. Ketam ini ditangkap dengan menggunakan cangkuk khas. Kajian meliputi enam plot yang melibatkan kawasan terganggu dan tidak terganggu. Sebelas sampel hidup telah disimpan di dalam bekas plastik dan dua sampel lagi disimpan dalam akuarium untuk pemerhatian tingkah laku ketam tersebut dalam kurungan. Ketam ini menunjukkan karapas segi empat, saiz sepit yang sama dan berwarna merah perang. Jarak saiz L. politum adalah dari 17.53 mm - 35.99 mm untuk lebar karapas (CW) dan 19.54 mm - 40.10 mm bagi panjang karapas (CL). Saiz telur adalah lebih kurang 330 mikron. Kepadatan populasi L. politum lebih tinggi di kawasan tidak terganggu berbanding kawasan terganggu. Dapatan kajian menunjukkan kelas saiz karapas jantan lebih besar daripada betina. Min saiz karapas (CW dan CL) menunjukkan saiz yang lebih besar di kawasan tidak terganggu berbanding kawasan diganggu dan ada perbezaan yang signifikan dalam analisis statistik (menggunakan Ujian t, 2 sampel tidak bersandar, p = 0.05). Dapatan kajian juga menunjukkan bahawa saiz jantan mendominasi kelas terbesar yang pada saiz kelas 38 mm - 41 mm. Nisbah jantina L. politum didokumenkan kebanyakannya telah condong ke arah betina dan 20 % daripada betina ditemui bertelur. Penilaian keseluruhan berdasarkan kepadatan menunjukkan bahawa populasi L. politum di Kampung Tanjung Assam menurun disebabkan oleh eksploitasi orang tempatan. Nisbah jantina dilaporkan condong ke arah betina yang mungkin disebabkan oleh kepadatan pokok nipah dan tingkah laku semulajadi ketam jantan yang ditunjukkan dalam pemerhatian kurungan

Kata Kunci: L. politum, ketam obligat arboreal, morfologi, struktur populasi, tingkah laku

1.0 INTRODUCTION

Mangroves consist of trees or large shrubs, including ferns and nipah palm (*Nypa fruticans*), which normally grow in or adjacent to the intertidal zones in the tropics and subtropics region (Middlejans, 2014). These plants are well adapted with the high salinity environment (Tomlinson, 1986; Spalding *et al.*, 2010). Mangroves support high diversity of living organisms and usually dominated by aquatic invertebrates (Muhamad, 2011). Mangroves forest provides wide varieties of goods and services. One of the species that can be found at mangrove area is *Labuanium politum* and locally known as 'Geramak Apong'. In local dialect, the term 'Geramak' means small crab that posses with non-swimming leg and 'Apong' means nipah palm tree. This crab is an obligate arboreal crab that lives in the nipah palm tree. Arboreal crabs are large number of crab species inhabits the nipah palm tree (Lee, 1998).

The narrow space of the nipah stalks provides good shelter for this crab because it is often filled with mud and water. Due to its flat carapace this species is perfectly adapted to hide between the nipah stalks (Ng *et al.*, 2015). This crab is being exploited by local people as food and caught this crab using hook with sharp end tip made from wire or steel that is attached to a bamboo approximately 30 cm known as 'pengait'. Other human activities on the nipah palm tree area for examples socio-economic of constructions activities can also affect the habitat of *L. politum*. Nipah palm tree are tapped to obtain the sap to make local wine called 'tuba' and sugar (Green *et al.*, 2002).

Based on prior observation and personal communication with local people, only one species existed in one stalk of nipah tree. This crab is nocturnal as they does not leaving their hiding spot during day time and it will roam outside the stalks during night. In addition, this species are non-seasonal crabs.

The studies of arboreal crab that live in nipah palm tree had been done by Ng *et al.*, (2015). According to Ng *et al.*, (2015), that crab was identified under *L. politum* based on the morphological characteristics. The studies were conducted at Philippines, Malaysia and Singapore. *L. politum* feed on the leaflets of nipah tree and often use their last pair of ambulatory legs to gain balance during climbing. The studies are related in noting the taxonomy of *L. politum* and the ecological behaviour.

The studies related to this specific crab species were still low. The studies only had been found at other countries including Sungai Sedili, Johor in Malaysia. Therefore, the detail information about this species is still lacking especially about their population structure, morphological description and ecology of *L. politum*. Therefore this study was conducted in order to: 1) describe the morphological characteristics of *L. politum* at Kampung Tanjong Assam, Spaoh Sarawak. Furthermore, in Kampung Tanjong Assam the population of *L. politum* seems declining since the construction of human shelter and embankment to prevent flood. Hence, the study was done to: 2) document the population structure *L. politum* at Kampung Tanjong Assam, Spaoh Sarawak that emphasized population densities, size class distribution, relationship between carapace width (CW) and carapace length (CL), sex ratio and brooding of females. Besides that, this study also conducted to: 3) observe the behaviour of *L. politum* from Kampung Tanjong Assam, Spaoh in captivity.

2.0 LITERATURE REVIEW

2.1 Taxonomy of Sesarmid Crab (*Labuanium politum*)

The key in identification for Sesarmidae Family is derived from Ng *et al.*, 2009.

54.b) Carapace well calcified; usually squarish or transversely ovate. Maxilliped 3 ischium and merus free. Free living. 56

56.a) Distinct rhomboidal gap between closed maxillipeds 3. Mandibles usually visible when mouthparts closed. 57

57.b) Carapace subquadrangular to quadrangular; suborbital crest with small granules; pterygostomial region glabrous to moderately setose. Pereopods 2-5 unarmed or with small chitinous spines on dactyli. 58

58. b) Merus and ischium of maxilliped 3 with distinct oblique setoe ridge. Pterygostomial region densely setose, setae arranged in reticulate pattern. .....**Sesarmidae**

Taxonomic classification of *L. politum* is based on Ng *et al.*, 2009 and World Register of Marine Species (WoRMS).

Phylum: Arthropoda (Latreille, 1829)

Subphylum: Crustacea (Brunnich, 1772)

Class: Malacostraca

Order: Decapoda (Latreille, 1802)

Family: Sesarmidae (Dana, 1851)

Genus: *Labuanium* (Serene & Soh, 1970)

Species: *Labuanium politum* (De Man, 1888)

2.2 Mangrove ecosystem

Mangrove ecosystems are very important for coastal resources in the aspect of human sosio-economic development. This ecosystem also protect the coast from erosion by the wave currents, UV-radiation to the coastal area, maintain the water level in flood prevention, and global carbon cycle (Kathiresan, 2012). Each zone of mangrove area inhabit by different mangrove plants. This results in different species of crabs that inhabit the area (Dahdough *et al.*, 2002). Nipah palm tree (*Nypafruticans*) is one of the mangrove plants in mangrove ecosystem of Southeast Asia that grow along the riverbank (Middeljans, 2014). It has fronds also known as leaves that can grow nine metres long, and flower stalks that grow upwards from the surface (Giesen *et al.*, 2007) Nipah palm tree grow in soft mud and slow moving tidal within salinity around 35 part per thousand. Nipah palm tree produced sap by tapping to produce amorphous sugar, alcohol, vinegar and local wine called 'tuba' (Green *et al.*, 2002).

2.3 Ecology of obligate arboreal crabs

Crabs are key component of Indo-Pacific mangroves ecosystem (Lee, 1998) and arboreal crabs are well known and have a large number of species in Indo-West Pasific (Ng *et al.*, 2015). This nocturnal species live many metres above the ground in pytotelms, and feeding on a variety of plant matter (Ho, 2003; Lee 2008; Li and Chiu, 2013). Phytotelms indicate the water bodies contained within some part of terrestrial plant that served as habitat to associated flora and fauna (Lehtinen, 2004). Obligate arboreal crabs were believed to be nocturnal. (Ng *et al.*, 2015).This species are adapted to the narrow hiding space between the stalks and the leaves by having flat carapace (Ng *et al.*, 2015). Research indicates that this species cling to the mangrove stems in avoidance from very long immersion in water

during high tides and it could not been confirmed yet (Jimmy, 2009). Growth and reproduction of the crabs may in turn be influenced by the associated mangrove species, mainly through the provision of food and the development of the landward mangroves will strongly affect survival of the crabs (Lee, 1998).

2.4 Morphology studies of Sesarmid crabs

Morphological studies of Sesarmid crab is the studies of made-up structure that represents the crab species under Family Sesarmidae. The morphology study of arboreal crab, *L. politum* have been reported by Ng *et al.*, (2015) at Philippines, Malaysia and Singapore and the taxonomy reported how the species adapt with its habitat based on the characteristics. The traits reported in the study of *L. politum* were, frontal view of carapace, chela, ambulatory legs, dorsal and ventral view of crabs. *L. politum* flat carapace is designed for hiding between the leaves. The last pair of ambulatory legs designed for gripping and balancing (Ng *et al.*, 2015). The carapace length, number of teeth on chela (Akin-Oriola *et al.*, 2005), and the number of epibranchial tooth are the morphometric and meristic characteristics of crabs are measured.

2.5 Related studies on population structure of crabs

The density of mangrove can be quantified using several technique techniques such as visual counting, transect, burrow casting and quadrats (Skov *et al.*, 2002). However, pitfalls trap are not applicable in estimating population size of mangrove crabs because they register crab activity rather than the abundance, while some of the species can avoid the traps (Lee, 1998). Furthermore, the results of the finding may be varied between the

locations of sampling. Besides that, studies on population structure can reflect the effects on recruitment, mortality rates and behavioural difference in population (Diaz and Conde, 1989). Population structure studies the composition of some organisms in certain area which comprise size class distribution, sex ratio and size class distribution (Lins and Costa, 2010).

The differences in the population densities can be attributed from the environmental factors that are intrinsic to a particular mangrove crab population such as primary productivity, pneumatophore density and pattern of larval recruitment (Piou *et al.*, 2009; Sandrini-Neto and Lana, 2012; Hirose *et al.*, 2015). Besides that, the densities of crabs' population depend on the growth rate and the amount of females' energy for reproduction (Diaz and Conde, 1989; Lins and Costa 2010). However, the population densities of mangrove crabs might also be consequences of the overexploitation by humans for their own consumption or economic resources (Hirose *et al.*, 2015). This make human exploitation is highly impactful towards the natural population of mangrove crabs.

Colpo and Negreiros-Fransozo (2004) also reported that number of male dominated in their studies and the average median size of male bigger than female using catch-per-unit-effort (CPUE) technique for sampling. Body size variations are common among the crustaceans that may reflects the phenotypic plasticity of the organisms of the influence of environmental factors such as photoperiod, temperature and food availability (Campbell and Eagles, 1983; Negreiros-Fransozo *et al.*, 2002; Hirose *et al.*, 2015). The relationship of body size between the years shows a relationship, with a tendency to diminution of maximum body size in relation to time (Hirose *et al.*, 2015). Besides that, exposure to tide action seems to be important since it may prevent the retention of litters. Otherwise, hydrological features, sedimentology and infauna composition may affect the growth and reproductive success of crabs (Colpo and Negreiros-Fransozo, 2004). The size class

distribution of crab between different populations might be the same if the environmental pressure (Lins and Costa, 2010).

The sex ratio skewed towards female due to high mortality rate of male. Males are highly territorial behaviour and tend to fight to gain their prices which are mating and territory (Lins and Costa, 2010).

3.0 MATERIALS AND METHODS

3.1 Study Area

The location of sampling is Kampung Tanjong Assam, Spaoh which located along Sungai Padeh. The sample was collected a six different plot as shown in Table 1 on 7 November 20115 until 9 November 2015. Coordinate of each study site were obtained using Global Positioning System (GPS) (GARMIN; GPSMAP® 78S). Figure 1 showed the location of sampling site.

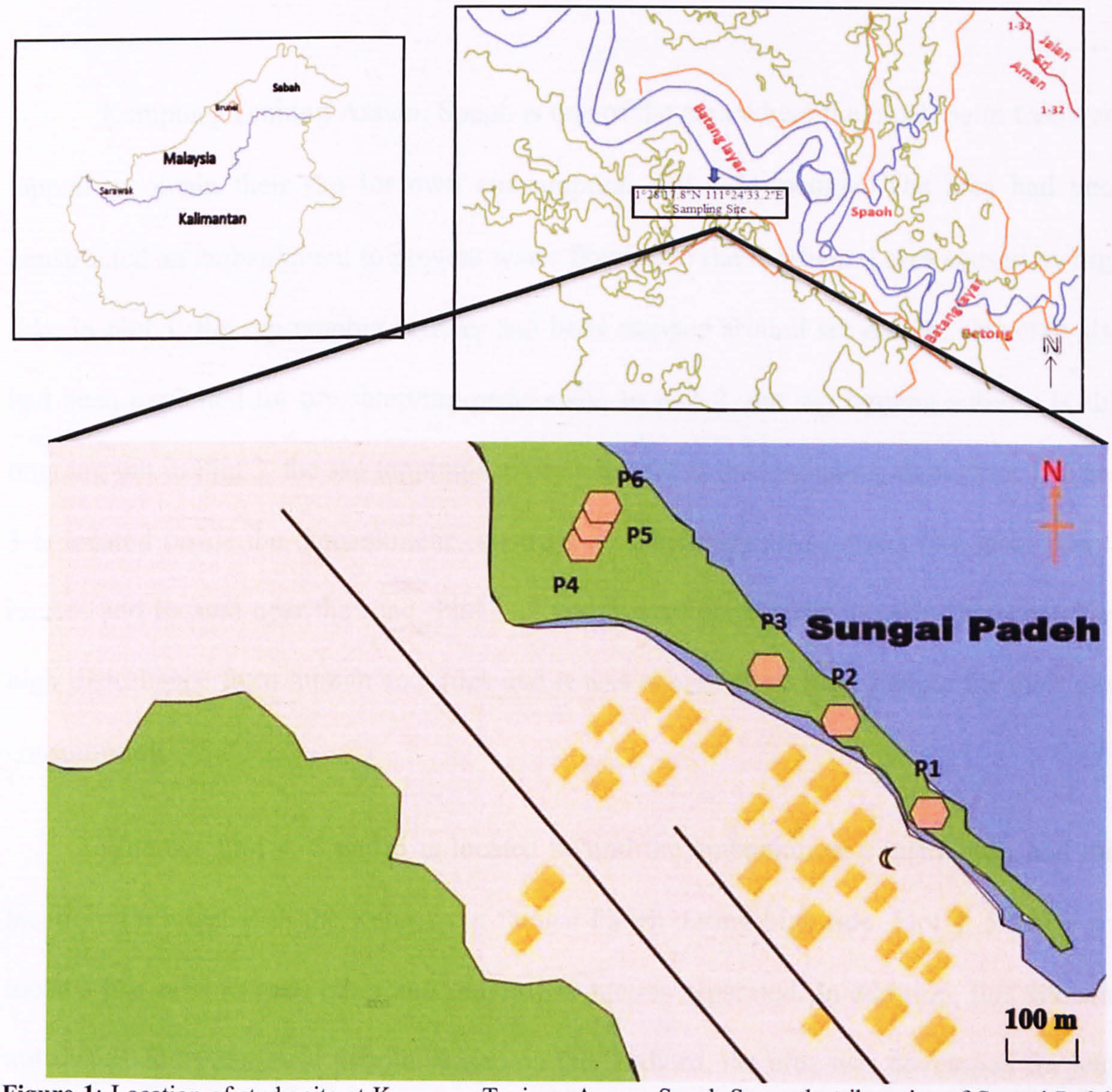

Figure 1: Location of study site at Kampung Tanjung Assam, Spaoh Sarawak, tributaries of Sungai Padeh. With the positioning of six plots. P1 = Plot 1, P2 = Plot 2, P3 = Plot 3, P4 = Plot 4, P5 = Plot 5, P6 = Plot 6 then ▬ = road, ☾ = mosque, ▬ = house. The green area indicated Nipah palm tree population area.

Table 1: The coordinates and description of plots

Plot	Coordinate	Plot Description
1	N 01°28.226' E 111°24.483'	No sap tapping activities around six month. *L. politum* exploited.
2	N 01°28.297' E 111°24.428'	Sap tapping on going
3	N 01°28.348' E 111°24.385'	The sap tapping was still at the beginning stage
4	N 01°28.382' E 111°24.345'	Undisturbed area. Behind the embankment
5	N 01°28.389' E 111°24.347'	Undisturbed area. Behind the embankment
6	N 01°28.390' E 111°24.350'	Undisturbed area. Behind the embankment

Kampung Tanjung Assam, Spaoh is one of the area where the nipah palm tree were tapped to obtain their sap for own consumption and side income. The area had been constructed an embankment to prevent water flowing to the residential area caused by high tide. In plot 1, the sap tapping activity had been stopped around six month. The crab also had been exploited for pre-sampling previously. In plot 2, the sap tapping activity is still ongoing but in Plot 3, the sap tapping activity was still at the beginning stage. Plot 1, 2 and 3 is located inside the embankment construction. The areas also have a few local people houses and located near the road. Plot 1, 2 and 3 were considered the area that contained high disturbance from human activities and it was exploited by local people for their own consumption.

Whereas Plot 4, 5 and 6 is located behind the embankment construction and this location got intact with the water from Sungai Padeh during high tide. Plot 4, 5 and 6 are located just next to each other and only a few metres separated. In addition, this site was not disturbed by the local people. Based on the landlord, the area was developed for jetty and not been used for almost three years since the construction of embankment. Old fragments of boąts also had been found during the sampling activities.

3.2 Sample Collection

Direct quantification of crabs were carried out within six plots put randomly at six different site of nipah palm tree area. The estimation studies only account area which inhabit by the species by not including the placed without nipah palm tree such as drainage, road, river and other sites (Skov *et al.*, 2002). The plots sampling method was adapted from Shoval and Raveh (2004) that enable to analyse the data simultaneously base on the observations and analysis. A special hook locally known as 'pengait' (Figure 2) was chosen to catch the samples. Besides that, the catching process also aid by plastic and long forceps depending on current situation to minimize the injuries of samples caused by 'pengait'. We set up the plot in selected area using range finder (Nikon; Prostaff S). The plots size was different because numbers of nipah palm tree in selected site were uneven to prevent unbiased results. Then, the numbers of nipah palm tree in the plot were counted. GPS reading was performed to measure the coordinate. Then each of nipah palm tree in the plots were checked for the presence of *L. politum*. The samples were caught carefully to minimize the damaged occurred for morphological identification of the crab. The samples were temporarily sedated in cooler box while determining their sexes and preserved with 10% buffered formalin to fix the tissue and can be applied to crustacean organisms for at least one day (Amaia *et al.*, 2000). Then, the samples were transferred into 70% ethanol (EtOH) for long term preservation and analysis (Lins and Costa, 2010).

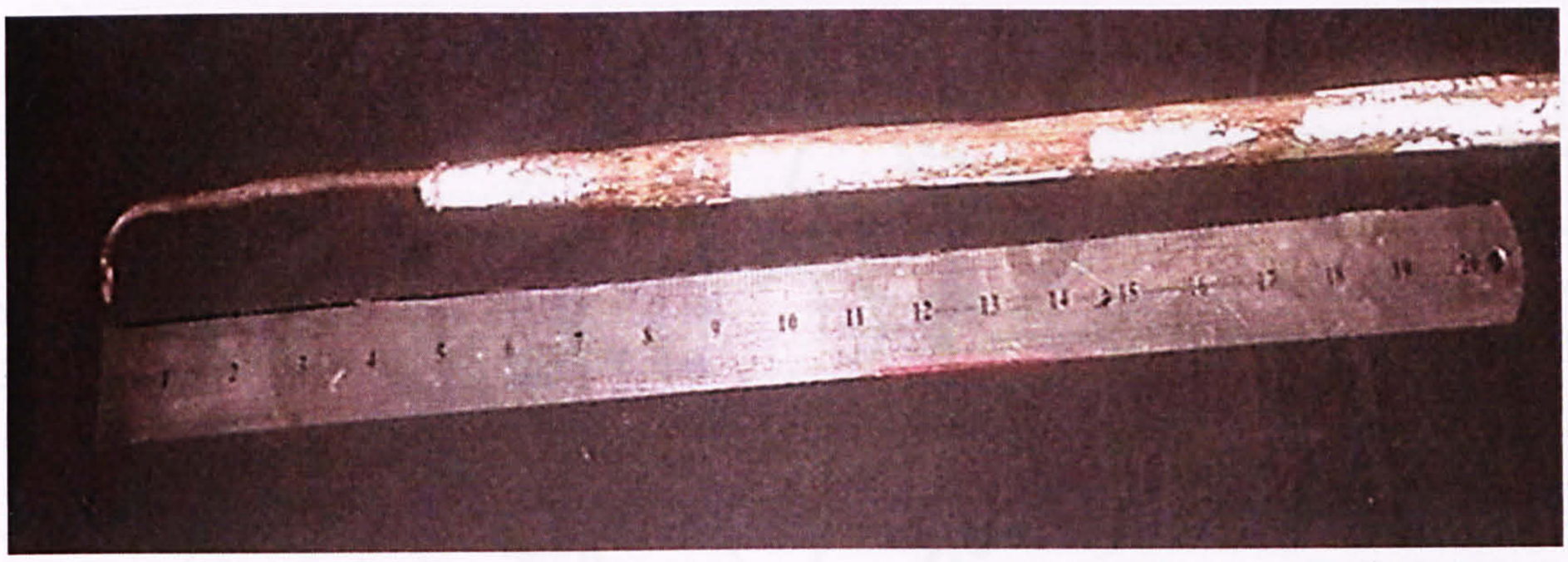

Figure 2: Special hook locally known as 'pengait' used to catch *L. politum* at Kampung Tanjong Assam.

3.3 Morphometric Measurements and Identification of *Labuanium politum*

Carapace Length (CL) and carapace width (CW) of each samples obtained from plots were measured using dial calliper (Mitutoyo) to the nearest 0.01 mm. The CL and CW were being used in determining the morphometric relationship of *L. politum*. The morphological identification of physical characteristics of *L. politum* referred to Ng *et al*., (2015); Ng *et al*., (2009) using illustration in Figure 4-9. Size of eggs also had been calculated using stereo microscope (Ravi and Manisseri, 2013) (Brand: RaxVision) (Figure 19). The samples for identification work were photographed using camera (Canon PowerShot A3200 IS).

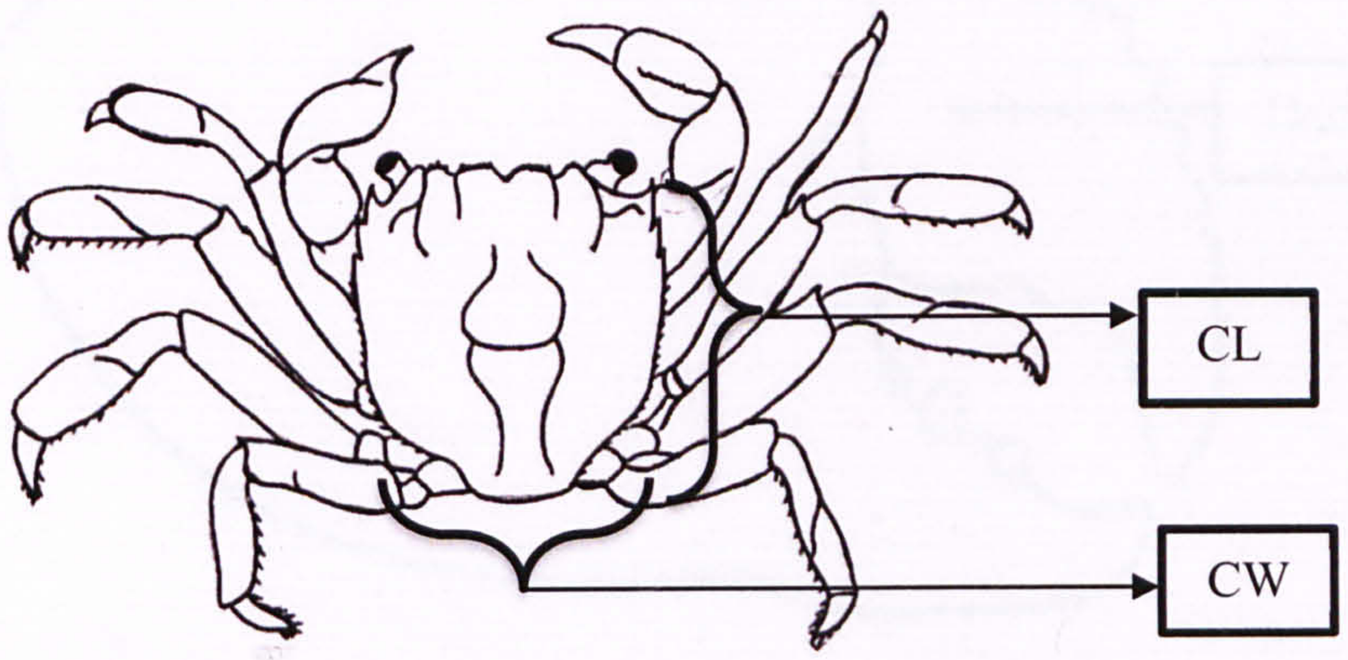

Figure 3: The measurement of carapace length (CL) and carapace width (CW) using the longest distance. Modified from Gregati and Negreiros-Fransozo (2007).

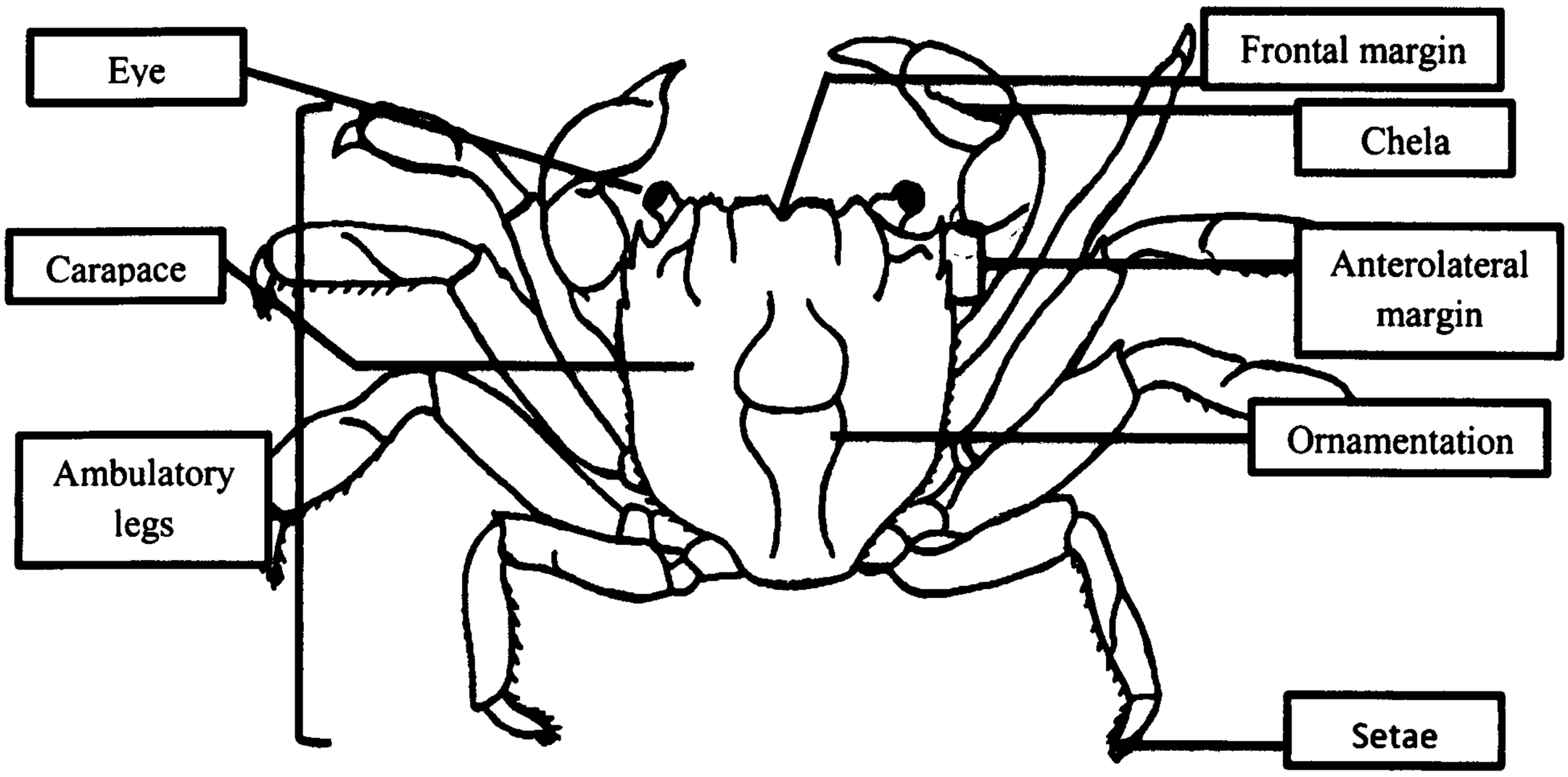

Figure 4: Illustration of *L. politum* for taxonomic identification that modified from Ng *et al.*, (2009).

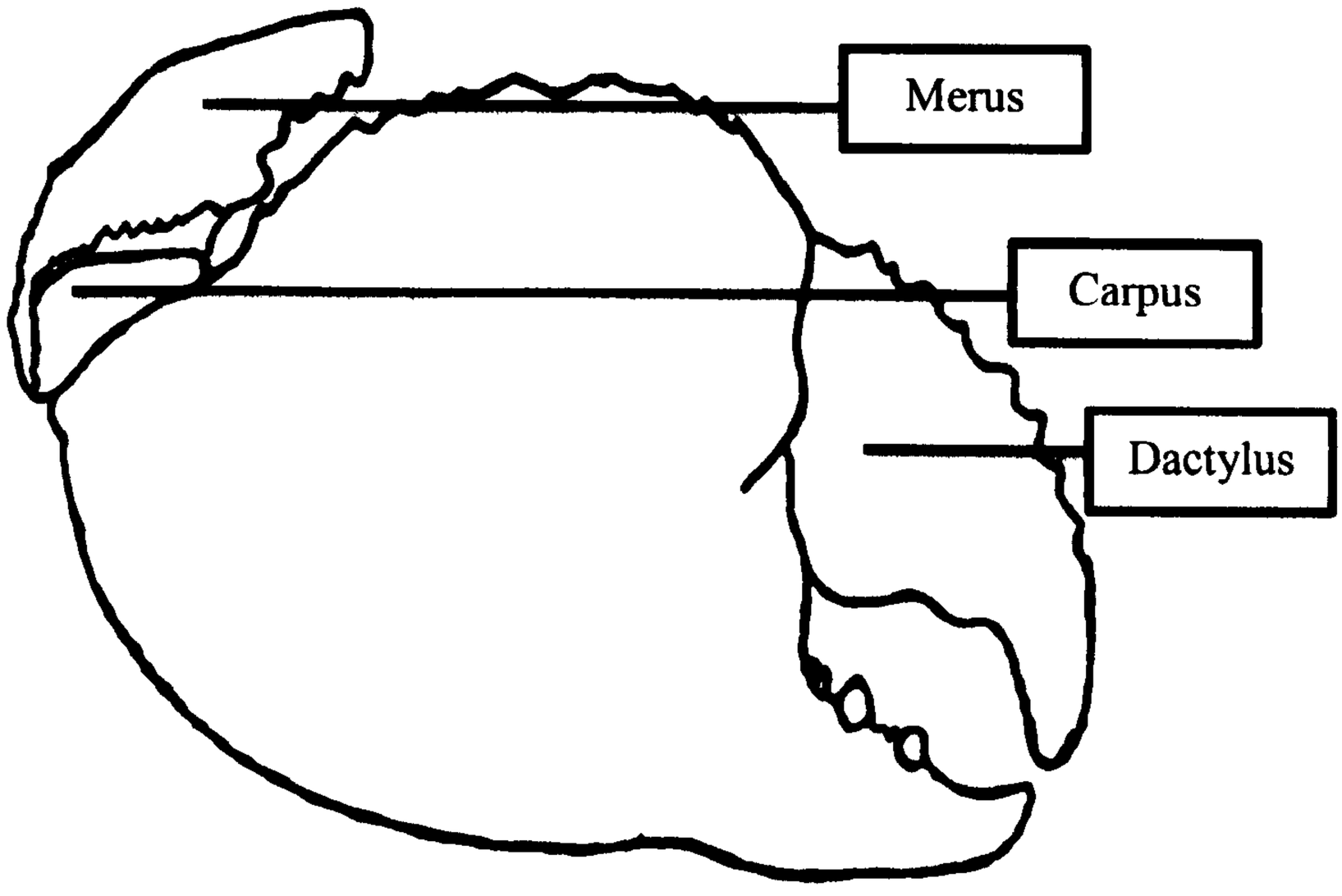

Figure 5: Illustration of outer view of chela of *L. politum* from Kampung Tanjong Assam modified from Ng *et al.*, (2009).