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OCCURRENCE OF ARBOREAL-CLIMBING GRAPSIDS AND OTHER BRACHYURANS IN TWO MANGROVE AREAS OF SOUTHERN LUZON, PHILIPPINES

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ABSTRACT

Despite the obvious importance to ecosystem functioning, the most prominent groups belonging to the Grapsidae are generally regarded as less studied in the Philippines. In this study, the occurrence of arboreal-climbing grapsids and other brachyurans associated with the mangals of Quezon and Catanduanes was considered including some aspects on climbing, burrowing and feeding behaviour of selected grapsids represented by *Hemigrapsus, Pseudograpsus* and *Metopograpsus*. The non-grapsoid taxa are represented by Varunidae (*Ptychognathus*), Portunidae (*Charybdis*, *Portunus*, *Scylla*, *Thalamita*); and Eriphiidae (*Epixanthus*). *Metopograpsus latifrons* (White 1847) [*Grapsus*] is an exclusive mangrove tree climber (EMTC), while *Pseudograpsus elongatus* (A. Milne Edwards 1873) is described here as occasional mangrove tree climber (OMTC). *Hemigrapsus (Hemigrapsus) penicillatus* (De Haan 1835) *[Grapsus (Eriocheir)]* is a non-mangrove arborealclimbing species (NTC) only seen on crevices of the mangrove areas. *P. elongatus* creates burrows most often than *M. latifrons*. Likewise, the study provides information on the presence of the portunid orange mud crab (*Scylla olivacea*); the green mud crab (*S. paramamosain*); the varunid (*Ptychognathus altimana*); and extremely abundant xanthiid crab, *Epixanthus dentatus* in the mangroves of Catanduanes but not in Pagbilao, Quezon.

Key words: Grapsid crabs, brachyurans, mangroves, Philippines

INTRODUCTION

The brachyurans are interesting to study in terms of their association with mangrove flora, behavior, feeding and ecology (Khan *et al.* 2005). This group makes up as much as 80% of the macro−faunal biomass in mangroves and densities can even reach to 80 to 90 sq. m. Reports attest that the mangrove forest constitutes the habitat

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with the richest diversity of land dwelling crabs (Hartnoll 1988, Fratini *et al*. 2005). It is also indicated that the most important functional role of mangrove crabs which received greater attention is their ability to process as much as 70% of the leaf litter (Leh & Sasekumar 1985, Slim *et al*. 1997, Dahdouh-Guebas *et al*. 1999, Ashton 2002). It was reported by Jones (1984) and Lee (1998) that brachyurans are important in the mangrove ecosystem structure and function. Members of family Grapsidae are possibly one of the most important components of the fauna of mangrove forests globally, in part because of their influence in nutrient cycling by feeding on litterfall (Salgado-Kent & McGuinness 2010). Unfortunately, it appears that there is still a dearth of detailed published information on the structural components as to the occurrence of these grapsoidal families like Grapsidae and other brachyurans in the mangroves of the Philippines. There are few reports in this country that deal with the ways in which these crabs use the mangrove resources compared to other southeast Asian countries wherein numerous crab literature are available (Sivasothi 2000, Sivasothi *et al*. 1993, Tan & Ng 1994, Ng & Liu 1999, Leh & Sasekumar 1985, Soemodihardjo & Soerianegara 1989, Rahayu & Davie 2002, Poovachiranon 1986, Lee & Leung 1993, Lee 1998, Kwok & Tang 2005). Except for some previous reports (McNae 1968, Banaag 1972, Zamora 1989a, Zamora 1989b, Dolar 1991, Dólar *et al*. 1991), there are scanty reports on occurrence, ecology and physiology of the mangrove-dwelling arboreal-climbing grapsid crabs in the Philippines.

This paper presents the occurrence of arboreal-climbing grapsid crabs and other brachyurans associated with the mangrove areas in Quezon and Catanduanes Island, Luzon (Philippines). Some insights on the dependence to mangrove trees as habitats, climbing skills and burrowing behavior of these grapsids are also noted.

MATERIALS AND METHODS

Crab specimens were handpicked and scooped using nets and locally made traps during daytime and at night time in two mangrove areas of southern Luzon, Philippines: (1) Palsabangon mangrove area, Pagbilao, Quezon; and (2) *Agojo Inlet Mangrove Reserve Project* and the Palnab-Pajo mangrove area in Catanduanes island. The collection sites include areas along rivers, creeks, inlets and the buffer zones or marginal strips of the coastline from June 2005 to February 2006. In addition nearby rivers, backshores and inside mangrove forests were also surveyed in May 2007 for these arboreal-climbing grapsid crabs. One female and several male specimens were obtained in each study area.

Measurements of the crab specimens were represented by maximum carapace width (*mcw*); carapace length (*cal*); body height (*boh*); and chelar palm height (cph). Ratios of cal/mcw, boh/mcw and cph/mcw were computed. All measurements are made with Vernier calipers and ratios are in two decimal places following Ng and Liu (1999) as used by Masagca (2009). Observations on the feeding ecology of the crabs under study were carried out each of the mangrove study areas modifying the methods of Gillikin (2000). In the mangrove areas covered, presence or absence of crab species were determined by visual inspection in 10 m diameter plots along a transect

perpendicular to the coastline, covering the full width of the forest. The study investigated at least 10 plots along a 100 to 200 m long transect in the study areas.

RESULTS AND DISCUSSION

Occurrence and some taxonomic diagnosis descriptions on the morphometry

Table 1 presents arboreal-climbing mangrove grapsid crabs described in the present study, while Table 2 shows the other brachyurans (or non-grapsids) occurring in the areas under investigation. Based on the field surveys conducted in banks of the streams or rivers, backshores and inside mangrove forests, the families of brachyurans included in this report are the (1) Grapsidae, (2) Portunidae, (3) Varunidae and (4) Eriphiidae. As shown in the said tables these brachyurans include 3 genera (*Metopograpsus*, *Pseudograpsus* and *Hemigrapsus*) for family Grapsidae; a single genus (*Ptychognathus*) for Varunidae; 4 genera (*Scylla*, *Thalamita*, *Portunus* and *Charybdis*) for Portunidae and a single genus (*Epixanthus*) for Eriphiidae.

Table 1. Summary of the different taxa of grapsoid sesarmid crabs identified in selected mangrove areas in Quezon and Catanduanes.

Family	Genus	Species	Occurrence/Location
Grapsidae	*Hemigrapsus*	*Hemigrapsus penicillatus*	Quezon
	Metopograpsus	*Metopograpsus latifrons*	Catanduanes
	Pseudograpsus	*Pseudograpsus elongates*	Quezon

Table 2. Summary of taxa of non-grapsoid sesarmid crabs obtained from different locations.

Family	Genus	Species	Occurrence/Location
Varunidae	*Ptychognathus*	*Ptychognathus altimana*	Catanduanes, Quezon
Portunidae	*Charybdis*	*Charybdis affinis*	Quezon, Catanduanes
	Portunus	*Portunus pelagicus*	Quezon
	Scylla	*Scylla serrata*	Quezon, Catanduanes
		Scylla olivacea	Quezon
	Thalamita	*Thalamita crenata*	Quezon, Catanduanes
Eriphiidae	*Epixanthus*	*Epixanthus dentatus*	Catanduanes

Based on field surveys, the different arboreal-climbing grapsid crabs associated with the mangrove areas under study include the three genera: (1) *Hemigrapsus Dana,* 1851 *(Hemigrapsus penicillatus),* (2) *Metopograpsus* H. Milne Edwards, 1853 *(Metopograpsus latifrons*) and (3) *Pseudograpsus* H. Milne Edwards, 1837 *(Pseudograpsus elongatus).* These grapsid crabs were known to occur both in the lowland portions of streams, estuaries, and backshores of the. The grapsid *M. latifrons* (White 1847) [*Grapsus*] in Quezon and Catanduanes island was observed to be associated with the sesarmid crabs, *Perisesarma bidens* (De Haan 1835) and *Neosarmatium smithii* H. Milne Edwards, 1853 [*Sesarma*]. This means that these mangrove crabs occupy the same spots in the mangrove habitats that include feeding as shown in their climbing and burrowing behavior.

The same observation that greater number of grapsid crabs occur in the banks of the stream and at the backshore of the mangrove rather than inside or within the forests of the 2 mangrove areas confirming the previous made by Tam and Wong (2000), showing a significant difference in occurrence or diversity of grapsoid sesarmids and other brachyurans.

The succeeding paragraphs present some taxonomic descriptions and morphometry of the arboreal climbing grapsids and other brachyurans.

Metopograpsus H. Milne-Edwards, 1853 (GRAPSIDAE)

= *Metopograpsus* H. Milne Edwards, 1853 (type species *Cancer messor* Forskal, 1775, subsequent designation by Davie, 2002; gender masculine)

Metopograpsus latifrons (White, 1847) [*Grapsus*]

= *Grapsus latifrons* White, 1847 [nomen nudum]
= *Metopograpsus maculatus* H. Milne Edwards, 1853
= *Grapsus (Grapsus) dilatatus* De Haan in Herklots, 1861 (nomen nudum)
= *Grapsus (Grapsus) dilatatus* De Man, 1879
= *Metopograpsus pictus* A. Milne-Edwards, 1867

Figure 1. *Metopograpsus latifrons* from a Maqueda Channel mangrove area (Palnab-Pajo Mangrove) in Catanduanes Island

This arboreal-climbing grapsid has squarish carapace, slightly converging backwards; with 3rd maxilliped not meeting in the middle line; and one tooth behind the antero-lateral one. Carapace of *M. latifrons* appears to be converging backwards.

This grapsid attacks the collector during several field works in Quezon and Catanduanes. This crab is conspicuously found in sluice gates of fish ponds in the mangrove area, prop roots of *Rhizophora* and tree trunks. As an arboreal - climbing grapsid crab, this opportunistic animal was observed to assume an inverted or downward position (facing the water) when found on trunks of mangrove trees. Some samples were also collected in crevices of trees during low tides. This grapsoid crab feeds on leaves, algae mollusks (Vannini *et al.* 1997) and crustaceans (Jones 1984). It is also stressed that in another species of the genus *Metopograpsus, M. oceanicus* is less dependent on the leaves of mangrove plants (Dahdouh-Guebas *et al.* 1999). In Singapore, 3 species (*M. gracilipes, M. frontalis* and *M. latifrons)* have been the subject of several reports.

Genus Pseudograpsus H. Milne Edwards, 1837

= *Pseudograpsus* H. Milne Edwards, 1837 (type species *Grapsus penicilliger* Latreille, 1817, subsequent designation by Holthuis, 1977; gender masculine)

= *Pachystomum Nauck,* 1880 (type species *Pachystomum philippinense* Nauck, 1880, by monotypy; gender neuter)

Pseudograpsus elongatus (A. Milne-Edwards, 1873) [*Heterograpsus*]

= *Pseudograpsus erythraeus* Kossmann, 1877

Table 3 shows the mean values of morphometric data of grapsid crab *Pseudograpsus elongates* from the mangroves under study. Males tend to be larger in terms of body size as to maximum carapace width (*mcw*) and body height (*boh*).

Table 3. Mean values (*in mm*) of the morphometry of *P. elongatus* from Catanduanes

Sex of crabs	mcw	cal	cal/mcw	Boh	boh/mcw	cph	cph/mcw
Male	32.95	37.23	1.13	18.62	0.56	14.82	0.45
Female	31.19	37.82	1.21	10.67	0.34	11.62	0.37

Legend: mcw=maximum carapace width; cal=carapace length; boh= body height; cph= chelar palm height (all values are in mm).

Female crab samples of *P. elongatus*, showed a mean mcw = 31.19 mm, while males = 32.95 mm. In terms boh, females mean showed mean boh of 10.67 mm and males gave a mean boh of 18.62 mm. Body form for females (boh/mcw = 10.67mm/31.19 mm = 0.34± 0.01, N=2), while for males (boh/mcw = 18.62 mm/32.95 mm = 0.56± 0.01, N=8) the body form is relatively vaulted. Chelipeds equal and sexually dimorphic. Male chelae larger (cph/mcw = 14.82mm/ 32.95mm = 0.45) and more strong than females (cph/mcw = 11.65mm/31.19mm = 0.37).

Identifying characters of *P. elongatus* are two distinct teeth behind the antero-lateral one, carapace converging backwards. Carapace squarish, slightly converging backwards; 3rd maxilliped not meeting in the middle line; legs and carapace not hairy, carapace slightly convex; two distinct teeth behind the antero-lateral one.

Genus Hemigrapsus Dana, 1851

= *Hemigrapsus* Dana, 1851 (type species *Hemigrapsus crassimanus* Dana, 1851, subsequent designation by Rathbun, 1918; gender masculine)

= *Lobograpsus* A. Milne-Edwards, 1869 (type species *Cyclograpsus crenulatus* H. Milne Edwards, 1837, subsequent designation by Rathbun, 1918; gender masculine)

Hemigrapsus penicillatus (De Haan, 1835) [*Grapsus* (*Eriocheir*)]

= *Brachynotus brevidigitatus* Yokoya, 1928

Table 4. Mean values (*in mm*) of some of the morphometrics of *H. penicillatus*

Sex of crabs	mcw	boh	boh/mcw	cph	cph/mcw
Male	28.72	17.02	0.59	9.39	0.33
Female	27.29	12.07	0.34	9.02	0.33

Legend: mcw=maximum carapace width; boh= body height; cph= chelar palm height (all values are in mm).

Table 4 shows the identity of the grapsid, *H. penicillatus* De Haan, 1858 from Catanduanes which was confirmed by Ms. Marivene Manuel from the PNM in Manila.

VARUNIDAE H. MILNE EDWARDS, 1853

Genus *Ptychognathus* Stimpson, 1858

= *Ptychognathus* Stimpson, 1858 (type species *Ptychognathus glaber* Stimpson, 1858, by monotypy; gender masculine) [Opinion 85, Direction 37]
= *Coelochirus* Nauck, 1880, (type species Coelochirus crinipes Nauck, 1880, by monotypy; gender masculine)

Ptychognathus altimanus Rathbun, 1914 [*Varuna*]

Table 5 shows the summary of the mean values of selected morphometrics of *P. altimanus*. Males are bigger than females. Carapace pitted but glabrous, a little broader than long (*mcw/cal*=39.54/36.08); lateral margin with two sharp teeth; legs fringed on the last 3 joints. Male chelipeds are larger (cph/mcw=0.38) than the females (cph/mcw=0.22).

Table 5. Mean values (*in mm*) of the some morphometrics of *P. altimanus*

Sex of crabs	mcw	cal	cal/mcw	boh	boh/mcw	Cph	cph/mcw
Male	39.54	36.06	0.91	15.56	0.56	15.02	0.38
Female	33.09	32.56	0.98	15.36	0.34	7.37	0.22

Legend: mcw=maximum carapace width; cal=carapace length; boh= body height; cph= chelar palm height (all values are in mm).

Samples were collected near the canals connected to a small stream inundated during the high tides. This varunid crab is abundant in the backshore portions of the mangroves. Found in the back mangroves of Quezon and Catanduanes (near the rice paddies) and at the edges near the areas where freshwater streams are flowing. Ng *et al.* (2008) notes that *Ptychognathus* is being revised by N.K. Ng P.K.L. Ng. Several groups of species are now recognizable and new genera will be established for them.

PORTUNIDAE RAFINESQUE, 1815

Subfamily Portuninae Rafinesque, 1815

Genus *Portunus* Weber, 1795

Portunus (Pelagicus) pelagicus Linnaeus, 1758) [Cancer]

= *Cancer pelagicus* Forskal, 1775
= *Cancer cedonulli* Herbst, 1794
= *Portunus denticulatus* Marion de Proce, 1822
= *Portunus pelagicus* var. *sinensis* Shen, 1932

As shown in Table 6, males of *P. pelagicus* are bigger than females. Buccal frame rectangular; carapace much wider than long (mcw/cal - 116.57/48.44= 2.41), bow fronted, and much serrate, drawn out into lateral spikes. Chelae strong but slender. Buccal frame rectangular, last pair of walking legs paddle-like; 9 antero-lateral spines. Samples of this portunid crab were obtained at the outer margins of the mangrove forest areas in Quezon and Catanduanes. The use of baited lift nets (local name= "bintol") allowed for the collection of this crabs.

Table 6. Mean values (*in mm*) of the some morphometrics of *P. pelagicus*

Sex of crabs	mcw	cal	cal/mcw	boh	boh/mcw	cph	cph/mcw
Male	116.57	48.44	0.42	25.73	0.22	17.78	0.152
Female	112.65	48.65	0.43	20.38	0.18	17.35	0.154

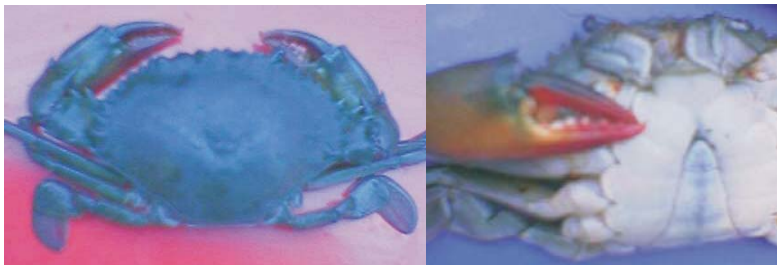
Legend: mcw=maximum carapace width; cal=carapace length; boh= body height; cph= chelar palm height (all values are in mm).

Genus *Scylla De Haan, 1833*

= *Scylla* De Haan, 1833 (type species *Cancer serratus* Forskal, 1775, subsequent designation by Rathbun, 1922; gender feminine)

*Scylla serrata (*Forskal, 1775) [*Cancer*]

= *Achelous crassimanus* MacLeay, 1838
= *Scylla tranquebarica* var. *oceánica* Dana, 1852
= *Lupa lobifrons* H. milne Edwards, 1834



A B

Figure 2. *Scylla serrata* (A, carapace) Pagbilao Quezon and Maqueda Channel Catanduanes.

As presented in Table 7, male samples of *S. Serrata* obtained from the study areas are smaller than the female samples. Samples obtained were heavy with moderately convex carapace (*mcw/cal* - 63.54/40.46 = 1.57), with 4 teeth; antero-lateral margin with 7 teeth, periopods/pleopods smooth, no hairs.

Table 7. Mean values (*in mm*) of the some morphometrics of *S. serrata*

Sex of crabs	mcw	boh	boh/mcw	cph	cph/mcw
Male	63.54	21.56	0.34	8.07	0.13
Female	67.85	23.45	0.35	9.23	0.14

Legend: mcw=maximum carapace width; boh= body height; cph= chelar palm height (all values are in mm).

Scylla olivacea (Herbst, 1796) [*Cancer*]

Summary data on selected morphometrics of *S. olivacea* are presented in Table 8. Ratios obtained for boh/mcw and cph/mcw show almost the same values, which may indicate that sexual dimorphism is not that intense.

Table 8. Mean values *(in mm)* of the some morphometrics of *S. olivacea*

Sex of crabs	mcw	boh	boh/mcw	cph	cph/mcw
Male	62.02	20.34	0.33	7.09	0.11
Female	63.52	21.57	0.34	7.26	0.12

Legend: mcw=maximum carapace width; boh= body height; cph= chelar palm height (all values are in mm).

Genus Charybdis De Haan, 1833

Charybdis (Charybdis) affinis Dana, 1852
=?*Charybdis barneyi* Gordon, 1931

Figure 3. General view of *Charybdis affinis* from Quezon.

Carapace of *C. affinis* more or less hexagonal (mcw/cal 40.09/29.63= 1.353), antero-lateral margins diverging backwards, fronto-lateral much less than maximum width, bow-shaped front cut into 6 teeth. Table 9 shows that the ratio of cph/mcw for both male and female samples are almost the same. Ward (1941, cited by Ng *et al.* 2008) described *C. philippinensis* from Davao as: carapace is broader than long, bare and glossy, granulated under lens.

Table 9. Mean values (*in mm*) of the some morphometrics of *C. affinis*

Sex of crabs	mcw	boh	boh/mcw	cph	cph/mcw
Male	43.34	16.8	0.39	17.78	0.41
Female	40.09	15.64	0.39	16.52	0.41

Legend: mcw=maximum carapace width; boh= body height; cph= chelar palm height (all values are in mm).

Genus *Thalamita* Latreille, 1829
= *Thalamita* Latreille, 1829 (type species *Cancer adnete* Herbst, 1803, by monotypy; gender feminine)
= *Thalamonyx* A. Milne Edwards, 1873 (type species *Goniosoma danae* A. Milne Edwards, 1869, subsequent designation by Rathbun, 1922; gender masculine)

Thalamita crenata Ruppell, 1830 [*Talamita*, sic]

As shown in Table 10, carapace of *T. crenata* (Figure 4) is much more or less hexagonal (*mcw* = 50.63 mm, *cal* = 32.02 mm), but antero-lateral margins sub-parallel; fronto-orbital not much less than maximum carapace width; chelipeds strong

(*cph*=11.35 mm, male; 12.06 mm, female); transverse ridges usually distinct. Carapace is rounded with five antero-lateral teeth.

Figure 4. *Thalamita crenata* from Pagbilao, Quezon.

Table 10. Mean values *(in mm)* of the some morphometrics of *T. crenata*

Sex of crabs	mcw	cal	cal/mcw	boh	boh/mcw	cph	cph/mcw
Male	50.63	47.01	0.93	17.93	0.35	11.34	0.22
Female	31.04	32.02	1.03	17.43	0.56	12.06	0.39

Legend: mcw=maximum carapace width cal=carapace length; boh= body height; cph= chelar palm height (all values are in mm)

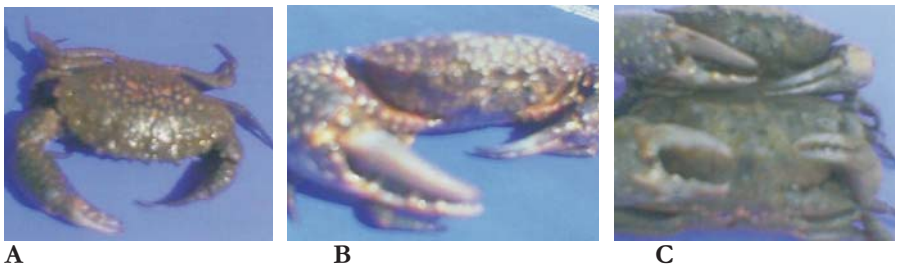
SUPERFAMILY ERIPHIOIDEA MACLEAY, 1838
FAMILY ERIPHIIDAE MACLEAY, 1838
Genus *Epixanthus* Heller, 1861

= *Epixanthus* Heller, 1861 (type species *Epixanthus kotschii* Heller, 1861, by monotypy; gender masculine)

***Epixanthus dentatus* (White, 1848) [*Panopeus*]**

= *Epixanthus dilatatus* De Man, 1879
= *Panopeus acutidens* Haswell, 1881

The mangrove crab, *E. dentatus* (Figure 5) displays two visible spines on the upper internal face of claw carpus; 5 big teeth on the antero-lateral carapace margins, carapace widely mottled. Celipeds are unequal (right larger than left). Table 11 shows that chelipeds of male samples (0.40) are larger compared to the female samples (0.26)



A **B** **C**

Figure 5. *Epixanthus dentatus* (carapace) from Palnab-Pajo Mangrove Area in Virac, Catanduanes (A), frontal view (B) and forcept-like claws (C).

Table 11. Mean values (*in mm*) of the some morphometrics of *E. dentatus*

Sex of crabs	mcw	cal	cal/mcw	boh	boh/mcw	cph	cph/mcw
Male	45.02	32.41	0.72	19.32	0.43	18.21	0.40
Female	50.01	29.45	0.59	17.05	0.34	13.01	0.26

Legend: mcw=maximum carapace width; cal= carapace length; boh= body height; cph= chelar palm height (all values are in mm).

Samples of *E. dentatus* were obtained under drift woods, buried on the mud. The right claw of this crab is stout and consists of a special tooth which it uses to open gastropods. Plate 17B (Fig. 5) shows the forcept-like claw of the crab. This crab is omnivorous (Dahdouh-Guebas *et al.* 1999), but preys mostly on crabs (Cannicci *et al.* 2008).

Arboreal-climbing, burrowing and feeding behavior of the grapsid crabs

On the arboreal-climbing behavior, several individuals of the mangrove crabs, *M. latifrons* (White, 1847) were observed as exclusive tree-climber (EMTC) in mangrove canopies. This grapsid, invariably stays longer on the branches of mangrove trees with mostly upside down position. During the study, climbing height range of 50 grapsid crabs (in each study area) observed from 0.065 m to 2.35 m above the water lining. Majority of these grapsid crabs climb at the main trunks of *Rhizophora* and sometimes on the branch of *Sonneratia* when the tide is rising and when insects (e.g. spiders) are also found, since they are omnivorous feeders (Jones 1984). Although some *M. latifrons* are seen on the lateral branches, these are only happening when these grapsids were antagonized. It was observed that when *M. latifrons* are being caught by hand picking at the bottom of the trunk of the mangrove tree submerged in water, some of these crabs rushed to the upper portion of the trunk evading from the capturist. In Catanduanes, a greater number of *M. latifrons* occur in the mangrove areas studied supporting the high biomass and density report in Segera Anakan, Indonesia (Geist *et al.* 2011). This climbing behavior was not observed in the grapsid crabs of Quezon.

Another observation refers to the tendency of the grapsid, *M. latifrons* to climb in the fronds of *Nypa fruticans* when chased or antagonized while they are in the water. Individuals of this grapsid, *M. latifrons* (and also the sesarmid crab, *Selatium elongatum*) tend to escape or evade the researchers by climbing fast to the trees.

The other grapsid, *P. elongatus,* is known to be an occasional mangrove tree-climber (OMTC), while *H. penicillatus* is non-arboreal species (NAS) that was seen only in crevices of the mangrove areas.

On burrowing behavior, the grapsid *P. elongatus* also creates burrows and so with *M. latifrons*, but the former is more active compared to the latter. Burrowing activities have a pronounced effect on sediment properties, contributing immensely in rendering changes in the properties of mangrove sediments. As noted by Nagelkerken *et al.* (2008) changes in biochemical processes can be observed by enhancing the porosity and water flow through the sediment, assisting in flushing toxic substances. Crab burrows provide an efficient mechanism for exchanging water between the anoxic substrate and the overlying tidal water.

Jones (1984) described the feeding habits of mangrove crabs and divided into seven groups: herbivore, carnivore, omnivore, deposit feeder, omnivore/deposit

feeder, specialized filterer, and filterer/omnivore. The grapsids *M. latifrons, P. elongates and N. penicillatus* are herbivores and omnivore/deposit feeders, eating mangrove litter and water plants. Nordhaus *et al.* (2011) described extensively the food preferences, diet and food consumption of grapsoid crabs in Indonesia. This will become an important reference for studying further the food and feeding habits of grapsids in the Philippines.

CONCLUSIONS

A total of 3 genera belonging to the family Grapsidae (*Hemigrapsus, Pseudograpsus* and *Metopograpsus*) are reported here possessing tree-climbing abilities. *Metopograpsus latifrons* (White 1847) [*Grapsus*] is an exclusive mangrove tree climber (EMTC), while *Pseudograpsus elongatus* (A. Milne Edwards 1873) is described here as occasional mangrove tree climber (OMTC). *Hemigrapsus (Hemigrapsus) penicillatus* (De Haan, 1835) *[Grapsus (Eriocheir)] is a n*on-mangrove arboreal-climbing species (NTC) only seen on crevices of the mangrove areas. The non-grapsoidal brachyurans are represented by 3 families [(Varunidae (*Ptychognathus*), Portunidae (*Charybdis*, *Portunus*, *Scylla*, *Thalamita*); and Eriphiidae (*Epixanthus*)]. To what extent this tree-climbing abilities of the said grapsid crabs in Quezon and Catanduanes relate to the feeding behaviour of the grapsid crabs reported in the present study awaits further studies. Likewise, food preference, diet and consumption of these grapsid crabs from the Philippines indicate future needs.

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