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RESEARCH ARTICLE

Morphological and Morphometric Characteristics of Crustaceans (Decapoda) in the East Coast of Aceh Province, Indonesia

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Abstract

The east coast of Aceh Province, including Pidie, North Aceh, and Aceh Tamiang Regencies, is a producer of Decapod (Crustacea), a marine capture fishery commodity. Decapod fishing activities are suspected to be excessive on the east coast of Aceh Province. Therefore, this study aims to map resources, identify morphology, and morphometrics of Decapods in these waters, as an initial step toward supporting sustainable management. This study was conducted from June to September 2025. Sampling was carried out in the waters of North Aceh Regency (Site 1), Pidie Regency (Site 2), and Aceh Tamiang Regency (Site 3). The collected samples were then taken to the Mathematics and Natural Sciences Laboratory of Almuslim University for further analysis. The analysis carried out included morphological and morphometric identification. There are 8 Decapods species caught in the waters of the east coast of Aceh Province, including *Charybdis feriata*, *Portunus sanguinolentus*, *Portunus pelagicus*, *Penaeus monodon*, *Metapenaeus monoceros*, *Penaeus merguiensis*, *Panulirus homarus*, and *Panulirus ornatus*. In the North Aceh Regency, the species caught were *Portunus sanguinolentus*, *Penaeus monodon*, *Metapenaeus monoceros*, and *Panulirus ornatus*. In the Pidie Regency, the species caught were *Portunus sanguinolentus*, *Charybdis feriata*, *Penaeus merguiensis*, and *Panulirus homarus*. Furthermore, in the Aceh Tamiang Regency, the species caught were *Portunus pelagicus*, *Penaeus monodon*, *Metapenaeus monoceros*, and *Penaeus merguiensis*. This study addresses this gap by providing a comprehensive morphometric baseline and taxonomic identification of 8 commercially vital species. The results reveal notable morphological variability in *Panulirus homarus* and high habitat specificity for *Charybdis feriata*, highlighting the influence of local ecological conditions on population structure. These findings offer a novel contribution to regional fisheries management, serving as a critical reference for establishing sustainable exploitation limits in the Malacca Strait ecosystem.

Keywords: Crustacea, Decapods, Lobsters, Morphology crabs, Shrimps

Introduction

Marine fishing activities play a crucial role in maintaining global food security and economic stability [1]. The crustacean fisheries sector, in particular, accounts for nearly 30% of the total fish and shellfish catches worldwide [2] and possesses substantial economic value [3]. Crustacea represent an important source of aquatic dietary protein [4], making a significant contribution to the global aquatic animal protein supply [5]. This group is distributed across virtually all aquatic habitats, including the diverse order Decapoda, which encompasses economically vital species such as crabs, shrimp, and lobsters [6]. Decapoda is one of the most diverse crustacean orders [7], currently comprising approximately 14,756 species worldwide [8]. With over 4,400 species of decapod shrimp alone exhibiting significant economic value [9], the global wild capture fisheries of decapod crustaceans are reported to be rapidly growing [10]. Due to this high market potential, the aquaculture of decapod crustaceans has also become a main economic driver in the fisheries sector [11].

The crustacean fisheries sector holds a pivotal position within the Indonesian fisheries industry [12]. Specifically, the waters of Aceh Province, Indonesia, are notable for their high production of crustaceans, sourced from both wild capture and aquaculture activities, with a particular focus on the order Decapoda. The eastern coast of Aceh Province, encompassing the regencies of Pidie, North Aceh, and Aceh Tamiang, functions as a major production hub for commercially valuable decapod crustaceans [13]. The substantial output in this region is ultimately achieved through the combined contribution of aquaculture systems and capture fisheries [14]. Despite the economic prominence of these regencies, local scientific documentation regarding the specific species composition and morphological variations of Decapods in these waters remains fragmented. While broader studies have addressed Indonesian marine biodiversity, there is a distinct research gap concerning the updated taxonomic baseline and morphometric characteristics of commercially exploited Decapods specifically within Aceh's coastal ecosystems. This lack of localized data hinders the development of province-specific conservation and harvesting quotas.

However, the exploitation and management of these resources necessitate prudent regulation. Unregulated fishing practices risk damaging stocks and habitats, thereby compromising both ecosystem integrity and economic sustainability [15-17]. Consequently, research focusing on the biology, distribution, habitat, and reproductive biology of decapod crustaceans is essential for implementing effective and sustainable fisheries management [18,19]. Therefore, this study aims to: (1) provide a comprehensive taxonomic identification of Decapod Crustacean species found across 3 major production hubs in Aceh; (2) analyze the morphological and morphometric characteristics of these species to establish a phenotypic baseline; and (3) map the distribution of these resources to support targeted, sustainable resource management strategies in the region.

Materials and methods

This research was conducted over a 4-month period, spanning from June to September 2025. Sampling was conducted at 3 designated locations within Aceh Province, Indonesia: North Aceh Regency (Location 1), Pidie Regency (Location 2), and Aceh Tamiang Regency (Location 3). The geographical context of the study area is illustrated in **Figure 1**. All collected specimens were subsequently transported to the Mathematics and Natural Sciences Laboratory at Universitas Almuslim, Aceh Province, for detailed analysis.

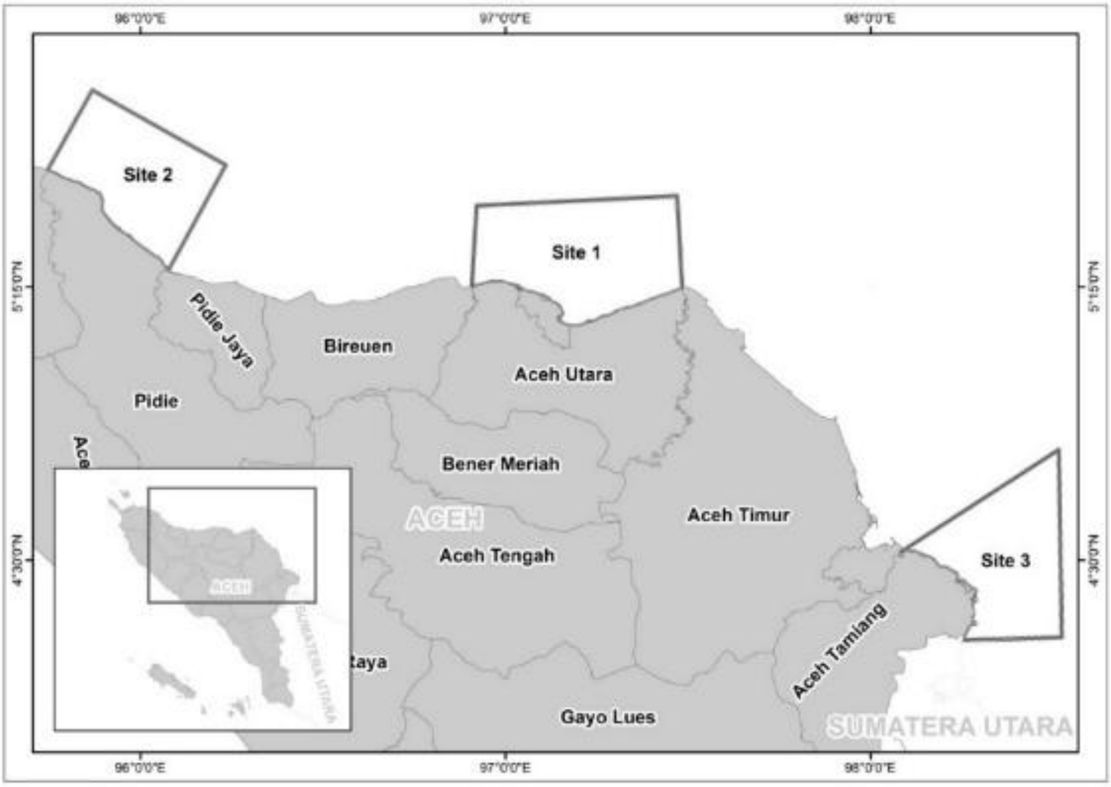

Figure 1 Map of research locations including North Aceh Regency (Site 1), Pidie Regency (Site 2), and Aceh Tamiang Regency (Site 3), Aceh Province, Indonesia.

Decapod Crustacean samples were systematically collected from direct landings at various Fish Landing Ports (PPIs) and Fish Auction Places (TPIs) across 3 locations: Pidie, North Aceh, and Aceh Tamiang Regencies. A total of 10 adult individuals per species were secured for analysis, representing a pooled sample from these 3 distinct study sites. The sampling criteria focused on adult specimens with weights up to 500 g and lengths ranging from 18 to 25 cm.

Morphometric measurements were performed on these 10 representative samples for each Decapod species. The measurements, which included the width, height, and length of specified morphological features, were executed using a digital caliper with an accuracy of 0.1 mm. The derived morphometric data (**Tables 1** - **3**) were subsequently processed using a modified analytical approach based on established methods [20-22]. Data transformation was performed according to the formula established by Batubara *et al.* [23]:

$$M_{trans} = (M \times 100)/CL$$

where M_{trans} is the transformed morphometric character data, M is the measured morphometric character data, and CL is the carapace length. The detailed parameters measured are outlined in **Figure 2**. The final morphometric data underwent descriptive statistical analysis, which included the calculation of mean values, intervals, and standard deviations.

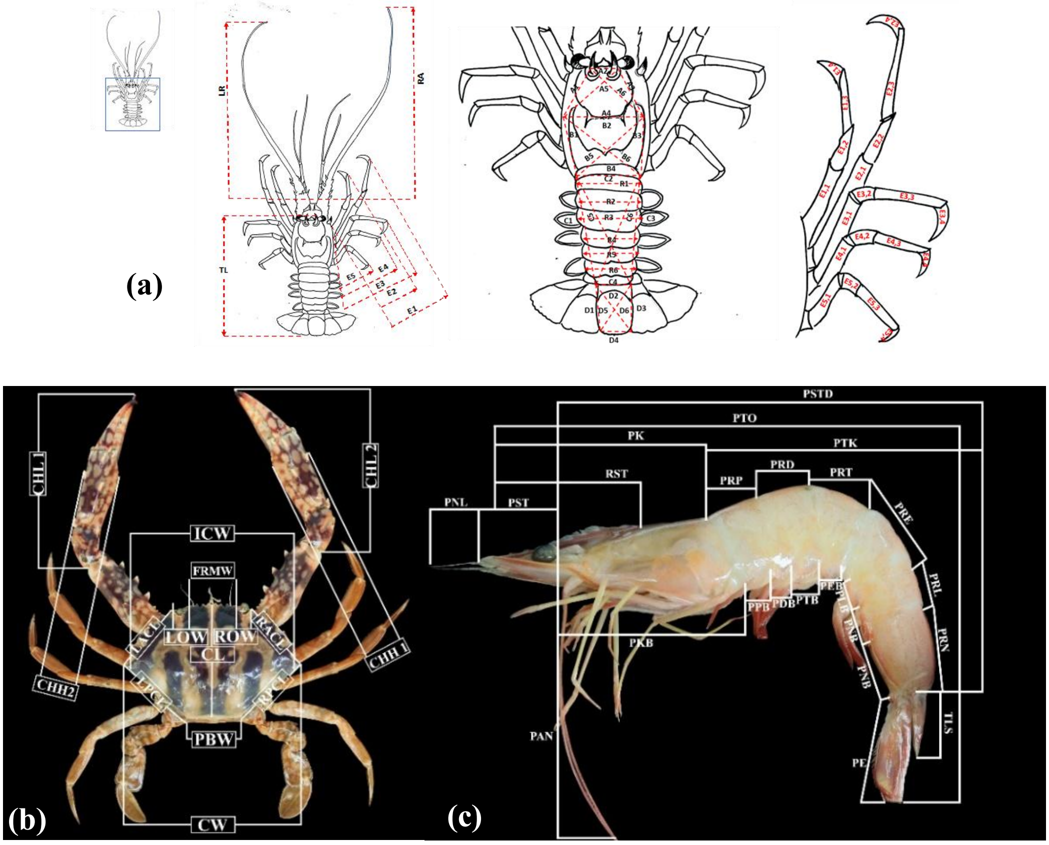

Figure 2 The morphometric measurement of (a) Lobster, (b) swimming crab, and (c) Shrimp. Measurement designations are given in **Tables 1 - 3** [22].

Table 1 Lobster morphometric measurements [22].

Body parts	Code	Information
Anterior Cephalothorax	A1	The distance between the widest left point of the carapace to the base of the left eye stalk
	A2	The distance between the right and left of the eye stalks
	A3	The distance between the widest right point of the carapace to the base of the left eye stalk
	A4	The distance between the widest carapace points
	A5	Diagonally point left carapace to right eye
	A6	Diagonally point right carapace to left eye
	RA	Right antenna
	LA	Left antenna
Posterior Cephalothorax	B1	The distance from the posterior point of the carapace to the point on the widest part of the carapace on the left region
	B2	The distance between the widest carapace points
	B3	The distance between the posterior point of the carapace to the point of the widest part of the carapace on the right region
	B4	The distance between the left and right points of the widest carapace posteriorly
	B5	Diagonal from left posterior carapace point to right widest carapace point

Body parts	Code	Information
	B6	Diagonal from the right posterior carapace point to the left widest carapace point
Abdomen	C1	The distance between the left posterior abdominal point to the left anterior abdominal point
	C2	The distance between the 2 left and right points of the posterior carapace
	C3	The distance between the posterior point of the right abdomen to the anterior point of the right abdomen
	C4	The distance between the right posterior abdominal point to the left side
	C5	Diagonal from the posterior point of the left abdomen to the anterior point of the right abdomen
	C6	Diagonal from the posterior point of the right abdomen to the anterior point of the left abdomen
Walking Leg (Pereiopod)	E1	The length between the base of the foot to the tip of the first foot
	E2	The length between the base of the foot to the tip of the second foot
	E3	The length between the base of the foot to the tip of the third foot
	E4	The length between the base of the foot to the tip of the fourth foot
	E5	The length between the base of the foot to the tip of the fifth foot
	E1,1	The distance from the ischium point to the merus point of the first foot
	E1,2	The distance between the merus point to the carpus point of the first foot
	E1,3	The distance from the carpus point to the propodus point of the first foot
	E1,4	Distance between propodus point to unguiculate point of the first foot
	E2,1	The distance from the ischium point to the merus point of the second foot
Abdominal Somites	R1	Diagonal from the right side point to the left side point of the first abdominal somites
	R2	Diagonal from the right side point to the left side point of the second abdominal somites
	R3	Diagonal from the right side point to the left side point of the third abdominal somites
	R4	Diagonal from the right side point to the left side point of the fourth abdominal somites
	R5	Diagonal from the right side point to the left side point of the fifth abdominal somites
	R6	Diagonal from the right side point to the left side point of the sixth abdominal somites
Caudal (Telson)	D1	The distance between the posterior point of the left telson to the anterior point of the left telson
	D2	The distance between the left and right points of the anterior telson
	D3	The distance between the posterior point of the right telson to the anterior point of the right telson
	D4	The distance between the left and right points of the posterior telson
	D5	Diagonal from the posterior point of the telson on the left to the anterior point of the right telson
	D6	Diagonal from the posterior point of the right telson to the anterior point of the left telson

Table 2 Swimming crab morphometric measurements.

Character	Code	Information
Carapace width	CW	Distance from the tip of the right marginal spine to the tip of the left marginal spine.
Internal carapace width	ICW	Internal distance or internal limit.
Carapace length	CL	Distance between the width or length of the body shell.
Left anterolateral carapace length	LACL	The width of the left side of the carapace in the front and lateral areas of the midline of the body.
Right anterolteral carapace length	RACL	The width of the right side of the carapace in the front and lateral areas of the midline of the body.
Left posterolateral carapace length	LPCL	Distance from the center of the back of the carapace to the end of the posterolateral part of the carapace on the left side.
Right posterolateral carapace length	RPCL	Distance from the center of the back of the carapace to the end of the posterolateral part of the carapace on the right side.
Frontal margin width	FRMW	Distance between the front of the carapace that has spines.
Left orbit width	LOW	Distance between the left eye and other body parts parallel to the carapace.
Right orbit width	ROW	Distance between the right eye and other body parts parallel to the carapace.
Posterior margin	PBW	Distance at the back of the posterior carapace.
Left claw length	CHH1	Left claw length.
Right claw length	CHH2	Right claw length.
Left claw width	CHL1	Left claw width.
Right claw width	CHL2	Right claw width.

Table 3 Shrimp morphometric measurements.

Character	Code	Information
Rostrum length	RST	Distance from the base of the eye to the tip of the rostrum.
Carapace length	CL	Distance from the orbital margin to the posterior edge of the carapace.
First abdominal segment length	FSL	Distance from the posterior margin of the carapace to the posterior end of the first abdominal segment.
Second abdominal segment length	SSL	Distance from the posterior end of the first abdominal segment to the posterior end of the second abdominal segment.
Third abdominal segment length	TSL	Distance from the posterior end of the second abdominal segment to the posterior end of the third abdominal segment.
Fourth abdominal segment length	FoSL	Distance from the posterior end of the third abdominal segment to the posterior end of the fourth abdominal segment.
Fifth abdominal segment length	FiSL	Distance from the posterior end of the fourth abdominal segment to the posterior end of the fifth abdominal segment.
Sixth abdominal segment length	SiSL	Distance from the posterior end of the fifth abdominal segment to the posterior end of the sixth abdominal segment.
Telson length	TLS	Distance from the base to the tip of the telson.
Scaphocerite length	SCL	Distance from the base to the tip of the scaphocerite (antennal blade).
Antennule length	ANL	Distance from the base to the tip of the antennule.
Antenna length	ANT	Distance from the base to the tip of the antenna.

Character	Code	Information
Total length	TL	Distance from the tip of the rostrum to the tip of the telson with the abdomen straightened.
Standard length	SL	Distance from the base of the rostrum to the base of the sixth abdominal segment.
Lower carapace length	LCL	Distance from the tip of the antenna to the posterior edge of the lower carapace.
First abdominal segment ventral length	V1SL	Distance from the posterior end of the lower carapace to the posterior end of the first ventral segment.
Second abdominal segment ventral length	V2SL	Distance from the posterior end of the first ventral segment to the posterior end of the second ventral segment.
Third abdominal segment ventral length	V3SL	Distance from the posterior end of the second ventral segment to the posterior end of the third ventral segment.
Fourth abdominal segment ventral length	V4SL	Distance from the posterior end of the third ventral segment to the posterior end of the fourth ventral segment.
Fifth abdominal segment ventral length	V5SL	Distance from the posterior end of the fourth ventral segment to the posterior end of the fifth ventral segment.
Sixth abdominal segment ventral length	V6SL	Distance from the posterior end of the fifth ventral segment to the posterior end of the sixth ventral segment.
Uropod length	UL	Distance from the posterior end of the sixth abdominal segment to the tip of the uropod.
Body length without carapace	BLC	Distance from the base of the first abdominal segment to the tip of the tail.

Results and discussion

Species diversity and distribution

Based on the identification of decapod crustaceans harvested along the eastern coast of Aceh Province, 8 commercially valuable species were identified (**Figure 3**). These species belong to the families Portunidae (crabs), Penaeidae (shrimps), and Palinuridae (spiny lobsters), and include: *Charybdis feriata*, *Portunus sanguinolentus*, *Portunus pelagicus*, *Penaeus monodon*, *Metapenaeus monoceros*, *Penaeus merguiensis*, *Panulirus homarus*, and *Panulirus ornatus* (**Table 4**).

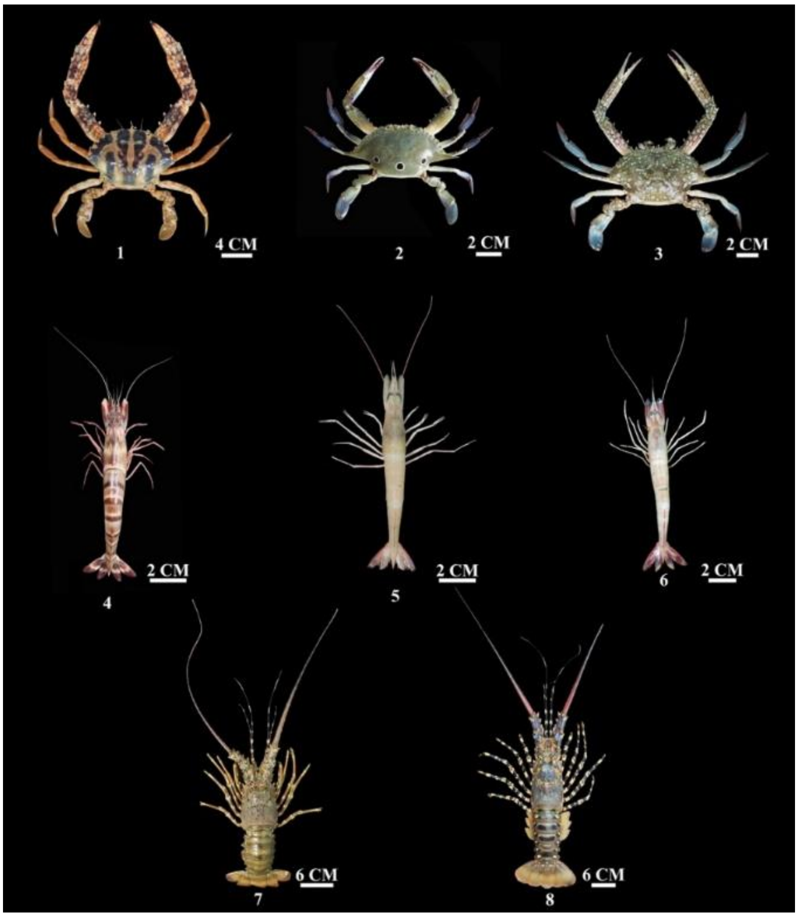

Figure 3 Decapod species collected from the waters of the east coast of Aceh Province including (1) *Charybdis feriata*, (2) *Portunus sanguinolentus*, (3) *Portunus pelagicus*, (4) *Penaeus monodon*, (5) *Metapenaeus monoceros*, (6) *Penaeus merguiensis*, (7), *Panulirus Homarus*, and (8) *Panulirus ornatus*.

Table 4 The distribution of decapod species varied across the sampling locations.

Regency (Location)	Identified decapod species
North Aceh (Location 1)	*Portunus sanguinolentus*, *Penaeus monodon*, *Metapenaeus monoceros*, and *Panulirus ornatus*.
Pidie (Location 2)	*Portunus sanguinolentus*, *Charybdis feriata*, *Penaeus merguiensis*, and *Panulirus homarus*.
Aceh Tamiang (Location 3)	*Portunus pelagicus*, *Penaeus monodon*, *Metapenaeus monoceros*, and *Penaeus merguiensis*.

Morphological characteristics

The detailed external morphology of each species was documented for all identified species, focusing on key features of the carapace, appendages, and body coloration (**Figures 4 - 11**).

Crabs (portunidae)

The identified crab species exhibit distinct morphological features. The Coral Crab (*C. feriata*) is characterized by a broad, round carapace featuring 6 prominent spines on each anterolateral margin and a conspicuous red and white striped pattern. The Star Crab (*P. sanguinolentus*) possesses a relatively slender, grayish-green carapace marked by 3 distinct red spots on its posterior aspect. In contrast, the Common Swimming Crab (*P. pelagicus*) is identified by its wide, flattened carapace, which bears 9 spines lateral to the eyes, with the terminal spine being notably the largest and longest. For all species, the general body structure is divided into distinct dorsal and ventral regions, comprising structures such as the dactylus, carapace, pleon, and associated musculature (tendons of adductor/abductor muscles) (**Figures 4** - **6**).

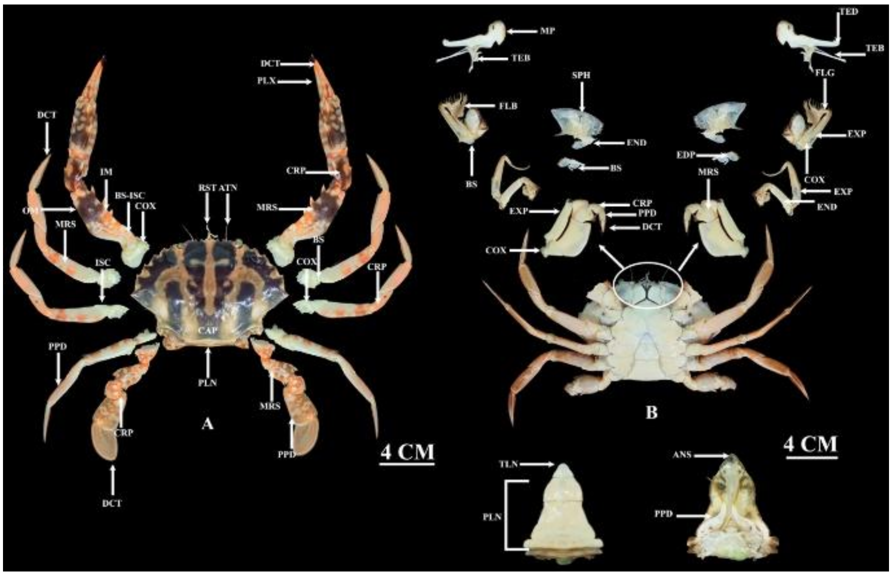

Figure 4 Anatomy of *Charybdis feriata*, (A) Dorsal, where DCT: Dactylus,PLX: Pollex, CRP: Carpus, MRS: Merus, BS: Basis, COX: COXA, PPD: Propodus, PLN: Pleon, CAP: Carapace, ISC: Ischium, ATN: Antenna, RST: Rostrum, BS-ISC: Basis-Ischium IM: Inner margin, OM: Outer margin, and (B) Ventral, where TED: Tendon of external adductor muscle, TEB: Tendon of external abductor muscle, FLG: Flagellum, EXP: Exopod, EDP: Endopod, SPH: Scaphognathite, FLB: Flabellum, MP: Mandibullar palp, TLN: Telson, ANS: Anus.

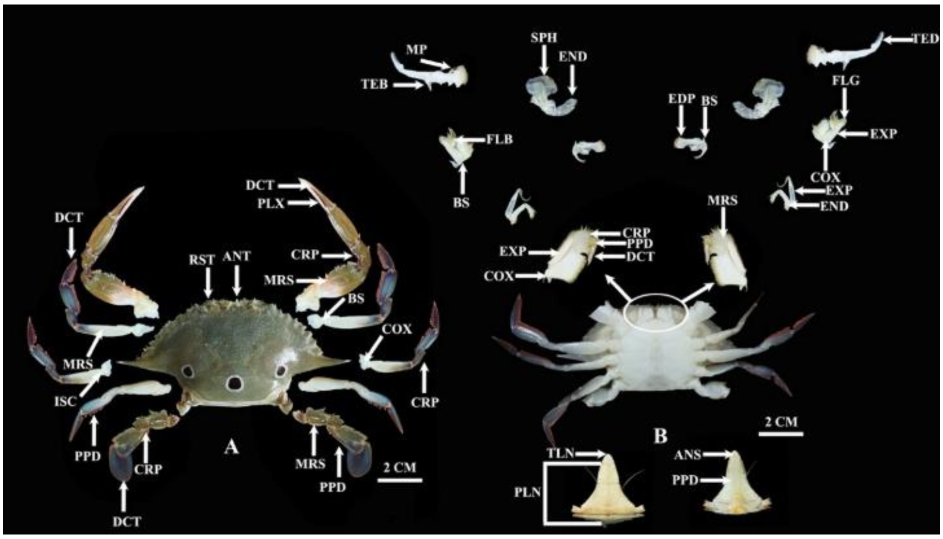

Figure 5 Anatomy of *Portunus sanguinolentus*, (A) Dorsal, where DCT: Dactylus,PLX: Pollex, CRP: Carpus, MRS: Merus, BS: Basis, COX: COXA, PPD: Propodus, PLN: Pleon, CAP: Carapace, ISC: Ischium, ATN: Antenna, RST: Rostrum, BS-ISC: Basis-Ischium IM: Inner Margin, OM: Outer margin, and (B) Ventral, where TED: Tendon of external adductor muscle,TEB: Tendon of external abductor muscle, FLG: Flagellum, EXP: Exopod, EDP: Endopod, SPH: Scaphognathite, FLB: Flabellum, MP: Mandibullar palp, TLN: Telson, ANS: Anus.

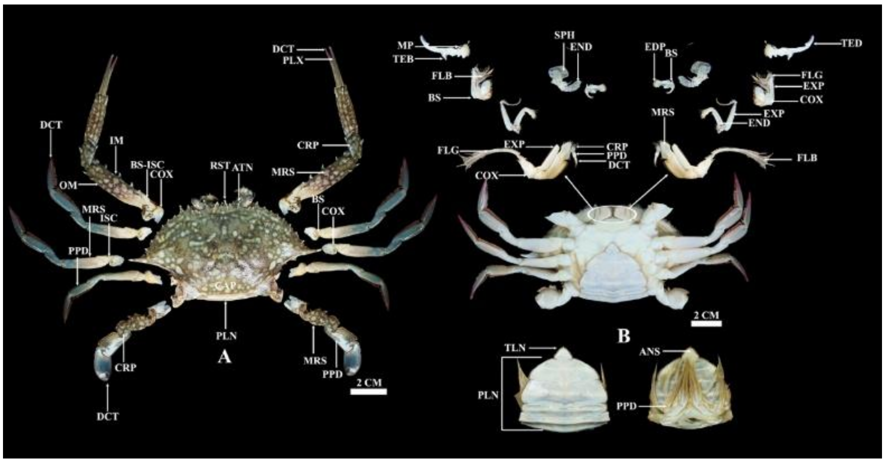

Figure 6 Anatomy of *Portunus pelagicus*, (A) Dorsal, where DCT: Dactylus,PLX: Pollex, CRP: Carpus, MRS: Merus, BS: Basis, COX: Coxa, PPD: Propodus, PLN: Pleon, CAP: Carapace, ISC: Ischium, ATN: Antenna, RST: Rostrum, BS-ISC: Basis-Ischium IM: Inner Margin, OM: Outer margin, and (B) Ventral, where TED: Tendon of external adductor muscle,TEB: Tendon of external abductor muscle, FLG: Flagellum, EXP: Exopod, EDP: Endopod, SPH: Scaphognathite, FLB: Flabellum, MP: Mandibullar palp, TLN: Telson, ANS: Anus.

Shrimps (penaeidae)

The external morphology of the 3 penaeid shrimp species follows the typical decapod pattern, consisting of a fused cephalothorax and a segmented abdomen. Key external features, detailed in **Figures 7 - 9**, include the telson, protopod, endopod, exopod, and pereopods on the dorsal side, while the ventral side comprises structures like the pleopods, coxa, mandible, and various sensory appendages (e.g., scaphocerite, basicerite). Distinctive coloration aids in identification: the Tiger Shrimp (*P. monodon*) is characterized by prominent striping; the Dogol Shrimp (*M. monoceros*) typically exhibits a pale gray coloration with scattered dark brown spots; and the Jerbung Shrimp (*P. merguiensis*) has a yellowish-white base color, with brown and green spots on the carapace and a reddish tail tip.

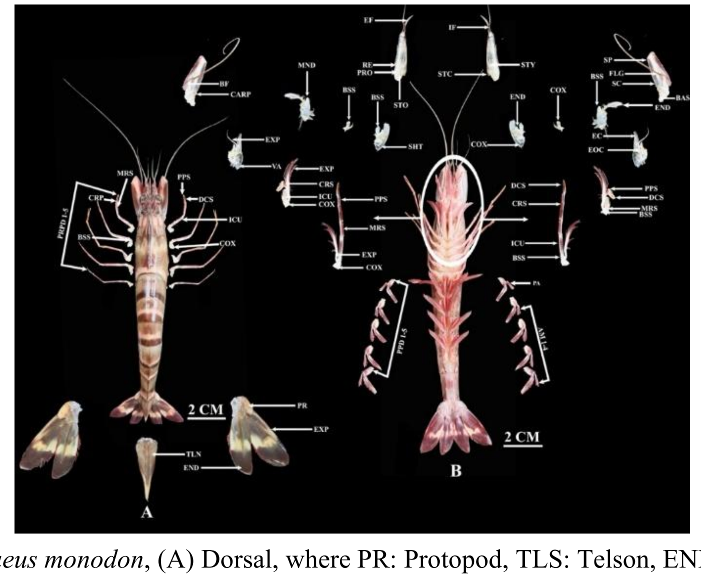

Figure 7 Anatomy of *Penaeus monodon*, (A) Dorsal, where PR: Protopod, TLS: Telson, END: Endopod, EXP: Exopod, PRPD: Pereopod, and (B) Ventral, where AM: Appendix masculina, PPD: Pleopod, COX: Coxa, EXP: Exopod, MRS: Merus, PPS: Propodus, ICU: Ischium, CRS: Carpus, VA: Vestigial arthrobranch, MND: Mandible, BSS: Basis, SHT: Scaphognathite, CARP: Carpocerite, BF: Base of flagellum, STO: Statocyst openin, RE: Recess for eye, PRO: Prosartema, EF: Recess for eye, IF: Inner flagellum, STC: Statocyst cover, STY: Stylocerite, SP: Spine, FLG: Flagellum, SC: Scaphocerite, BAS: Basicerite, EC: Exite of coxa, EOC: Endite of coxa, DCS: Dactyl.

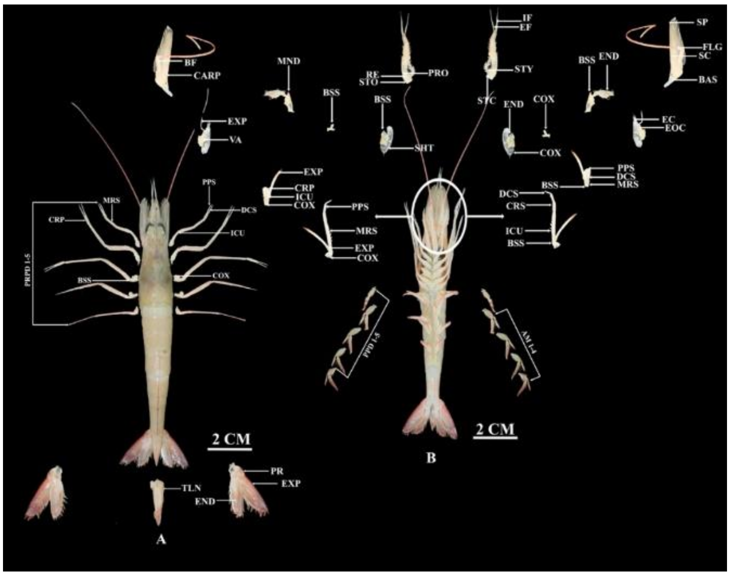

Figure 8 Anatomy of *Metapenaeus monoceros*, (A) Dorsal, where PR: Protopod, TLS: Telson, END: Endopod, EXP: Exopod, PRPD: Pereopod, and (B) Ventral, where AM: Appendix masculina, PPD: Pleopod, COX: Coxa, EXP: Exopod, MRS: Merus, PPS: Propodus, ICU: Ischium, CRS: Carpus, VA: Vestigial arthrobranch, MND: Mandible, BSS: Basis, SHT: Scaphognathite, CARP: Carpocerite, BF: Base of flagellum, STO: Statocyst openin, RE: Recess for eye, PRO: Prosartema, EF: Recess for eye, IF: Inner flagellum, STC: Statocyst cover, STY: Stylocerite, SP: Spine , FLG: Flagellum, SC: Scaphocerite, BAS: Basicerite, EC: Exite of coxa, EOC: Endite of coxa, DCS: Dactyl.

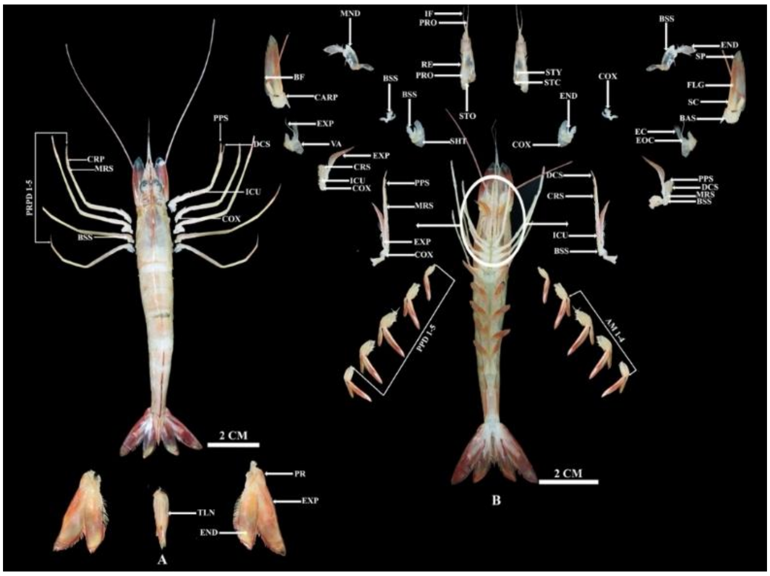

Figure 9 Anatomy of *Penaeus merguensis*, (A) dorsal, where PR: Protopod, TLS: Telson, END: Endopod, EXP: Exopod, PRPD: Pereopod, and (B) Ventral, where AM: Appendix masculina, PPD: Pleopod, COX: Coxa, EXP: Exopod, MRS: Merus, PPS: Propodus, ICU: Ischium, CRS: Carpus, VA: Vestigial arthrobranch, MND: Mandible, BSS: Basis, SHT: Scaphognathite, CARP: Carpocerite, BF: Base of flagellum, STO: Statocyst openin, RE: Recess for eye, PRO: Prosartema, EF: Recess for eye, IF: Inner flagellum, STC: Statocyst cover, STY: Stylocerite, SP: Spine , FLG: Flagellum, SC: Scaphocerite, BAS: Basicerite, EC: Exite of coxa, EOC: Endite of coxa, DCS: Dactyl.

Spiny lobsters (Palinuridae)

The lobsters identified, the Sand Lobster (*P. homarus*) and Pearl Lobster (*P. ornatus*), share a robust morphology (**Figures 10** and **11**). The head and thorax feature small spines on the carapace, and the abdomen displays distinct transverse segments. The Sand Lobster is typically greenish or brownish with white, sand-like spots, whereas the Pearl Lobster is recognized by its striking blue-green body color and distinct white and yellow speckled texture. Morphological structures common to both include the mandibular palp, processes (molar and incisor), various podites (carpopodite, ischiopodite, etc.), pleopod, and telson.

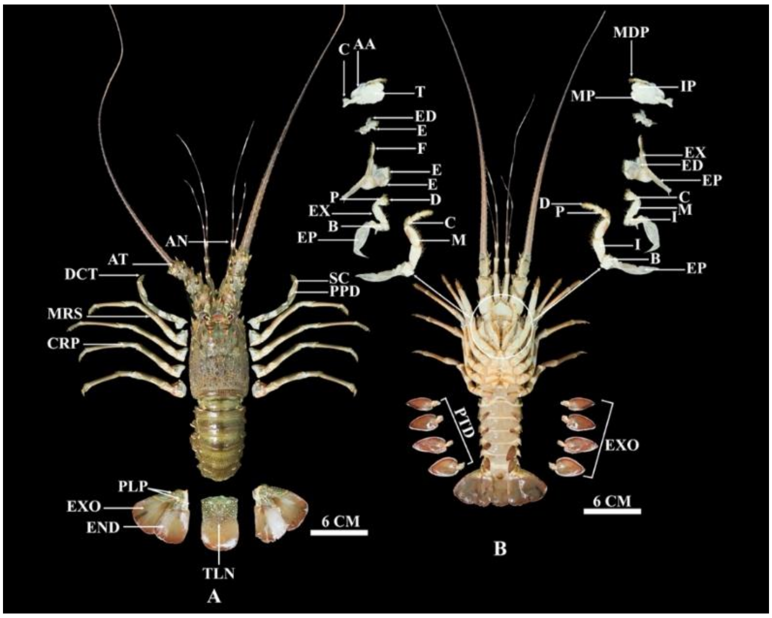

Figure 10 Anatomy of *Panulirus homarus*, (A) Dorsal, where MP: Molar process, MDP: Mandibular palp, IP: Incisor process, EX: Exopodite, ED: Endopodite, EP: Epipodite, C: Carpopodite, M: Meropodite, I: Ischiopodite, D: Dactylopodite, P: Propodite, I: ischiopodite, B: Basis, EP: Epipodite, EXO: Exopod, PTD: Protopod, E: Endite, T: Tubercles, AA: Anteror apodeme, C: Condyle, and (B) Ventral, where PPD: Propodus, SC: Subchela, AN: Antennulary, AT: Antennary, DCT: Dactylus, MRS: Merus, CRP: Carpus, PLP: Pleopod, EXO: Exopod, END: Endopod, TLN: Telson.

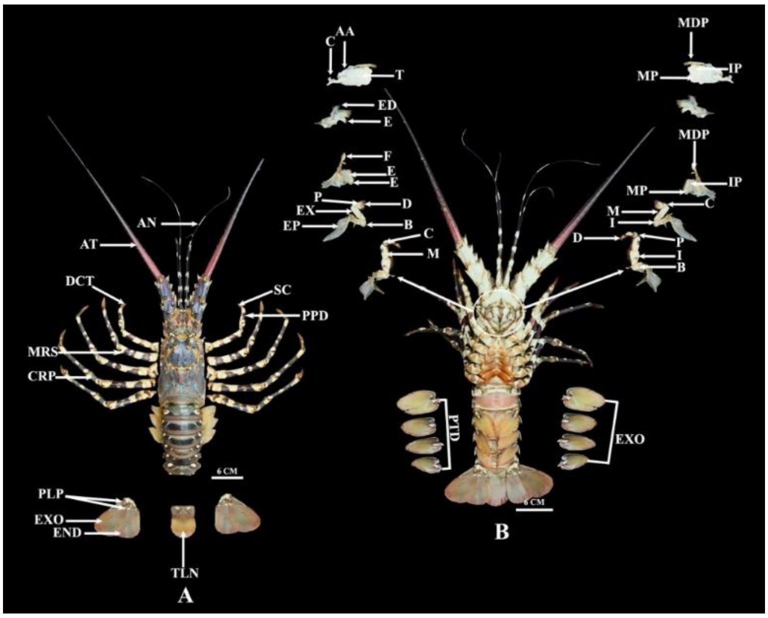

Figure 11 Anatomy of *Panulirus ornatus*, (A) Dorsal, where MP: Molar process, MDP: Mandibular palp, IP: Incisor process, EX: Exopodite, ED: Endopodite, EP: Epipodite, C: Carpopodite, M: Meropodite, I: Ischiopodite, D: Dactylopodite, P: Propodite, I: ischiopodite, B: Basis, EP: Epipodite, EXO: Exopod, PTD: Protopod, E: Endite, T: Tubercles, AA: Anteror apodeme, C: Condyle, and (B) Ventral, where PPD: Propodus, SC: Subchela, AN: Antennulary, AT: Antennary, DCT: Dactylus, MRS: Merus, CRP: Carpus, PLP: Pleopod, EXO: Exopod, END: Endopod, TLN: Telson.

Morphometric analysis of swimming crab species

The morphometric analysis was conducted on 3 commercially important decapod crab species: *P. sanguinolentus*, *P. pelagicus*, and *C. feriata* (n = 10 for each). The data, including the mean, range (min-max), and standard deviation (SD) for various carapace and appendage measurements, highlight significant interspecific differences in body dimensions and growth characteristics (**Table 5**).

Table 5 Morphometric analysis of swimming crabs collected from the east coast of Aceh Province, Indonesia

Parameters	***Portunus sanguinolentus* (n = 10)**				***Portunus pelagicus* (n = 10)**				***Charybdis feriata* (n = 10)**			
	min	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar Deviation**	**min**	**max**	**mean**	**Standar deviation**
(CW)	6.47	9.81	8.12	1.05	9.24	12.37	10.64	1.07	9.23	11.85	10.95	0.90
(ICW)	4.92	7.75	6.42	0.70	7.30	10.72	8.57	1.04	8.89	11.89	10.39	0.93
(CL)	2.60	4.08	3.32	0.48	4.22	6.26	4.91	0.63	6.16	8.05	7.12	0.58
(LACL)	2.63	4.08	3.45	0.46	3.81	5.31	4.42	0.47	3.14	5.17	4.41	0.66
(RACL)	2.63	4.09	3.44	0.46	3.81	5.31	4.42	0.47	3.94	4.99	4.60	0.41
(LPCL)	2.74	4.00	3.36	0.41	3.80	5.13	4.44	0.44	4.06	5.52	4.97	0.46
(RPCL)	2.77	4.00	3.39	0.39	3.80	5.12	4.45	0.44	4.08	5.58	4.94	0.46
(FRMW)	0.25	1.70	1.12	0.49	1.68	2.46	1.93	0.22	2.95	3.85	3.29	0.36
LOW	0.32	0.77	0.48	0.11	0.38	0.70	0.50	0.10	0.27	0.91	0.58	0.21
(ROW)	0.28	0.52	0.41	0.07	0.39	5.53	1.00	1.59	0.25	0.92	0.53	0.22
(PBW)	1.13	2.91	2.29	0.45	2.82	4.72	3.48	0.57	3.12	3.68	3.49	0.16
(CHL2)	6.52	10.77	7.87	1.20	8.28	12.81	10.55	1.47	10.18	23.88	18.46	5.54
(CHL1)	6.12	10.93	7.62	1.20	8.48	12.29	10.25	1.37	10.27	24.36	19.04	5.67
(CHH2)	0.42	0.98	0.77	0.17	0.80	1.39	1.05	0.18	1.23	2.56	1.78	0.42
(CHH1)	0.50	0.98	0.77	0.16	0.79	1.30	1.05	0.16	1.35	2.46	1.88	0.38
Weight	10.06	48.27	28.55	9.91	52.29	122.80	77.70	23.69	156.46	341.15	268.33	76.84

The analysis of carapace dimensions established a distinct size hierarchy among the 3 crab species. The Carapace Width (CW) consistently showed *C. feriata* as the largest species, recording the highest mean value at 10.95±0.90 cm (range: 9.23 - 11.85 cm), closely followed by *P. pelagicus* (10.64 ± 1.07 cm; range: 9.24 - 12.37 cm). In contrast, *P. sanguinolentus* was significantly smaller, with a mean CW of only 8.12 ± 1.05 cm. This size trend was similarly reflected in the Carapace Length (CL) and the Interorbital Carapace Width (ICW), where *C. feriata* maintained the largest dimensions (7.12 ± 0.58 cm for CL and 10.39 ± 0.93 cm for ICW), underscoring its generally larger size profile compared to the *Portunus* species.

Measurements of the anterior and posterior carapace length (LACL, RACL, LPCL, RPCL) and the major chela (claw) dimensions revealed significant structural differences, particularly concerning predatory and defensive morphology. The Chela Length (CHL1) for *C. feriata* averaged 19.04 ± 5.67 cm, which was approximately double the mean length observed in *P. pelagicus* (10.25 ± 1.37 cm) and *P. sanguinolentus* (7.62 ± 1.20 cm). Furthermore, the high standard deviation in *C. feriata*’s chela measurements (e.g., 5.67 cm for CHL1) indicates substantial allometric variability in claw development within this species. Correspondingly, Chela Height (CHH1) was also greatest in *C. feriata* (1.88 ± 0.38 cm), suggesting a more robust and powerful claw structure when compared to the appendages of the 2 *Portunus* species.

The Body Weight data provided the clearest distinction in biomass among the species. The mean weight for *C. feriata* was the highest at 268.33 ± 76.84 g (range: 156.46 - 341.15 g), confirming its status as the heaviest species captured. This substantial size difference is further emphasized when compared to *P. pelagicus*, which averaged 77.70 ± 23.69 g, and *P. sanguinolentus*, which registered the lowest mean weight at 28.55 ± 9.91 g. Collectively, these morphometric results consistently establish that *C. feriata* is the most dimensionally extensive and heaviest species among the decapod crabs analyzed in the study.

Overall, the morphometric data consistently indicate that *C. feriata* is the largest and most morphologically robust species among the 3 analyzed crabs, while the dimensions of *P. pelagicus* and *P. sanguinolentus* are considerably smaller. Furthermore, the higher standard deviation values observed in the chela measurements of *C. feriata* (e.g., 5.67 cm for CHL1) suggest greater allometric variability in claw development within this species compared to the *Portunus* species.

Morphometric analysis of penaeid shrimp species

The morphometric analysis, utilizing ten individuals (n = 10) for each species, was conducted on 3 commercially important penaeid shrimps: *P. monodon*, *M. monoceros*, and *P. merguiensis*. The results demonstrate clear dimensional differences, with *P. monodon* consistently exhibiting the largest average measurements across most parameters, followed by *P. merguiensis*.

Body Weight served as the clearest indicator of size disparity. *P. monodon* (Tiger Shrimp) was the heaviest species, recording a mean weight of 82.67 ± 18.85 g (ranging from 61.10 - 126.65 g). This mean weight was more than double that of *P. merguiensis* (Jerbung Shrimp), which averaged 38.15 ± 13.16 g. The smallest species was *M. monoceros* (Dogol Shrimp), with a mean weight of only 18.6 ± 5.1 g, reflecting its generally smaller commercial size. This size hierarchy established by weight was supported by the Total Length of the Pleon (PTO), where *P. monodon* (23.89 ± 2.60 cm) and *P. merguiensis* (19.82 ± 5.62 cm) were significantly larger than *M. monoceros* (13.6 ± 3.3 cm) (**Table 6**).

Table 6 Morphometric analysis of shrimps collected from the east coast of Aceh Province, Indonesia

Parameters	***Penaeus monodon* (n = 10)**				***Metapenaeus monoceros* (n = 10)**				***Penaeus merguiensis* (n = 10)**			
	min	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**
(RST)	3.88	6.07	4.92	0.58	2.0	4.1	3.0	0.7	3.09	7.93	4.00	1.03
(PK)	6.90	9.43	8.08	0.66	3.5	6.1	4.9	0.7	4.91	12.42	6.15	1.54
(PRP)	0.81	2.35	1.95	0.28	0.7	1.9	1.2	0.3	1.15	3.66	1.64	0.53
(PRD)	1.50	2.39	1.78	0.22	0.5	1.6	1.1	0.3	1.04	2.84	1.58	0.40
(PRT)	1.26	2.31	1.81	0.24	0.3	1.5	1.2	0.3	1.05	3.25	1.77	0.49
(PRE)	1.34	2.10	1.66	0.24	0.9	1.9	1.3	0.3	1.14	3.70	1.67	0.53
(PRL)	1.03	1.80	1.27	0.19	0.5	1.4	0.9	0.2	0.92	2.54	1.29	0.37
(PRN)	1.99	2.74	2.37	0.21	0.9	1.8	1.4	0.3	1.78	4.09	2.20	0.49
(TLS)	1.95	2.95	2.54	0.21	1.4	2.0	1.7	0.2	1.73	4.18	2.13	0.56
(PST)	1.89	3.43	2.64	0.42	1.1	2.1	1.7	0.3	1.61	3.71	2.20	0.47
(PNL)	1.92	4.20	3.22	0.61	0.5	3.8	1.8	1.2	0.46	2.65	1.50	0.81
(PAN)	21.72	38.75	30.19	4.41	10.1	32.4	18.1	8.1	21.70	44.74	27.57	4.80
(PTO)	20.90	33.42	23.89	2.60	7.3	20.2	13.6	3.3	7.30	39.09	19.82	5.62
(PSTDR)	15.47	28.59	17.85	2.87	9.2	13.5	10.8	1.3	11.41	32.05	15.12	4.38

Parameters	***Penaeus monodon* (n = 10)**				***Metapenaeus monoceros* (n = 10)**				***Penaeus merguiensis* (n = 10)**			
	min	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**
(PKB)	5.93	8.79	7.04	0.76	2.8	4.8	3.9	0.5	0.65	10.50	4.97	1.71
(PPB)	1.42	2.00	1.67	0.14	0.4	1.2	0.8	0.2	0.63	2.77	1.41	0.46
(PDB)	0.91	1.27	1.10	0.09	0.3	1.4	0.6	0.2	0.58	2.28	0.90	0.35
(PTB)	0.99	1.31	1.11	0.09	0.4	0.8	0.6	0.1	0.58	1.81	0.87	0.26
(PEB)	1.09	1.51	1.22	0.09	0.4	1.2	0.7	0.2	0.69	2.26	0.99	0.33
(PLB)	1.15	1.45	1.27	0.09	0.3	1.0	0.6	0.2	0.82	2.27	1.09	0.32
(PNB)	1.20	2.01	1.73	0.17	0.6	1.4	1.1	0.2	1.28	3.39	1.65	0.44
(PE)	3.10	4.43	3.85	0.33	1.5	3.3	2.3	0.4	0.51	6.09	3.12	0.93
(PTK)	13.14	17.82	15.15	1.24	8.2	12.3	10.0	1.4	10.95	27.12	14.19	3.67
Weight	61.10	126.65	82.67	18.85	10.6	29.6	18.6	5.1	21.11	62.44	38.15	13.16

Parameters related to the carapace and rostrum consistently highlighted the dominance of *P. monodon*. The Rostrum Length (RST) averaged 4.92 ± 0.58 cm for *P. monodon*, which was considerably greater than *P. merguiensis* (4.00 ± 1.03 cm) and *M. monoceros* (3.0 ± 0.7 cm). Similarly, the Carapace Length (PK) for *P. monodon* was the largest at 8.08 ± 0.66 cm. Notably, *P. merguiensis* displayed the highest variability across several key parameters, evidenced by its large Standard Deviation (SD) for PK (1.54 cm) and PTO (5.62 cm), suggesting a broader range of sizes captured or higher morphological plasticity compared to the tightly distributed measurements of *P. monodon* (SD for PK: 0.66 cm; SD for PTO: 2.60 cm).

Appendage measurements, such as the length of the pleopods (e.g., PRP, PRD, PRT) and the length of the Telson (TLS), generally followed the overall body size trend: *P. monodon* ≥ *P. merguiensis* ≥ *M. monoceros*. For instance, the Telson Length (TLS) averaged 2.54 ± 0.21 cm for *P. monodon* and 1.7 ± 0.2 cm for *M. monoceros*. Despite its smaller mean size, *P. merguiensis* exhibited notably high variability in most appendage measurements (e.g., 0.56 cm for TLS), similar to its larger carapace dimensions, while *P. monodon* showed the lowest variability across nearly all measured parameters, indicating a more uniform sample set.

Morphometric analysis of spiny lobster species

The morphometric analysis, utilizing ten individuals (n = 10) for both species, compared *P. ornatus* (Pearl Lobster) and *P. homarus* (Sand Lobster) based on various body, appendage, and caudal measurements. The data reveal notable differences, particularly in overall size and the symmetry of certain morphological features.

P. homarus consistently exhibited a larger mean size profile than *P. ornatus*. *P. homarus* recorded a significantly higher mean Body Weight at 218.88 ± 46.68 g (range: 94.08 - 273.91 g), substantially exceeding the mean weight of *P. ornatus* (177.40 ± 51.26 g). Similarly, the Total Length was greater for *P. homarus* (18.41 ± 2.53 cm) compared to *P. ornatus* (15.47 ± 1.50 cm). The higher standard deviation in the total length of *P. homarus* (2.53 cm) suggests greater dimensional variability within the sampled population of this species (**Table 7**).

Table 7 Morphometric analysis of lobsters collected from the east coast of Aceh Province, Indonesia.

Parameters	***Panulirus ornatus* (n = 10)**				***Panulirus homarus* (n = 10)**			
	min	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**
Weight (g)	112.45	272.76	177.40	51.26	94.08	273.91	218.88	46.68
Total Length (cm)	13.47	17.63	15.47	1.50	12.92	20.82	18.41	2.53
A (Anterior of the head) (mm)								
A1	2.57	4.01	3.09	0.45	2.68	4.32	3.89	0.53
A2	1.27	2.10	1.64	0.27	1.01	1.96	1.27	0.29
A3	2.57	4.02	3.09	0.45	2.68	4.32	3.89	0.53
A4	3.46	4.81	4.08	0.44	3.70	5.36	4.97	0.52
A5	3.21	4.98	3.95	0.61	3.20	5.30	4.54	0.54
A6	3.21	4.91	3.94	0.60	3.20	5.31	4.54	0.54
B (Posterior of the head) (mm)								
B1	2.93	4.00	3.44	0.41	2.54	4.84	3.84	0.66
B2	3.52	4.82	4.13	0.44	3.69	5.36	4.98	0.49
B3	2.93	4.00	3.43	0.39	2.54	4.84	3.84	0.66
B4	3.12	4.66	3.88	0.52	3.07	4.31	4.03	0.35
B5	4.47	6.09	5.27	0.55	4.40	5.96	5.55	0.45
B6	4.47	6.08	5.27	0.54	4.40	5.96	5.55	0.46
Body (C) (mm)								
C1	5.61	7.36	6.36	0.53	4.62	7.75	6.76	1.07
C2	3.07	4.20	3.64	0.37	2.87	4.31	3.98	0.40
C3	5.61	7.36	6.36	0.54	4.62	7.75	6.76	1.07
C4	1.92	2.97	2.45	0.33	1.86	3.68	2.66	0.47
C5	6.15	7.95	6.92	0.60	5.16	8.43	7.53	1.05
C6	6.15	7.83	6.91	0.57	5.16	8.43	7.53	1.05
Body Sections (R) (mm)								
R1	3.05	4.15	3.60	0.38	3.09	4.69	4.21	0.44
R2	2.76	4.23	3.46	0.42	2.92	4.62	4.15	0.49
R3	2.74	3.91	3.32	0.38	2.83	4.44	3.96	0.47
R4	2.56	3.76	3.16	0.39	2.50	4.17	3.67	0.50
R5	2.44	3.50	2.93	0.37	2.42	3.76	3.35	0.40
R6	2.33	3.19	2.71	0.31	2.39	3.66	3.33	0.41
Caudal (D) (mm)								
D1	2.14	2.87	2.45	0.27	1.57	3.64	2.92	0.77
D2	1.62	2.35	2.02	0.27	1.26	3.68	2.29	0.68
D3	2.10	2.85	2.45	0.28	1.57	3.64	2.92	0.77
D4	1.32	2.00	1.72	0.25	1.30	3.68	2.36	0.69
D5	2.59	3.48	2.93	0.29	2.42	4.30	3.62	0.79
D6	2.45	3.48	2.91	0.31	2.42	4.30	3.62	0.79
Leg (E: front legs to the bottom) (mm)								
E1	6.80	9.26	7.79	0.81	5.78	8.21	7.58	0.73
E2	3.66	6.08	5.00	0.68	3.97	10.27	7.66	2.37
E3	6.71	11.87	9.31	1.34	7.27	12.41	10.20	1.42
E4	6.68	10.54	8.48	1.10	6.17	10.45	9.27	1.28

Parameters	*Panulirus ornatus* (n = 10)				*Panulirus homarus* (n = 10)			
	min	**max**	**mean**	**Standar deviation**	**min**	**max**	**mean**	**Standar deviation**
E5	5.20	10.14	7.03	1.27	5.36	8.45	7.45	0.94
E1 (from top to bottom) (mm)								
E1, 1	0.90	2.36	1.65	0.53	1.35	3.71	2.68	0.94
E1, 2	0.88	1.43	1.13	0.18	0.93	1.99	1.33	0.28
E1, 3	1.19	1.84	1.42	0.18	1.00	1.94	1.61	0.32
E1, 4	0.44	0.83	0.64	0.15	0.70	1.39	1.17	0.25
E2 (from top to bottom) (mm)								
E2, 1	3.02	3.78	3.29	0.25	2.38	4.56	3.64	0.72
E2, 2	1.09	1.61	1.24	0.16	1.10	1.47	1.31	0.11
E2, 3	2.05	2.77	2.24	0.22	1.64	2.82	2.33	0.40
E2, 4	0.77	1.17	0.98	0.12	0.77	1.33	1.12	0.17
E3 (from top to bottom) (mm)								
E3, 1	3.69	4.83	4.14	0.37	3.20	4.71	4.24	0.44
E3, 2	1.15	1.70	1.35	0.17	1.21	1.64	1.43	0.13
E3, 3	2.43	3.52	2.81	0.34	2.08	3.70	3.02	0.44
E3, 4	1.15	1.41	1.26	0.09	1.05	1.78	1.42	0.21
E4 (from top to bottom) (mm)								
E4, 1	2.76	4.46	3.53	0.54	3.05	4.20	3.82	0.36
E4, 2	0.94	1.48	1.24	0.16	0.99	1.74	1.39	0.19
E4, 3	2.12	2.91	2.50	0.23	1.89	3.07	2.76	0.35
E4, 4	0.98	1.51	1.28	0.17	0.95	1.69	1.44	0.24
E5 (from top to bottom) (mm)								
E5, 1	2.34	3.71	2.84	0.39	2.21	3.14	2.84	0.26
E5, 2	1.01	1.33	1.15	0.11	0.99	1.42	1.29	0.13
E5, 3	1.80	2.92	2.26	0.32	1.72	2.69	2.44	0.30
E5, 4	0.59	1.27	0.93	0.26	0.79	1.47	1.06	0.20
Antena (mm)								
Left	28.90	49.65	37.50	7.10	23.30	46.50	38.52	6.24
Right	26.93	44.73	35.92	6.69	22.50	46.10	36.91	8.57

Measurements across the head (A,B) and body sections (C,R) generally supported the size hierarchy, with *P. homarus* often showing slightly larger mean values. For instance, the posterior head measurements (B2) averaged 4.98 ± 0.49 mm for *P. homarus* compared to 4.13 ± 0.44 mm for *P. ornatus*. Similarly, body section measurements (C2) were larger in *P. homarus* (3.98 ± 0.40 mm) than in *P. ornatus* (3.64 ± 0.37 mm). Notably, the caudal (D) dimensions displayed a particularly high degree of variability in *P. homarus*. Parameters such as D1 (mean 2.92 ± 0.77 mm) and D5 (mean 3.62 ± 0.79 mm) showed standard deviations approximately 3 times higher than those recorded for *P. ornatus* (e.g., 0.27 mm for D1; 0.29 mm for D5). This indicates a marked heterogeneity in the caudal structure size of *P. homarus*.

Measurements of the pereopods (Leg E) revealed complex differences. While *P. homarus* showed a larger mean for several proximal segments (e.g., E2 mean 7.66 ± 2.37 vs. 5.00 ± 0.68 mm for *P. ornatus*), *P. ornatus* displayed greater means in others. Importantly, the E2 measurement in *P. homarus* exhibited a highly substantial standard deviation (SD = 2.37), the largest variation observed across all limb parameters, reflecting significant allometric or sexual differences in this particular appendage.

Regarding Antenna Length, *P. homarus* possessed slightly longer mean left and right antennae (38.52 ± 6.24 and 36.91 ± 8.57 mm, respectively) compared to *P. ornatus*. Both species showed some degree of asymmetry between the left and right antennae, though the difference in the right antenna measurement for *P. homarus* (SD = 8.57) suggests greater variability in this feature than in *P. ornatus* (SD = 6.69).

In conclusion, the morphometric results confirm that *P. homarus* is generally the larger and heavier species. Furthermore, it exhibits significantly higher morphological heterogeneity in its caudal section and certain appendage segments compared to the more uniformly sized *P. ornatus.*

Discussion

The Decapoda Crustacean group represents a globally significant component of marine biodiversity, comprising an immense 17,229 recorded species spanning 2,550 genera and 203 families [24]. Recognized as the taxon with the largest number of species [25], decapods are critically important for both marine ecology and global fisheries. Locally, this research focused on the eastern coast of Aceh Province, Indonesia, identified 8 commercially relevant decapod species: *C. feriata*, *P. sanguinolentus*, *P. pelagicus*, *P. monodon*, *M. monoceros*, *P. merguiensis*, *P. homarus*, and *P. ornatus*. However, our findings reveal distinct ecological patterns and morphological variations that reflect the local environmental conditions of the Malacca Strait. Given the ecological and economic significance of these taxa, the conservation of their natural habitats is imperative in Indonesia to ensure sustainable resource utilization [26].

The family Portunidae includes highly valuable resources such as the blue swimming crab (*P pelagicus*), an important organism globally [27] and a key fishery commodity in Indonesia [28]. Similarly, the coral crab (*C. feriata*) is a major economic contributor to fishermen worldwide [29]. The widespread distribution of *P. pelagicus* spans 17 Provinces and 10 Fisheries Management Areas (WPP) across Indonesia [30], often appearing as bycatch in regions like South Sumatra [31], and Southeast Sulawesi [32]. The management of *P. sanguinolentus*, however, is increasingly critical, as its population is declining due to intensive exploitation pressure and habitat destruction [33,34]. Detailed morphological analysis is foundational for accurate stock assessment. The general external anatomy of these crab species includes characteristic dorsal features such as the carapace, pleon, dactylus, and rostrum, while the ventral structure is defined by muscles (tendons of external adductor/abductor), appendages (exopod, endopod, flagellum), and the telson. Such structural details are directly linked to morphometric studies, particularly those correlating carapace width with body weight, which is essential for defining management parameters [35]. By correlating our morphometric data - specifically carapace width to body weight - we provide the foundational parameters necessary for local fisheries authorities to establish sustainable catch quotas.

Interestingly, the *C. feriata* was recorded exclusively in the Pidie sampling site. This spatially restricted occurrence may be attributed to habitat specificity and the unique seafloor topography of Pidie, which features more prominent rocky and coral reef patches compared to the predominantly muddy estuaries of North Aceh and Aceh Tamiang. *C. feriata* is known to prefer reef-associated or rocky substrates [29]. Additionally, this distribution may be influenced by gear selectivity; the traditional bottom gillnets and traps (*bubu*) used by Pidie fishermen are specifically deployed in these rocky corridors, whereas the trawling and push-nets common in other regencies are less suited for capturing this species. This localized presence suggests that Pidie serves as a critical habitat for *C. feriata* in Aceh, necessitating specialized management of its rocky-coastal ecosystems.

The family Penaeidae encompasses some of the most economically and ecologically important marine shrimps globally [36]. Ecological and morphometric studies are vital for gathering information on population structure, growth rates, and morphological relationships within these species [37]. The presence of the decapod *Penaeus* species is widely confirmed across marine waters worldwide [38]. *P. monodon* (Tiger Prawn), a native Indonesian species, commands high economic value and offers enormous potential for fishery products [39]. Other key catches include *M. monoceros*, a commercially important penaeid shrimp in the Indo-West Pacific [40,41], and *P. merguiensis*, which is a primary commercial target along the coastal areas of Sumatra, Indonesia, possessing high economic and ecological value [42,43]. The dorsal morphology of these penaeid species is characterized by the protopod, telson, exopod, and pereopods. The ventral section is complex, featuring the masculine appendix, pleopods, mandibles, and specialized sensory structures like the statocyst opening and scaphocerite.

Lobsters (*Panulirus* spp.) represent another high-value fishery resource, with the majority of catches derived from marine environments [44]. Aceh Province is known to harbor several species, including *P. homarus* and *P. ornatus* [22]. The Pearl Lobster (*P. ornatus*) has a wide distribution across the Indo-West Pacific and is recognized as one of the world's most valuable seafood products [45]. Conversely, the Sand Lobster (*P. homarus*) is characterized by a greenish or brownish body color with sand-like white spots, small carapace spines, and segmented abdomen [46]. Morphological features, such as antenna shape and body pattern color, serve as significant distinguishing characteristics between the 2 species [47]. The dorsal morphology of *Panulirus* species is defined by structures like the mandibular palp, incisor process, and various podites (e.g., carpopodite, ischiopodite). Ventrally, key features include the propodus, subchela, pleopod, and telson. Morphological measurements provide essential data for the accurate characterization of *Panulirus* stocks [48]. To ensure resource sustainability and expand scientific understanding, continuous monitoring and further research in this area are necessary [49].

Notable morphological variability was observed in *P. homarus* across the sampling sites. This variability, particularly in carapace coloration and spine density, likely reflects adaptations to the diverse benthic substrates found between Pidie and Aceh Tamiang. The eastern coast of Aceh is characterized by a gradient of sandy-muddy bottoms influenced by riverine discharge. Such environmental heterogeneity, combined with varying levels of fishing pressure, may drive localized phenotypic plasticity or population structuring. In areas with higher turbidity, *P. homarus* exhibited darker pigmentation, a trait potentially linked to camouflage and survival in low-visibility environments. Furthermore, the morphometric range observed suggests that the population consists of multiple age cohorts, highlighting the need for site-specific size limits to prevent growth overfishing.

Conclusions

This study provides foundational morphological and morphometric baselines for the decapod crustacean resources along the eastern coast of Aceh Province, Indonesia, identifying 8 commercially important species across the Portunidae, Penaeidae, and Palinuridae families. The morphometric analysis successfully established a clear size hierarchy, positioning *C. feriata*, *P. monodon*, and *P. homarus* as the largest species within their respective groups based on mean body weight and carapace dimensions. Furthermore, the high standard deviation observed in key measurements for species like *P. merguiensis* and *P. homarus* highlights significant morphological heterogeneity, suggesting potential variations in allometric growth or local environmental influences within these stocks. Given the ecological and economic significance of these species - particularly the evident exploitation pressure on taxa such as *P. sanguinolentus* - the data from this research are indispensable for informing species-specific management strategies, monitoring growth rates, and establishing sustainable resource utilization protocols necessary to mitigate the threats posed by unregulated harvesting.

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Conflict of interest declare

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Generative AI in Scientific Writing

This manuscript utilized generative AI tools, namely QuillBot and Grammarly, to enhance language clarity, grammar, and overall readability.

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