Data collection protocol for mud crab (*Scylla* spp.) fishery in Indonesia

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Yayasan
Masyarakat dan Perikanan
Indonesia

This document can be downloaded from the I-Fish website with the following link:

http://ifish.id/?q=id/content/library-protocol

Table of Contents

Chapter 1 Introduction

1.1. Motivation for a mud crab data collection system in Indonesia..... 1

1.2. Objectives of this data collection protocol..... 2

1.3. Background to the mud crab fisheries of Indonesia..... 4

1.4. I-Fish database system and Data Management Committees..... 5

Chapter 2 Mud crab species identification guidelines……... 7

Chapter 3 Standard Operating Procedures……. 16

2.1. Standard Operating Procedure, SOP, I – Fishing gear and grounds…….. 16

2.2. Standard Operating Procedure II – Sampling Design..... 20

2.3. Standard Operating Procedure III – Bait Data……... 22

Chapter 4 Data Collection Process..... 24

4.1. Daily Port Sampling Form..... 24

4.2. Data storage and analysis..... 26

Appendix Data collection form..... 27

References 29

Chapter 1 – Introduction

1.1 Motivation for a mud crab data collection system in Indonesia

In recent years, the concept of 'sustainability' has become an important focus of fisheries management, but is hard to define and interpretation of the concept continues to evolve (Rice 2014). It is generally accepted that a fishery must fulfill three sustainability dimensions to be considered sustainable: ecological, economic and social (Garcia & Staples 2000). The three dimensions may be defined as follows:

- ecological dimension: the stock biomass should be greater than a minimum reference level
- economic dimension: the individual vessel profit should be greater than a minimum reference level
- social dimension: there must be a minimum level of employment and activity (Martinet et al. 2007).

Additional requirements relating to bycatch of non-target species and environmental impacts can be included when necessary (Jacquet et al. 2009). Continuous data collection systems are required to evaluate the status and progress of the three dimensions of sustainability. This protocol aims to contribute towards data collection activities for the mud crab fisheries of Indonesia, so that progress towards achieving sustainability can be monitored and improved.

The global demand for sustainably-sourced seafood is increasing as certification schemes and consumer recommendation lists influence consumers' preferences (Belson 2012). The European Commission has regulations stipulating a traceability system as a requirement for food producers and a catch certification scheme to combat the import of IUU fish (EC 2009; EC 2008). In the US, the 2011 Food Safety Modernization Act (Anon 2011) allows the Food and Drug Administration to order the establishment of food product tracing systems. To maintain Indonesia's position as a competitive player in the global seafood market it is advised that its products begin a conversion process towards sustainability and eventual certification of sustainability. Such a certification process can only be conducted when a high level of knowledge exists regarding annual catch estimates, separated by gear and species, operational catch and effort data, size distribution of the stock and general health of the stock and the ecosystem. This data is usually limited within Indonesian fisheries and it is important that data collection processes are improved.

Despite referencing a ‘sustainable approach’ to fisheries resource management in its Development Plan, Indonesia has a poor record of implementation and enforcement and is supporting expansion rather than following the precautionary approach to fisheries, the ecosystem approach to fisheries or improving stock sustainability. Regulations from 2004 cover development and resource use within Indonesian archipelagic waters and within the Exclusive Economic Zone (MMAF 2004b; MMAF 2004a). National regulations are established and to monitor the success/progress of these regulations, robust data collection is required. Regulations relevant to this protocol include:

- Ministerial Regulation No.1/2015: outlaws capture of berried mud crabs and establishes a minimum carapace landing size for of 15cm. All catches of dead berried or undersized individuals must be reported (MMAF 2015)

Monitoring the progress and success of this regulation requires robust data collection activities. Fisheries management in Indonesia has developed into a decentralised system, whereby individual regions can introduce region-specific regulations. To coordinate management of the stocks at a national level, the government must have information from the different regions. Each region should have a number of data collection sites, providing sufficient sampling coverage to contribute to national management plans. Efforts should be made to coordinate and consolidate the data from each region. The national regulation, the regional decentralisation and the market demand for sustainably-sourced seafood motivate the need for improved data collection systems in Indonesia. This need exists in both the commercial and artisanal fisheries as also in the various gear differentiated fisheries. This protocol focuses on data collection for the mud crab, *Scylla* species. The associated staff training protocol (available from the I-Fish website) should be consulted for detailed information on the duties of field staff.

1.2 Objectives of this data collection protocol

This document is a guide for the data collection process at mud crab, *Scylla* species, landing sites within Indonesia. It includes: species identification guidelines (Chapter 2); Standard Operating Procedures for recording data on fishing ground, carapace width, sex and maturity level and bait data (Chapter 3); instructions for the data collection process (Chapter 4); and the data collection forms (Appendices).

This protocol has the following objectives:

- Ensure a set of standards are in place for the data collection process for mud crab species in Indonesia; that this data is collected in a uniform way, that transferability of this data is ensured and that it is done in a cost efficient method
- Allow fishery managers, government agencies, regional fishery management councils and private industry to gain access to high quality data on mud crab catches in Indonesia and to use this information to improve Indonesian mud crab management

In achieving the above objectives it is anticipated that the following general objectives may also be achieved. These objectives address scientific, management and market related issues relevant to Indonesian waters:

- Improve existing knowledge within Indonesia and the wider scientific community on a small but important fishery in Indonesia
- Use the improved knowledge to better understand stock dynamics, changes occurring due to environmental factors, such as climate change, and to adapt to these changing circumstances with appropriate management measures
- Catalogue the encounters (if any) this fishery has with endangered, threatened and protected species and develop strategies to minimize the impact of fishing activity on these species
- Ensure ecosystem and habitat functioning and resilience by increased knowledge and adaptive decision making
- Acquire additional information on the associated bycatch and make relevant decisions to minimize the indirect effects on these species/stocks
- Ensure that sustainable management practices are implemented to profile the stock correctly, ensuring catch advice adheres to sustainable and precautionary guidelines, progressing towards a sustainable mud crab fishery in Indonesia
- Increase local government involvement in the data collection process by capacity building and creating data collection networks
- Ensure that the management process takes financial as well as food security matters into consideration if making decisions on catch allowances,
- Transfer knowledge and background of the data collection process to various stakeholders involved in the mud crab supply chain, with the aim of developing ownership and eventual acceptance within the community

- Support Indonesian mud crab achieve management and sustainability levels required for eco-certification, enhancing its competitiveness in the global market
- Maximize/maintain profits from mud crab fisheries while considering ecological limits
- Support the conservation and sustainable use of mangrove areas in West Papua

1.3 Background to the mud crab fishery in Indonesia

Mud crabs, *Scylla* spp., can tolerate low salinity levels and can respire out of water, thus making them adaptable to habitats experiencing tidal cycles of salinity and water levels, such as mangroves. Mud crabs molt numerous times over their lifecycle, during which time they are vulnerable to predation and cannibalism (Mirera & Moksnes 2013). Mating occurs when the female in a molt stage, when she is in a soft-shell condition, and the male will protect her during this time (Meynecke & Richards 2014). Adults and juveniles are often found in separate habitats (Dumas et al. 2012), with females migrating offshore during the spawning season to find habitats that are more chemically and thermally stable than closer inshore (Meynecke & Richards 2014).

The mud crab fisheries are important, small-scale fisheries throughout Australia and southeast Asia and are gaining importance as an aquaculture product (Mirera 2011). There are four species of mud crab found in Indonesia (see more detail in Chapter 2) and are found in all mangrove regions of Indonesia, with Northern Sumatera, Eastern Java and Eastern Kalimantan being the most important areas historically (BOBP 1991). The largest mangrove area in Indonesia is in West Papua, where production has increased in recent decades and women conduct the fishing activity rather than men. Crabs are sold to local markets but the highest demand is as a live export product to other Asian countries, particularly China. Suppliers buy the crabs from local fisherwomen for between 20,000-25,000Rp/kg. In West Papua, the fishing season is usually from January to July, with the highest market demand from August to December, from Chinese buyers.

Mud crabs are caught using baited traps and there is thought to be little associated bycatch. The traps are known locally as '*bubu'*, with each fisherwoman having between 5-10 traps, catching three to five crabs per trap per day. The dimensions of the collapsible traps are typically 40cm x 30cm x 20cm, with a mesh size of 1 inch. The fisherwomen use small wooden canoes, typically <3m in length. Fishing activity for mud crab is restricted to coastal mangrove areas, with the crabs usually remaining in site-specific populations, burrowing

below the mean low water level (FAO 2011). Mud crabs are a robust species, surviving trap-induced physical damage, although post-molts can suffer more damage than inter-molt individuals (Butcher et al. 2012). Mud crab fisheries are small-scale and coupled with the narrow range of crab movements, it could be possible to develop site-specific management measures for this species (Ewel 2008; Dumas et al. 2012).

1.4. I-Fish database system and Data Management Committees

Given the volume of data that can be collected to inform fisheries management, a database system has been developed to store the collected data and make it easily available to different types of stakeholders. This system, termed I-Fish (Indonesian Fisheries Information System), aims to inform fisheries management planning at district, provincial and national levels, and address the urgent need for an effective and flexible data management platform in Indonesia (Figure 1). I-Fish aims to align with national fisheries data standards, as well as with market certification requirements, such as the Marine Stewardship Council (MSC) certification. In this way, I-Fish provides a transparent tool for data entry, storage and processing, fulfilling an essential need for fisheries under consideration for eco-label certifications. I-Fish is a comprehensive system for enabling the private sector to collect valid and verifiable data required by the government in order to manage fisheries sustainably. Involvement of the private sector— including fishers, traders, fishing companies, and exporters—provides near real-time data about the fishery, and assists governments to target resources where they are needed most.

To ensure I-Fish data transparency and promote collaboration amongst stakeholders, Data Management Committees, DMCs are established as co-management initiatives. DMCs focus on data from artisanal fisheries, such as mud crab fisheries. The committee aims to achieve a complete representation of stakeholders to the fishery in the target area, and if necessary to support a rotational system of membership. The committees are an efficient way to coordinate data management between government officials, representatives of the fishing industry, and researchers. Through the DMCs it is expected that these stakeholders gain an informed and shared understanding about the status of the mud crab stock in a local region.

The mission of the DMCs is to support and contribute to the collection and analysis of data relating to catch composition, fishing grounds and effort so as to identify specific patterns within the fishery. A summary of this data shall be published and disseminated to DMC members and stakeholders. Fishery targets can be suggested based on the shared use of

the data, stakeholders can be informed of the implications of the data analysis and the information can be integrated into local management decisions. The tools and capacity to contribute to management of the fishery are then developed in the DMC members, who can help to sustainably develop and manage the fishery.

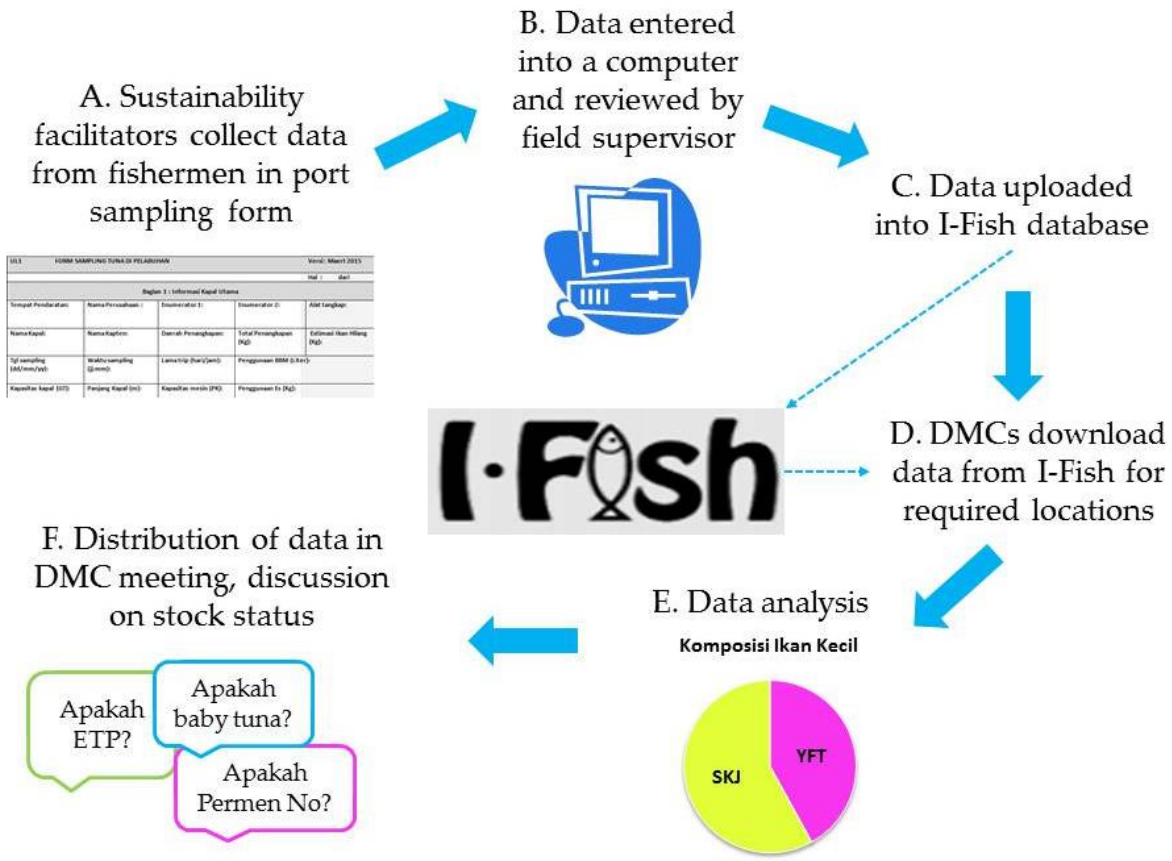

Figure 1. The data flow for the I-Fish approach. A. Sustainability facilitators collect the data from fishermen and suppliers, in both the port sampling form and the monthly unloading form. B. The data is entered in into a computer and verified by the field supervisor. C. Once the data has been verified it is uploaded into the I-Fish database where it can be accessed by stakeholders. D. Representatives of the Data Management Committees, DMCs, can access and download the data from I-Fish. E. Representatives of the DMCs can conduct data analysis and evaluation. F. The analyses data is presented and discussed at the DMC meetings by various stakeholders.

Chapter 2 – Mud crab species identification guidelines

There are potentially four species of the *Scylla* in Indonesia: *Scylla serrata, Scylla tranquebarica, Scylla olivacea,* and *Scylla paramamosain*. This chapter describes the defining features of each species, with a species identification guide for use in the field. The main features used for differentiating between species are on the carapace and the chelipeds (Table 1 and Figure 2, 3 and 4). The periopods can also be used, but mainly for colour differences between species. In most cases the size and shape of the spines near the eyes, and those on the claw arm, are most useful when differentiating between species (Table 2). Keenan et al. (1998) currently provides the most comprehensive description of, and differences between *Scylla* species, and the majority of this chapter is based on that paper.

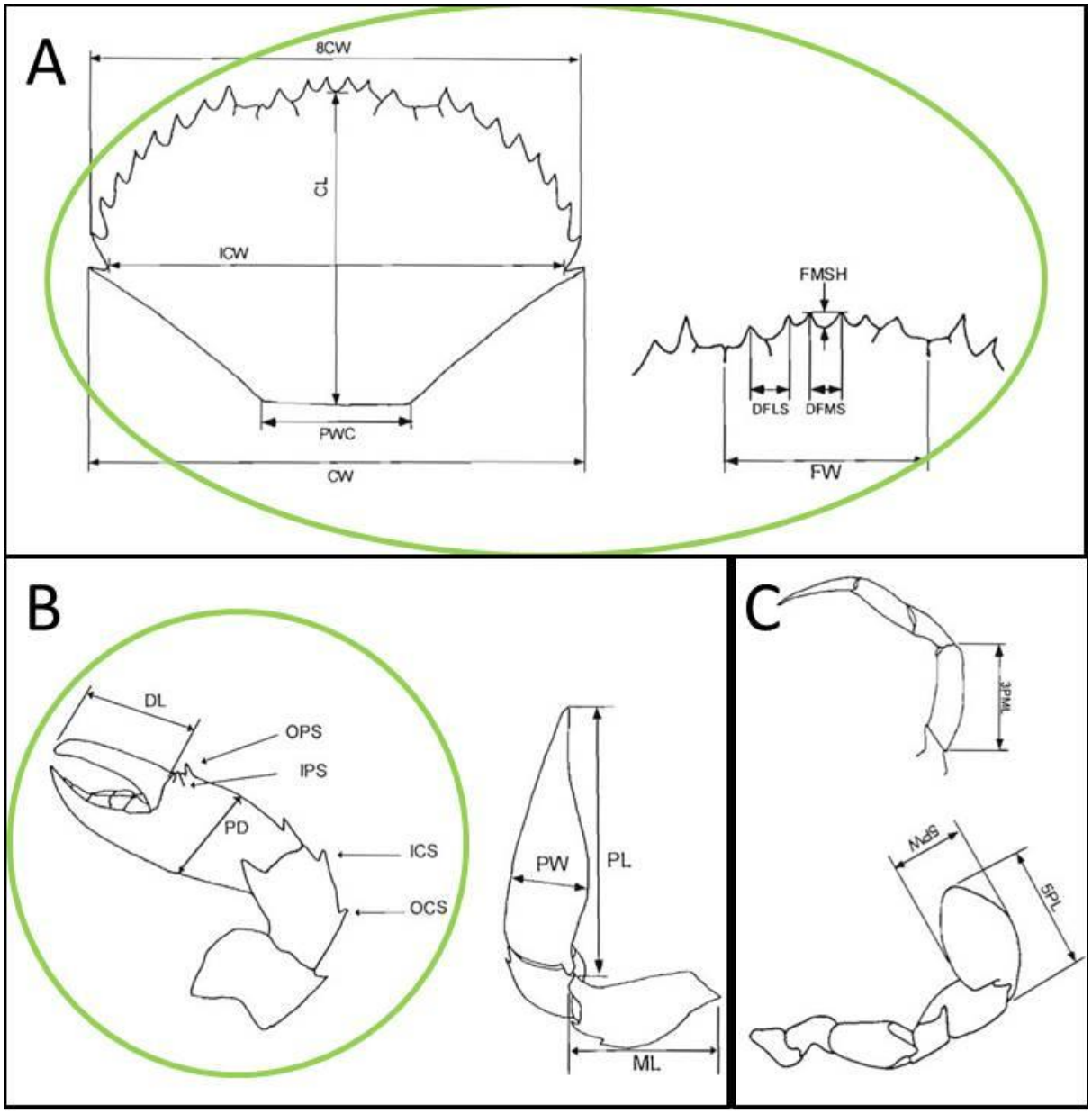

Figure 2. Standard sections for measurement on a crab. Green circles highlight the measurements that are most useful for species identification. A – carapace, B – cheliped, C — periopods.

Table 1. Full name of abbreviations in Figure 2.

Area	Abbreviation	Full name
A. Carapace	ICW	Internal carapace width
	CL	Carapace length
	PWC	Posterior width of carapace
	OW	Outer width
	8CW	Carapace width at spine 8
	FMSH	Frontal median spine height
	DFMS	Distance between frontal median spines
	DFLS	Distance between frontal lateral spines
	FW	Frontal width
	CW	Carapace width
B. Cheliped	PL	Propodus length
	DL	Dactyl length
	PW	Propodus width
	PD	Propodus depth
	IPS	Inner propodus spine
	OPS	Outer propodus spine
	ICS	Inner carpus spine
	OCS	Outer carpus spine
	ML	Merus length
C. Periopod	5PW	5^{th} periopod dactyl width
	5PL	5^{th} periopod dactyl length
	3PML	3^{rd} periopod merus length

Table 2. Morphological features for distinguishing between adult species

	Frontal Lobe Spines (spines on carapace near the eyes)		**Cheliped**	
	Shape	**Height**	**Carpus spines**	**Propodus spines**
Serrata	Blunt point	High	Both obvious	Obvious
Tranquebarica	Blunted	Moderate	Both obvious	Obvious
Olivacea	Rounded	Low	Inner absent Outer reduced	Reduced
Paramamosain	Triangular	Moderately high	Inner absent Outer reduced	Obvious

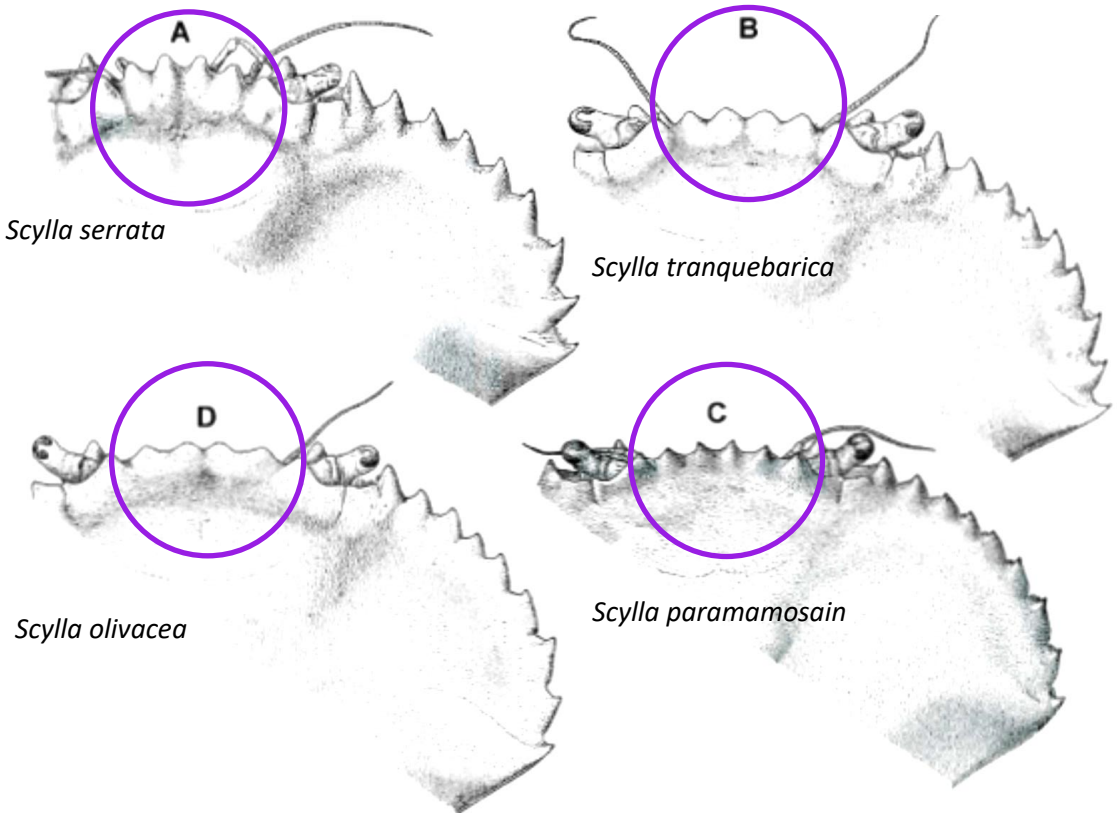

Figure 3. Drawing of crab carapace showing diagnostic taxonomic features. Note differences in frontal lobe spines (circled).

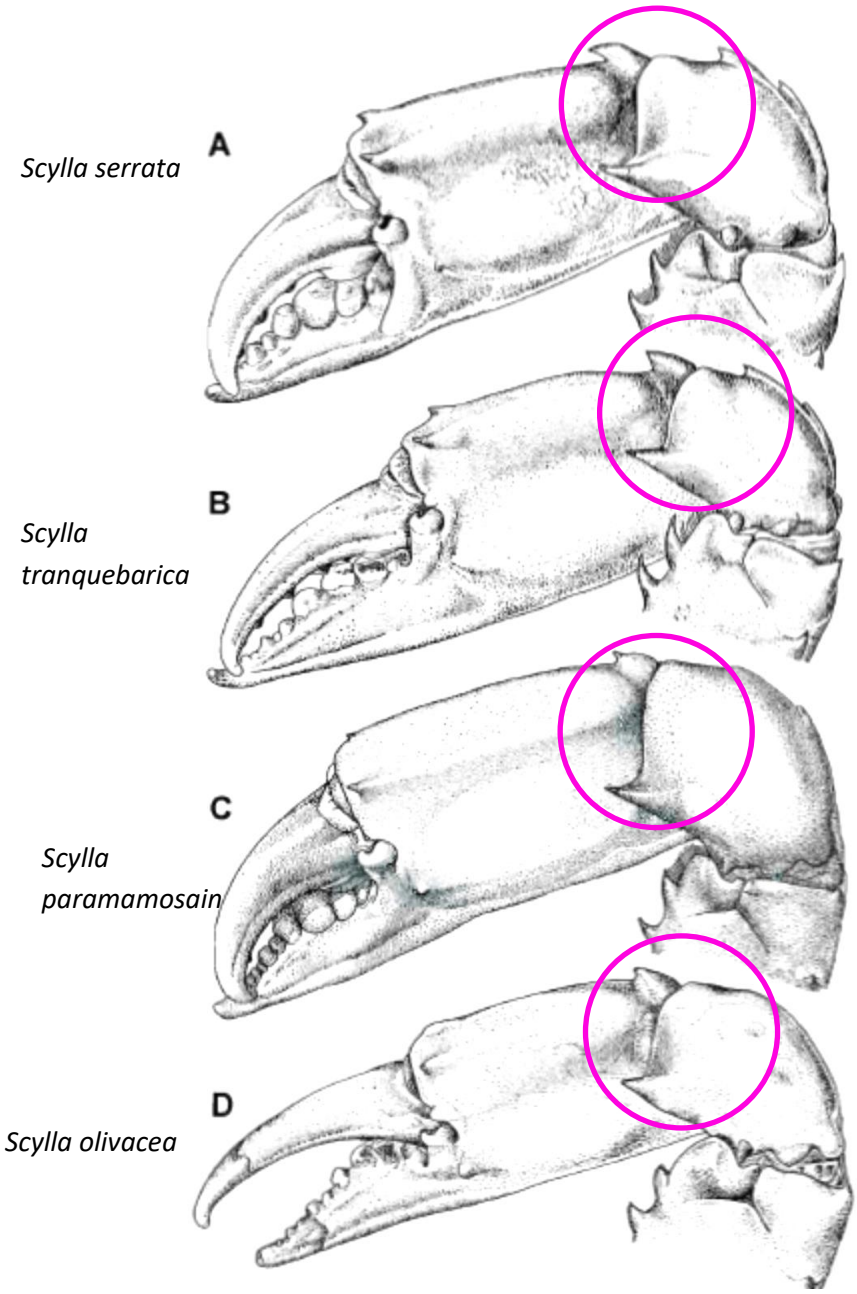

Figure 4. Drawings of right cheliped showing diagnostic taxonomic features. Note differences in spines on carpus (circled).

The site supervisor is responsible for ensuring all individuals are identified to species level. If there is doubt as to the identification of a species the following steps should be taken:

- The fisherwomen/supplier should be consulted as to the identification of the species. This may result in the species being identified with a local name, which should be recorded and reported to the supervisor. The supervisor should ensure the new species is included in this protocol.

- If the species cannot be identified a detailed description of external features of the species should be recorded and a picture taken for reference. This should be forwarded to relevant supervisors/managers, etc.

1. *Scylla serrata* / Indo-Pacific swamp crab / Kepiting bakau / MUD

Scylla serrata is a portunid crab, meaning that fourth pair of legs are flattened into paddle-like structures and are used for swimming. *Scylla serrata* has a smooth oval-shaped carapace and the dorsal shell is usually a dark olive/brown colour, with a visible H-shaped groove (Figure 5). They have a large, strong claw, nine sharp spines along the margins of the dorsal shell and also on the joints of the legs. From the three species of crab covered in this protocol, *Scylla serrata* grows to the largest size, capable of reaching carapace widths of ~25-28cm but widths of 15-20cm are most common. It has a blotchy pattern on the swimming paddles, the carapace shell and the claw arms. The claws are often purple/green in colour and the spines on the frontal lobe and claw arms are more pronounced than in other *Scylla* species.

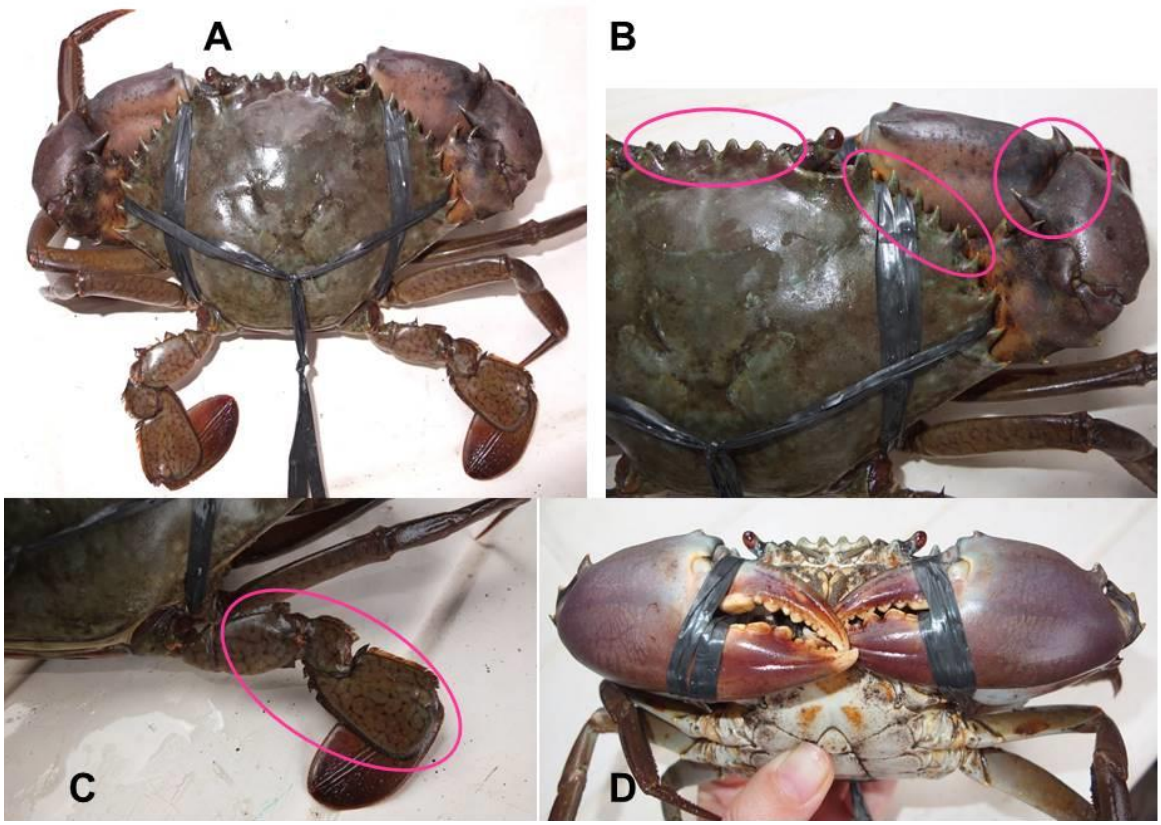

Figure 5. *Scylla serrata* identification photos with noticeable features circled. i.e. spines on claw arm, high frontal spines, high spines on outer margin of carapace, green colour of carapace shell, spotted pattern on paddle leg and purple colour of claws.

2. *Scylla olivacea* / Orange mud crab / Kepiting bakau / YLW

Scylla olivacea is a portunid crab, meaning that fourth pair of legs are flattened into paddle-like structures and are used for swimming. *Scylla olivacea* has a smooth oval-shaped carapace, with a visible H-shaped groove (Figure 6). They have a large, strong claw, nine sharp spines along the margins of the dorsal shell and also on the joints of the legs. *Scylla olivacea* can reach carapace widths of 18cm. Unlike *Scylla serrata*, *Scylla olivacea* does not have a blotchy pattern on the swimming legs and claw arms. The dorsal shell is usually dark orange/brown in colour and the claws can be orange/red in colour. The frontal lobe spines are smoother than in both *Scylla serrata* and *Scylla tranquebarica* and the spines on the claw arms are blunt and not very obvious.

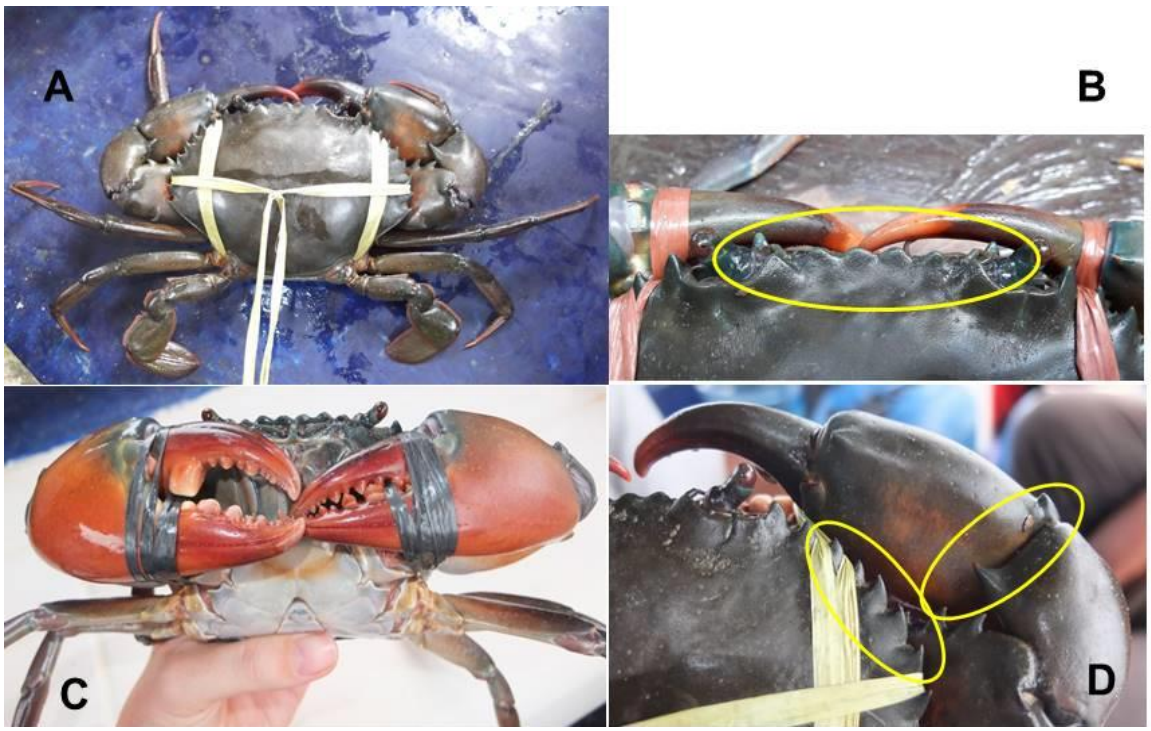

Figure 6. *Scylla olivacea* identification photos with noticeable features circled. i.e. brown/green colour of carapace, low frontal median spines, red colour of claws, spines on outer margin of carapace and claw arm.

3. *Scylla tranquebarica* / Purple mud crab / Kepiting bakau / YAT

Scylla tranquebarica is a portunid crab, meaning that fourth pair of legs are flattened into paddle-like structures and are used for swimming. *Scylla tranquebarica* has a smooth oval-shaped carapace, with a visible H-shaped groove (Figure 7). They have a large, strong claw, nine sharp spines along the margins of the dorsal shell and also on the joints of the legs.

Scylla tranquebarica can reach carapace widths of ~20cm. Similar to *Scylla serrata*, *Scylla tranquebarica* may have a blotchy pattern on the swimming legs and claw arms, but it is not a constant feature. The dorsal shell is usually dark orange/brown in colour and the claws can be orange/red in colour, with tinges of blue/green. The frontal lobe spines and claw spines are similar to *Scylla serrata*, but a little bit smaller.

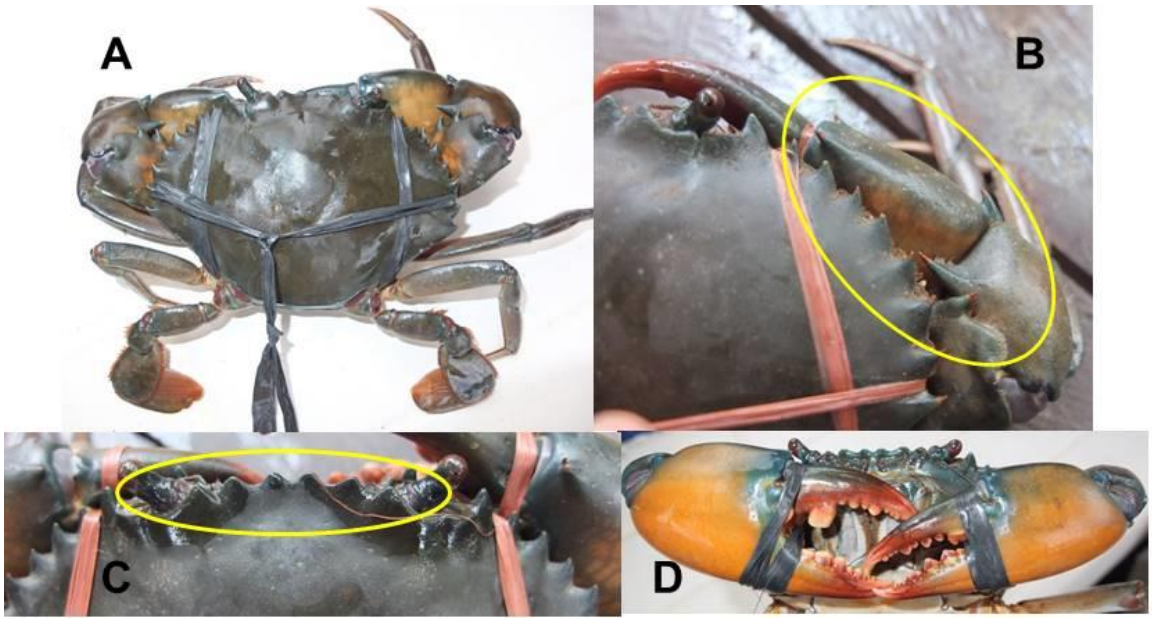

Figure 7. *Scylla tranquebarica* identification photos with noticeable features circled. i.e. green colour of carapace, spines on claw arm and high spines on outer margin of carapace, median frontal spines, green colour of carapace shell, no spotted pattern on paddle leg and orange/red colour of claws.

4. *Scylla paramamosain* / Green mud crab / Kepiting bakau / YAR

Scylla paramamosain is a portunid crab, meaning that fourth pair of legs are flattened into paddle-like structures and are used for swimming. *Scylla paramamosain* has a smooth oval-shaped carapace, with a visible H-shaped groove (Figure 8). They have a large, strong claw, nine sharp spines along the margins of the dorsal shell and also on the joints of the legs. The dorsal shell varies from purple/green to brown/black. The frontal lobe spines are high and triangular with straight edges and angular interspaces. The spines on the outer side of the carapace are broad with curved edges.

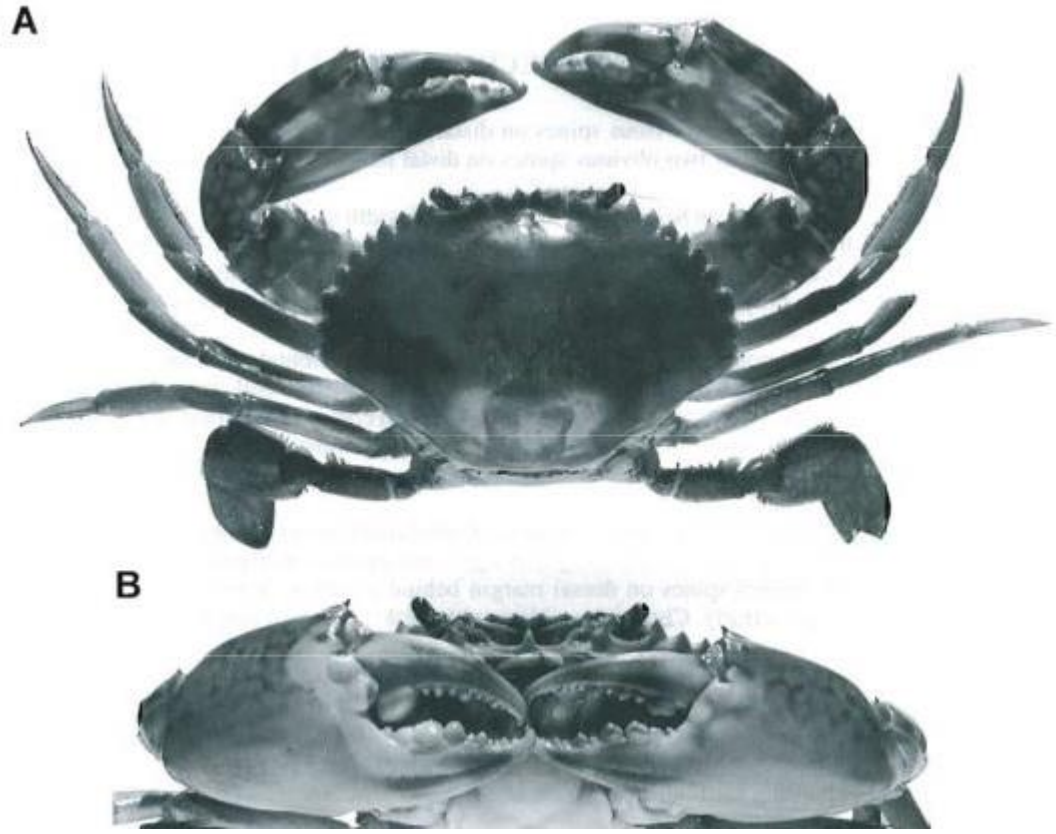

Figure 8. *Scylla paramamosain* identification photo (from Keenan et al., 1998).

For better identification between species, and if the conditions in the field permit the recording of more detailed data, the length of the following features could be recorded for each individual and the ratios between specific features compared with values in Table 3. More figures with information on the specific naming of mud crab morphology can be found in Appendix I.

Table 3. Means and standard deviations of the three most useful morphological ratios for differentiating between the four species of mud crab.

	ICS/OCS	**FMSH/FW**	**FW/ICW**
Serrata	0.940 ± 0.233	0.061 ± 0.010	0.371 ± 0.016
Tranquebarica	0.980 ± 0.251	0.043 ± 0.006	0.412 ± 0.016
Olivacea	0.006 ± 0.035	0.029 ± 0.005	0.415 ± 0.017
Paramamosain	0.006 ± 0.035	0.029 ± 0.005	0.415 ± 0.017

Chapter 3 – Standard Operating Procedures

This chapter covers seven Standard Operating Procedures, SOPs, which can support field staff in their data collection activities. These SOPs should be referred to in the first instance should there be any problem with data collection in the field. If the problem cannot be resolved using the relevant SOP, the site supervisor/manager should be contacted. The solution to the problem should then be incorporated into the relevant SOP.

3.1. Standard Operating Procedure I – Fishing gear and grounds

Mud crabs are caught using baited traps, locally known as '*bubu'*. There are two variations of the traps, either rectangular or oval-shaped (Figure 6 for rectangular version). Crabs enter through each end, fall into the main chamber of the trap and are unable to escape. In Arguni Bay (Figure 9), fishing activity occurs at least 50m offshore of the mangrove, extending to ~1km offshore. Consequently, maps developed for data collection purposes need to be site-specific. In applying this data collection protocol to other sites besides Arguni Bay, site-specific maps should be developed to facilitate data collection.

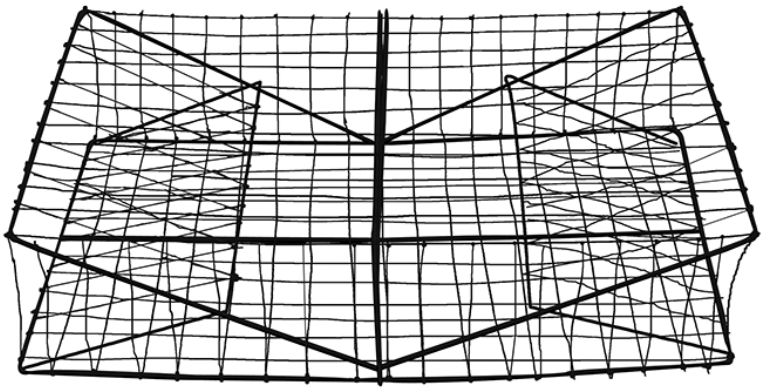

Figure 9. Rectangular trap used for catching mud crabs.

A map was created for data collection purposes (Figure 10). The map has a grid overlaid, with the side of each square measuring 1km. The MDPI site office is marked with a circle and POKMASWAS Post is marked with a triangle. Labels on the horizontal axis are numerical, 1-8, and labels on the vertical axis are alphabetical, A-G. When recording the fishing location, the fisherwoman points out all squares where she placed traps. For each square the letter is recorded first followed by the number, i.e. a fisherwoman may have fished in squares B6 and C6.

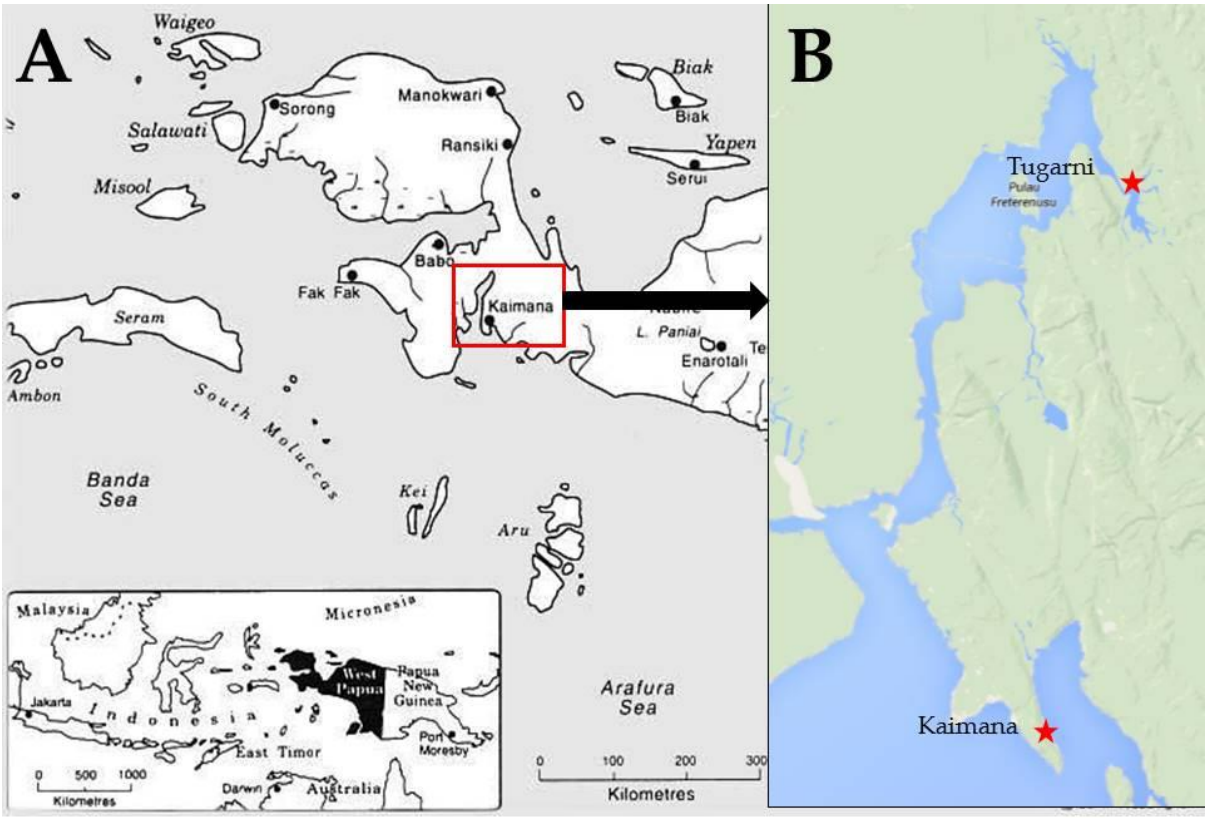

Figure 10. A. Arguni Bay in West Papua, highlighted with red box. Kaimana is the main town in this region. B. Enlarged map of Arguni Bay. Tugarni where data collection will be conducted highlighted with stars.

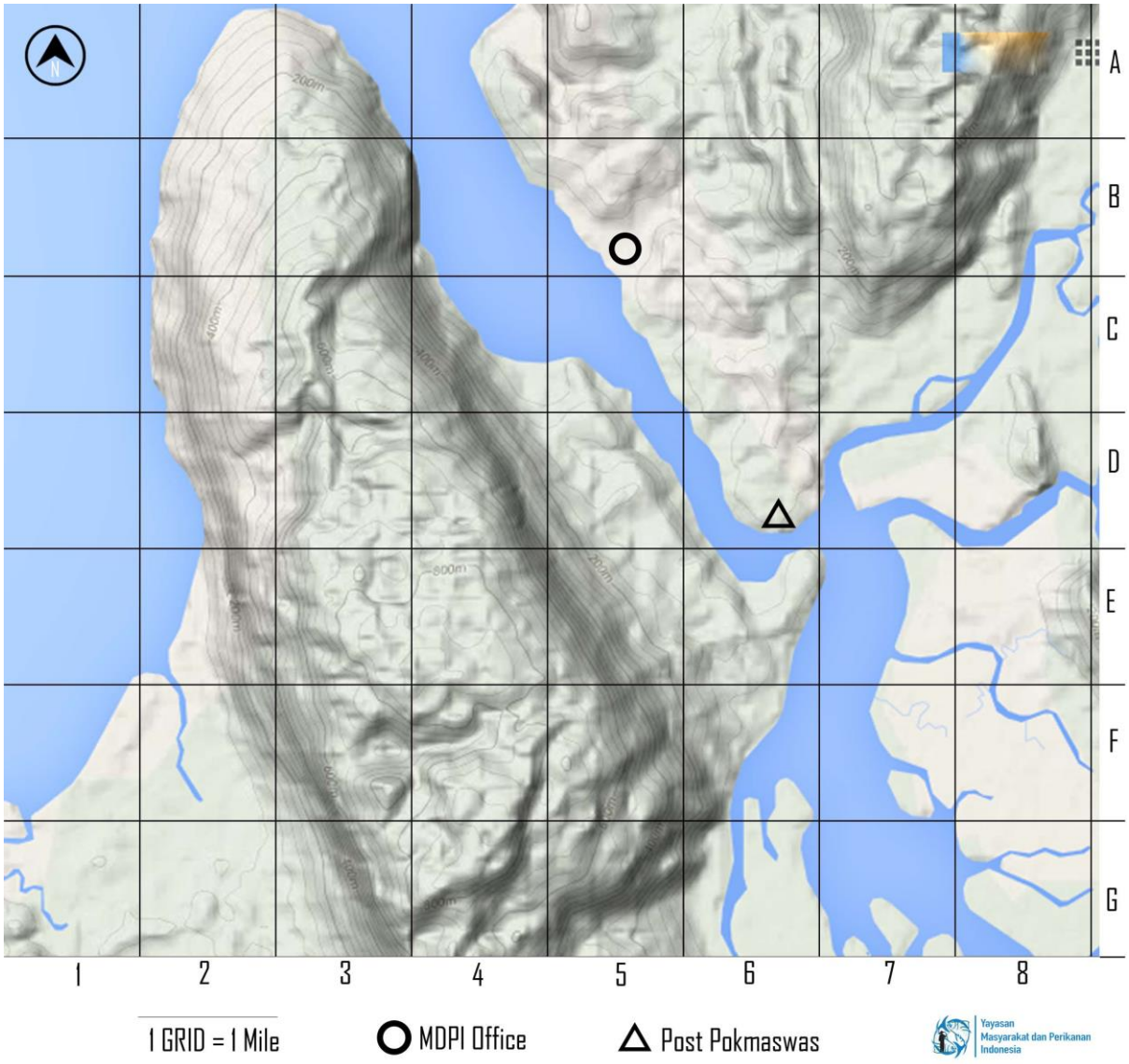

Figure 11. Map for recording the location of fishing activities in Upper Arguni Bay – Tugarni Region

3.2. Standard Operating Procedure, SOP, II – Sampling Design

Sampling is usually conducted in the supplier's house. The catches from individual fisherwomen are collected from their landing sites and transported daily to the supplier's house. The catches of each fisherwoman are kept separate until the supplier has paid for the catch. Sampling should be conducted before the crab catches are mixed. A maximum of twenty individual crabs should be randomly sampled from the catch of each fisherwoman.

This method is useful for sampling large amounts of data in a cheap and efficient manner. The use of this protocol for data collection purposes will generate information for use in estimating the crab stock status. Estimation of Spawning Potential Ratio (SPR (Hordyk et al. 2015)) can be used in determining the status of crab stocks. This sampling method requires the length or width frequency of the brood stock found in the population. This method is useful as it does not have a high data demand.

Carapace width measurements

The carapace is the hard-shelled dorsal side of a crab. Length measurements of individual crabs are measured as carapace width. Carapace width is a measurement across the widest part of the dorsal side of the crab, recorded using a calipers (Figure 12). Carapace length measurements are not recorded with this protocol. The front of the calipers is placed at one side of the crab carapace and the movable section is extended to reach directly across to the opposite side. The carapace width is recorded to the nearest mm, i.e. a carapace width of 15.5cm is recorded as 155mm. The weight of each sampled individual should also be recorded in grams.

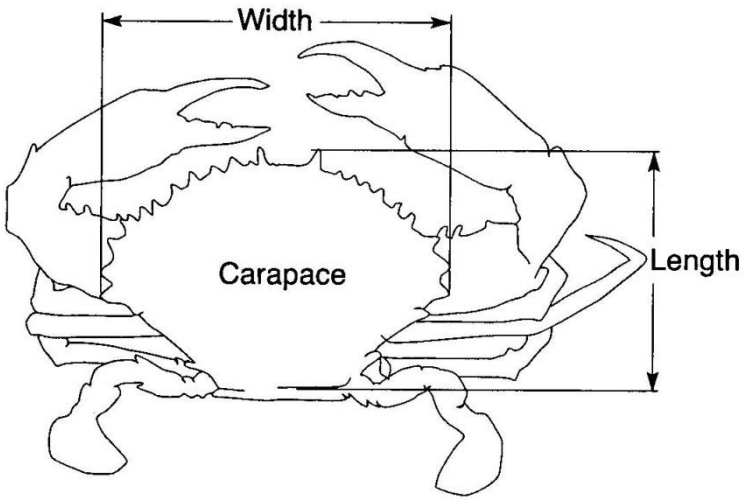

Figure 12. Standard carapace width and length measurements of individual crabs.

Sex and maturity level

The field staff must distinguish between male and female crabs and, where possible, identify the maturity level of individuals. To identify the sex and the maturity level, look at the abdominal. Males will have a narrow triangular shaped abdominal flap whereas females will have a larger rounded abdominal flap, which may be a darker colour than the rest of the belly (Figure 13).

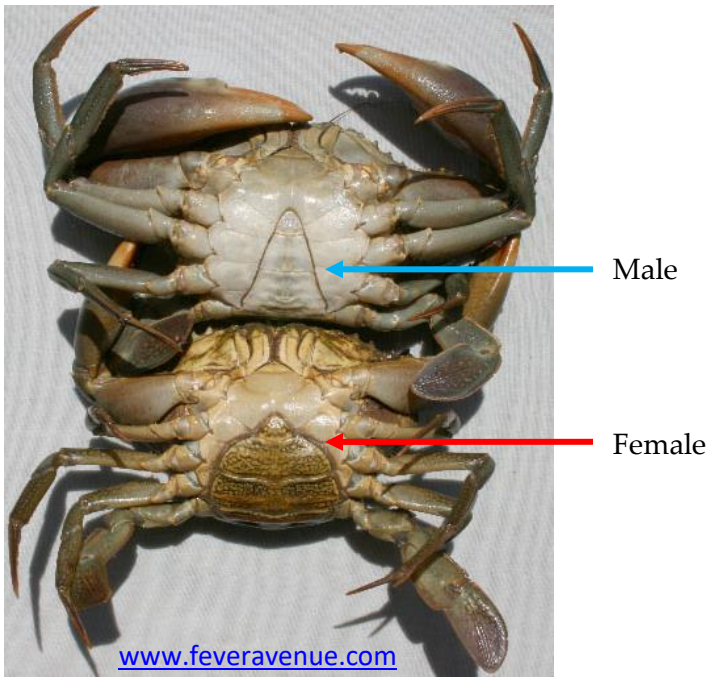

Figure 13. Male and female *Scylla serrata*.

Currently there is little information on the external characteristics of *Scylla* species maturity levels. Usually, immature females will have a small, pale abdominal flap and mature females will have a darker, larger, more rounded abdominal flap (Figure 14). Immature females should be assigned a maturity level 'I' and mature, non-berried females should be assigned a maturity level of 'M'. Berried females, those with visible eggs in the abdominal flap, should be assigned a maturity level of 'B'. the presence of mating scars on males may be an indication of maturity (Knuckey 1996). Mating scars occur during the precopulatory embrace between males and females and are visible on the abdominal and on the forward walking legs. They are usually visible on large individuals, indicating maturity. However, the absence of mating scars from a large individual does not mean the individual is immature as the scars disappear after each molt (Knuckey 1996).

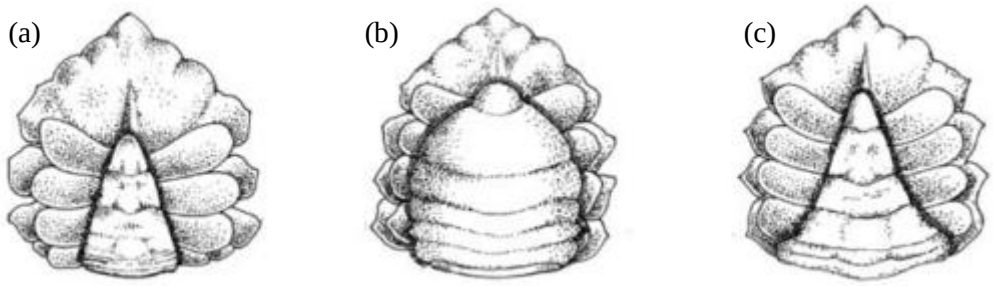

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Figure 14. Abdomens of (a) immature, (b) mature female and (c) mature male *Scylla serrata*.

3.3. Standard Operating Procedure, SOP, III – Bait Data

Eel is the main bait used, with fish used on rare occasions. Each eel is cut into smaller pieces and can be used to bait multiple traps. Sometimes fish or leftover food is used to bait the traps but the eels are the preferred bait. Artificial bait is not used in this fishery. The bait fishery should be regarded as a separate fishery from the main target fishery and undergo a separate evaluation. To determine whether the bait species is at risk of overexploitation, a risk-based assessment should be conducted. If a stock is considered at risk, mitigation measures should be designed and implemented. To conduct the bait risk-based assessment, the following data is required for each species used as bait during a fishing trip:

- ❖ Species
- ❖ Location of capture
- ❖ Gear used
- ❖ Total weight

The bait species are divided into three categories: A) eel, B) non-eel fish and C) others

Category A – Eel

1. Asian Swamp eel / Belut / *Monopterus albus* / FLT

This eel is found in brackish-freshwater environments and is native to the Asian region. The maximum recorded length is 100cm, with lengths of 40cm more common (Figure 15). The body is cylindrical, with a compressed tail that ends in a fine point. The eel does not have scales or pectoral and pelvic fins. The dorsal, caudal and anal fins are joined into a single skin fold. The gills open in a single slit under the head. The eels are red or brown in colour with dark spots across the dorsal side. They have large blunt mouths and small eyes.

Figure 15. Asian Swamp eel / Belut / *Monopterus albus* / FLT

Category B – Non-eel fish

2. Ikan Ganadi

This fish has a small head with a short, blunt mouth. The dorsal side is raised after the head and then tapers down to the caudal fin (Figure 16). The dorsal side is dark grey/silver and the ventral side is white/silver. The pectoral, pelvic and anal fins have an orange/red tinge. The caudal fin is not forked and is grey in colour. The second dorsal fin is elongated, reaching from the middle of the body to the caudal peduncle.

Figure 16. Ikan Ganadi ©MDPI

3. Blue catfish / Ikan sembilang ekor dua / *Neoarius graeffei*

This species inhabits brackish estuaries and coastal marine waters across the Western Pacific. The maximum recorded length is 60cm. The dorsal side is blue whereas the ventral side and flanks are white/silver (Figure 17). There are no scales and the body is smooth. There are a pair of barbelss around the mouth, which is rounded with a fleshy upper lip. The eyes are small. The dorsal and pectoral fins are thick and sharp. The fins have a red/brown tinge to them.

Australian National Fish Collection, CSIRO

Figure 17. Blue catfish / Ikan Sembilang Ekor Dua / *Neoarius graeffei*

Category C - Other

Eels and non-eel fish are the most common bait type with other species rarely used for bait. If another species is observed in the field it should be recorded in this section.

Chapter 4 – Data Collection Process

This section focuses on the collection process of fishery-dependent data from Indonesian landing sites for use in stock assessments. This data will be the basis for designing improved management systems that will move Indonesian mud crab fisheries towards sustainability. The process of uploading the data to I-Fish is described below.

In collaboration with district DKP and the owner / supplier of the vessels, the following vessel data should be recorded:

- vessel name
- captain name
- origin
- registration number
- vessel size class (GT)
- engine capacity (HP)
- number of fishermen employed
- gear used
- main fishing ground

This process is conducted annually in most ports, through an automatic renewal system for registration, which may result in vessel/gears changes being unrecorded. Therefore this information should be recorded at the start of each year for each vessel participating in data collection activities.

4.1. Daily Port Sampling Form

The daily port sampling form is used to collect data from unloading events from individual vessels on a daily basis. One form is used per vessel per day. The following is a description of the data that should be recorded in each section of the port sampling form, (the port sampling form can be found in Appendix II):

MC 1, bagian 1 – Informasi Kapal utama

Tempat Pendaratan	- Name of port/landing site
SF	- Name of sustainability facilitator
Nama Nelayan	- Name of fisherwoman
Daerah Penangkapan	- Location of fishing ground
Alat tangkap	- Gear used
Tgl Sampling	- Data of sampling, recorded as dd/mm/yyyy
Waktu sampling	- Time of sampling, recorded as hh:mm
Rendam Waktu	- Soak time, recorded in hh:mm. Soak time is the length of

	time that a trap is submerged under water
Total berat	- Total weight of catch
Total Jumlah	- Total number of individuals in the catch
Panjang Kapal	- Length of the vessel
Kapasitas Kapal	- Capacity of the vessel, in GT
Kapasitas mesin	- Engine capacity, in horse power, HP/PK
Lain-lain	- Anything else of interest to add?

MC 1, bagian 2 – Informasi umpan

Kategori	- Bait category, recorded as one of the two bait categories, A) eel, B) non-eel fish and C) other
Nama lokal	- Record the local name, if known
Spesies	- Bait species, if known
Daerah Penangkapan	- Fishing ground for bait species
Total Umpan	- Total amount of bait, in kg
Estimasi Umpan	- Record an estimated weight if the total weight is not available
Alat tangkap	- Fishing gear used to catch the bait species

MC 1, bagian 3 – Random sampling kepiting individu

No	- Number of individual in the sampling amount
Lebar	- Carapace width, in mm
Kelamin	- Sex of individual, either M or F
TK	- Maturity level, for females only, 'I' – immature, 'M' – mature, and 'B' – berried
Spesies	- One of the three options: serrata, olivacea or tranquebarica

MC 1, bagian 4 – Jenis hasil Tangkapan lain (Perkiraan total Tangkapan)

Nama spesies	- Species name of other catch
Jumlah	- Number of individuals caught per species
Berat	- Weight of total individuals caught
Perkiraan?	- Is the weight an estimate, Y / N

Deskripsi mengenai sampling - Anything else to add about the sampling event?

4.2. Data storage and analysis

All data collected in these forms will be checked by the site supervisor, who then enters the data into spreadsheets on a computer every day. Data are entered into spreadsheets on the same day that they are collected to ensure discrepancies or data errors can be addressed and corrected while the information is still fresh. The site supervisor will then upload the data to I-Fish every month.

The sampled data can be analysed to create graphs and tables showing different types of information, such as:

a. Total produksi per alat tangkap
b. Total produksi per kategori spesies
c. Cakupan Sampling dari total produksi
d. Komposisi tangkapan spesies target
e. Komposisi tangkapan dari total tangkapan
f. Komposisi spesies tangkapan
g. Hubungan Panjang / berat spesies target (MUD)
h. Tangkapan per Upaya Unit (Kg / L bahan bakar)
i. Tangkapan per Upaya Unit (Kg / Jam (hari) di laut)
j. Produktivitas per Fishing Ground (FG)
k. Produktivitas per WPP
l. Kapasitas per Site (jumlah kapal aktif per kategori GT)

These graphs and tables can be shared with stakeholders using the I-Fish automatic reporting system and used for discussion at the DMC meetings.

Appendix I

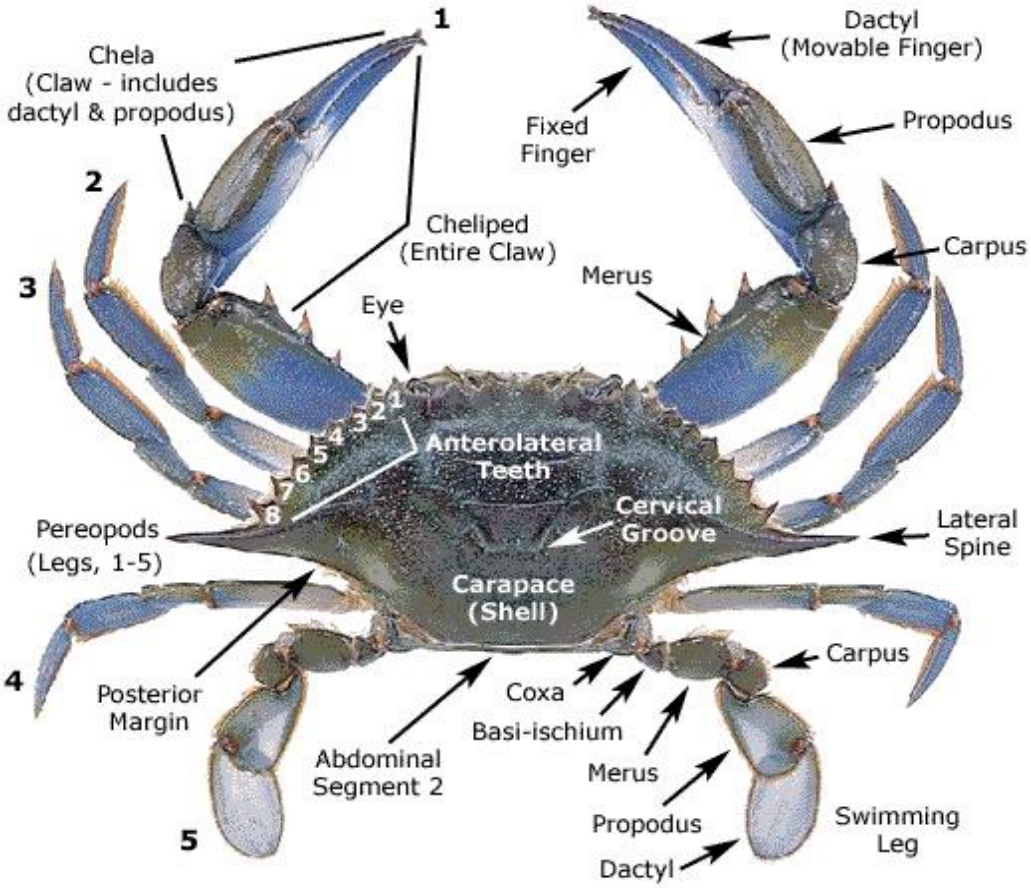

Figure A1. General morphology and naming for crabs.

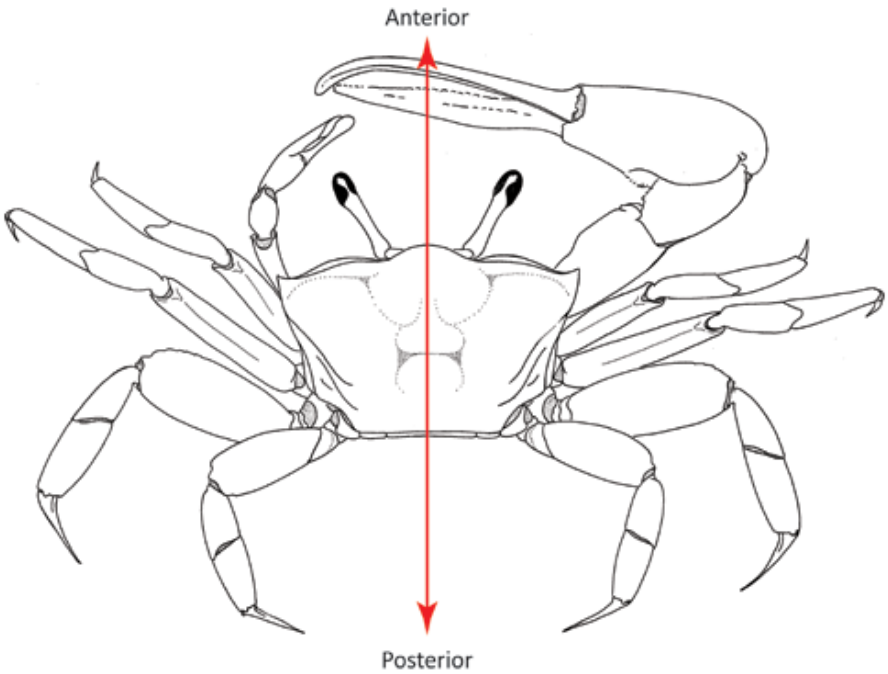

Figure A2. Illustration of anterior and posterior for crab descriptions.

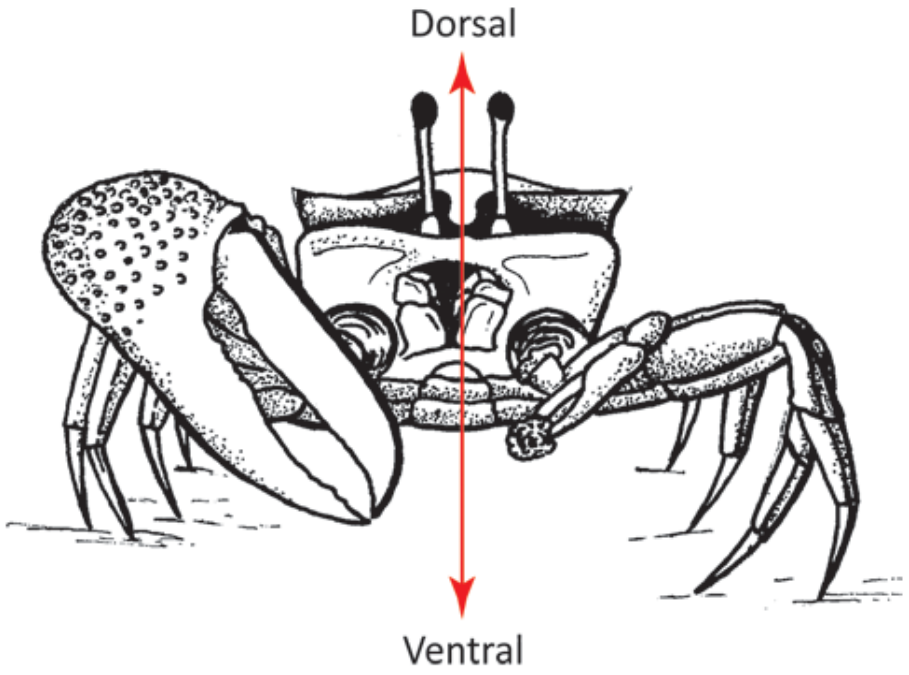

Figure A3. Illustration of dorsal and ventral for crab descriptions.

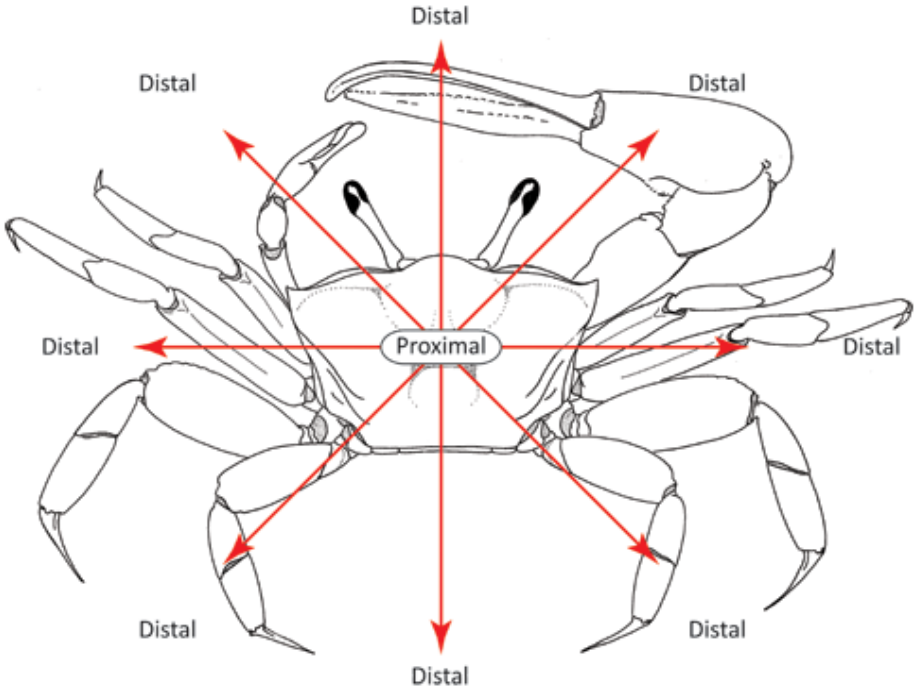

Figure A4. Illustration of proximal and distal for crab descriptions.

Appendix II

MC 1 MDPI Data collection form for Mud Crab				Versi: Maret 2017
			Hal:	dari
Bagian 1: Informasi Kapal Utama				
Tempat Pendaratan:	**Nama Enumerator:**	**Nama Nelayan:**	**Daerah Penangkapan:**	**Alat tangkap:**
Tgl sampling (dd/mm/yy):	**Waktu sampling (jj:mm):**	**Rendam waktu (jj:mm):**	**Total berat (Kg):**	**Total jumlah:**
Panjang Kapal (m):	**Kapasitas kapal (GT):**	**Kapasitas mesin (PK):**	**Lain-lain:**	

Bagian 2: Informasi Umpan							
Kategori	**Spesies**	**Nama lokal**	**Daerah Penangkapan**		**Total Umpan (kg)**	**Estimasi Umpan (kg)**	**Alat tangkap**
A – Belut							
B – Ikan non-belut							
C – Lain-lain							

Bagian 3: Random Sampling Kepiting Individu									
No.	**Lebar**	**Kelamin**	**TK**	**Species**	**No.**	**Lebar**	**Kelamin**	**TK**	**Species**
1					**11**				
2					**12**				
3					**13**				
4					**14**				
5					**15**				
6					**16**				
7					**17**				
8					**18**				
9					**19**				
10					**20**				

Bagian 4: Jenis hasil tangkapan lain (Perkiraan total tangkapan)							
Nama Spesies							
Jumlah							
Berat							
Perkiraan?							

Deskripsi mengenai sampling:

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