

RESEARCH PROGRESS REPORT

**Interaction Between Blue Swimming  
Crab Fisheries And Marine Mammals  
In Indonesia**



**Asosiasi Pengelola Rajungan Indonesia**  
**Indonesian Blue Swimming Crab Association**  
Surabaya, East Java, Indonesia  
2025

# **Interaction Between Blue Swimming Crab Fisheries And Marine Mammals In Indonesia**

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## SUMMARY

Indonesian blue swimming crab fisheries face serious challenges in responding to consumer trends on sustainability and increasingly strict export regulations, such as the United States Marine Mammal Protection Act (MMPA). The blue swimming crab, *Portunus pelagicus* (Linnaeus, 1758), is one of Indonesia's top five fishery commodities, with the primary export destination being the United States. Fishing activities have the potential to disturb marine mammal populations. These animals may suffer injuries or death due to accidental entanglement in fishing gear. Therefore, this study aims to identify the marine mammal species that interact with blue swimming crab fisheries and to analyze the types of interactions and the potential risks they pose to both blue swimming crab fisheries and marine mammal species. The research was conducted from January to March 2025 in seven main crab-producing districts in Indonesia: Batubara (North Sumatra), East Lampung (Lampung), Cirebon (West Java), Rembang (Central Java), Gresik (East Java), Pamekasan (East Java), and West Muna (Southeast Sulawesi). Data collection was carried out through surveys and interviews with 210 fishermen. The study reveals that marine mammal sightings are relatively common among blue swimming crab fishermen, with approximately 59% of respondents reporting have seen marine mammals during their fishing activities. Marine mammal species vary across regions, with a total of nine species identified, based on pictures provided to assist in species identification. Fishermen reported minimal marine mammal bycatch incidents over the period 2022-2024, highlighting the non-interactive and passive nature of their interactions with marine mammals. The majority of fishermen (97%) are aware of marine mammal protection laws, and their efforts to minimize interactions, such as avoiding fishing locations with frequent marine mammal sightings, demonstrate a proactive approach to conservation and sustainable fishing practices. The results of this study are expected to contribute to efforts in the protection of marine mammal species, as an important component in the management of sustainable and environmentally friendly blue swimming crab fisheries.

Surabaya, March 2025  
APRI Executive Director



Dr. Ayu Ervinia

## BACKGROUND

The blue swimming crab is one of Indonesia's top five export fishery commodities and plays an important role in the local and national economy. The crab industry provides a livelihood for millions of coastal communities, ranging from fishermen to processing industries. The crabs are primarily exported to the United States in the form of canned products containing pasteurized meat [1,2]. Consumer trends towards seafood consumption based on sustainability principles, along with increasingly strict export regulations such as the United States Marine Mammal Protection Act (MMPA), require urgent attention.

The blue swimming crab belongs to the Crustacea group, class Malacostraca, order Decapoda, family Portunidae. Based on its color, this crab species complex consists of *Portunus pelagicus*, *Portunus segnis*, *Portunus armatus*, and *Portunus reticulatus* [3]. One of the most economically valuable species is *P. pelagicus*, commonly known as the Blue Swimming Crab (BSC). Blue swimming crabs are found in coastal waters with sandy or muddy substrates, extending to depths of up to 40 meters. They inhabit various ecosystems such as estuaries, lagoons, and seagrass beds [4,5].

Indonesian waters are a critical migratory route for marine mammals, serving as an important ecological area for endangered, threatened, and protected (ETP) species. Approximately 33 species of marine mammals, including whales, dolphins, and dugongs, inhabit these areas [6]. Cetaceans, such as whales, dolphins, and dugongs, play an important role in marine ecosystems; however, many species are either endangered or vulnerable [6]. The dugong is one such endangered marine mammal in Indonesia, inhabiting shallow waters and seagrass beds. The sperm whale (*Physeter macrocephalus*) is categorized as vulnerable due to threats from human activities, such as noise pollution from ship sonar that disrupts whale navigation, as well as disturbances from fishing operations using nets. Sperm whales are also threatened by plastic pollution and heavy metals. The blue whale (*Balaenoptera musculus*) is the largest marine mammal and is endangered due to habitat loss, hunting, and climate change. The orca (*Orcinus orca*) faces threats from climate change that affects prey distribution, as well as

the risk of entanglement in nets. Dolphins also face threats from hunting, noise pollution, and habitat destruction. Despite their ecological significance, there is limited understanding of the spatial and temporal distribution of marine mammals in Indonesia. This knowledge gap hinders effective conservation efforts and management strategies aimed at ensuring the protection and sustainability of these vulnerable species.

Fishing practices around the world have the potential to cause ecological disturbances to protected marine life. Several studies have shown that marine mammal species, such as whales and dolphins, often become involved in conflicts with fishing activities through operational interactions, such as physical contact with fishing gear, including entanglement or being caught in nets, accidental bycatch, and damage to fishing equipment [7,8]. These interactions can threaten the survival of marine mammals, causing injuries or death, disrupting feeding and reproductive behaviors, and, in the long term, leading to a decline in their populations, many of which are apex predators in marine ecosystems. Disruption of apex predator populations can have significant impacts on food web imbalances in the ocean [9]. Therefore, understanding the interactions between fishing practices and marine mammals is crucial in efforts to minimize bycatch, which remains a major challenge for sustainable fisheries management.

This study aims to identify the marine mammal species that interact with blue swimming crab fisheries and to analyze the types of interactions and the potential risks they pose to both blue swimming crab fisheries and marine mammal species. The results of this study are expected to contribute to efforts in the protection of marine mammal species, as an important component in the management of sustainable and environmentally friendly blue swimming crab fisheries.

## **RESEARCH ROADMAP**

The research planned for this year focuses on identifying the marine mammal species that interact with blue swimming crab fisheries and mapping their distribution as a basis for developing conservation strategies and sustainable blue swimming crab fisheries. The research roadmap for the 2022-2029 period is presented in Figure 1.

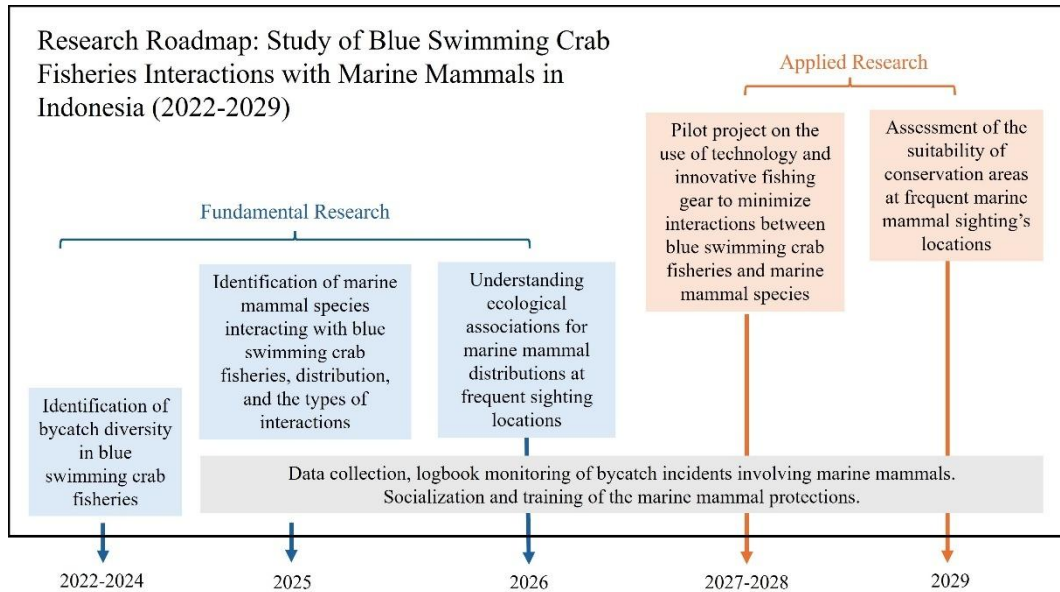


Figure 1. Research roadmap: study of blue swimming crab fisheries interactions with marine mammals in Indonesia (2022-2029)

## METHODS

### Time and location of the study

This study was conducted from January to March 2025 in seven main blue swimming crab-producing districts in Indonesia: Batubara (North Sumatra), East Lampung (Lampung), Cirebon (West Java), Rembang (Central Java), Gresik (East Java), Pamekasan (East Java), and West Muna (Southeast Sulawesi) (Figure 2). Sampling locations represent three Fisheries Management Area (FMA), which include FMA571 (Batubara), FMA712 (Lampung, Cirebon, Rembang, Gresik, and Pamekasan), and FMA714 (Tanjung Pinang). Data collection was carried out by field support from APRI.

### Data collection

#### *Onboard observation of blue swimming crab fishing practices*

Data collection on the composition of target species (*Portunus pelagicus*) and non-target species (bycatch) was conducted by accompanying the blue swimming crab fishermen on their trips at each research station. Field support identified the diversity of bycatch species found in the fishing gear used by the fishermen.

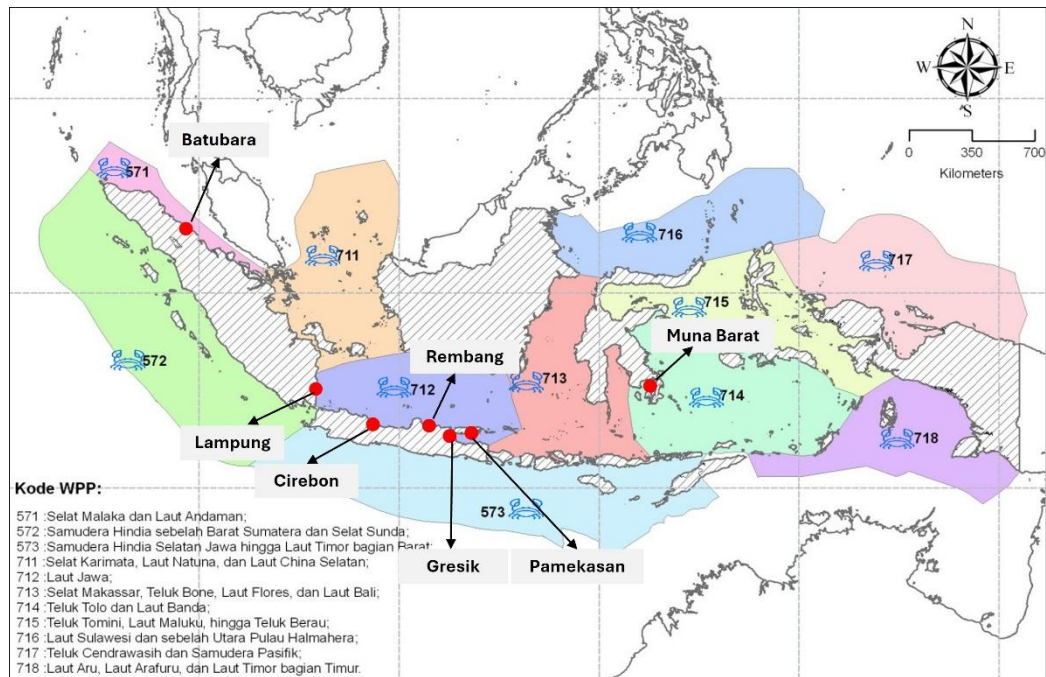


Figure 2. Sampling locations

### *Fishermen interviews*

Interviews were conducted with 210 fishermen at seven blue swimming crab landing sites. The interviews aimed to gather various types of information, including fishing characteristics, fishermen's experiences, marine mammals species, interaction types, and bycatch incidents involving blue swimming crab fishing gear. Fishermen were also asked for their opinions on the presence of marine mammals while fishing and the actions taken if they were accidentally caught. This data collection method provides insights into the biodiversity and distribution of marine mammals in the area, as well as the efforts made by local communities to handle marine mammals species. The questionnaire used in this study can be found in Appendix 1. Identification of marine mammals species was carried out based on pictures provided to assist in species identification (Appendix 2).

### **Data analysis**

Qualitative and quantitative analysis of the fishermen's interview results.

## RESULTS

### Characteristics of the blue swimming crab fishermen

The research results from interviewing 210 respondents show that all blue swimming crab fishermen are male, with an age range between 22 and 70 years. The majority of the fishermen are in the young age group (53%), followed by the middle-aged group (40%) and the older age group (7%) (Figure 3A). Based on fishing experience, most of the fishermen have been fishing for around 5-30 years (66%) (Figure 3B).

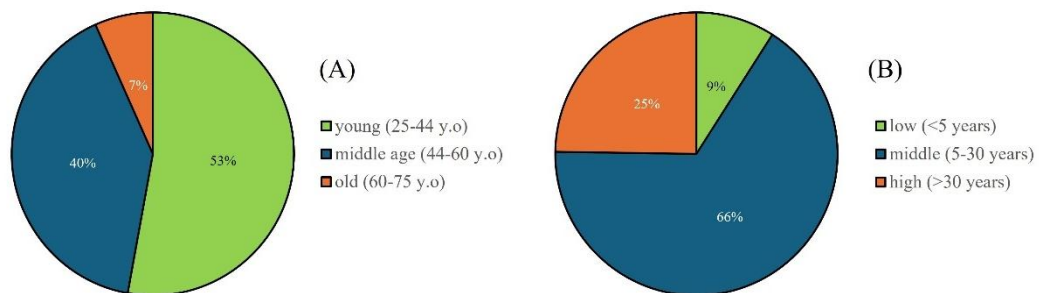


Figure 3. Characteristics of the blue swimming crab fishermen:  
(A) age of the respondents and (B) fishing experiences

### Characteristics of the fishing vessels, fishing gear, and fishing activities

The size of the crab fishing vessels used by the fishermen range from 1-3 GT, with engine power between 5-30 HP (Figure 4A). This vessel size is classified as small boats without refrigerated storage because the fishing distance is short. Figure 4B showed the types of crab fishing gear used by the respondents. About 74% of the fishers use gillnets, and 26% use traps.

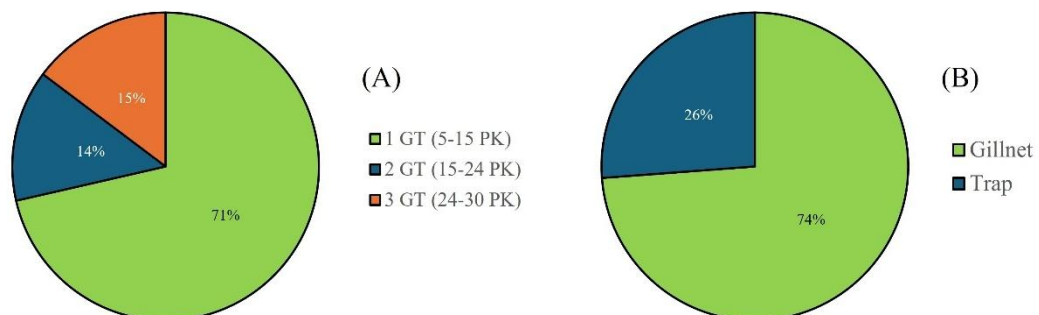


Figure 4. Fishing vessels size and engine power (A) and the type of fishing gears  
(B) used by the blue swimming crab fishermen respondents

Based on the data presented in Figure 5A, the majority of respondents engage in 20-30 days of fishing per month (56%). This indicates that blue swimming crab fishing is a relatively frequent where fishing operations are generally one-day fishing trips. The variation in the number of trips could be attributed to factors such as fishing distances, seasonal changes, weather conditions, or availability of the crabs. Figure 5B shows the fishing distances typically traveled by the fishers. The majority of fishers fish within 12 miles from the shore (84%). The minority of fishers (16%) traveled beyond 12 miles. This suggests that blue swimming crab fishing primarily takes place in nearshore areas, which are easily accessible and cost-effective for the fishers. The shorter fishing distances may reflect the use of smaller vessels and the preference for one-day fishing trips.

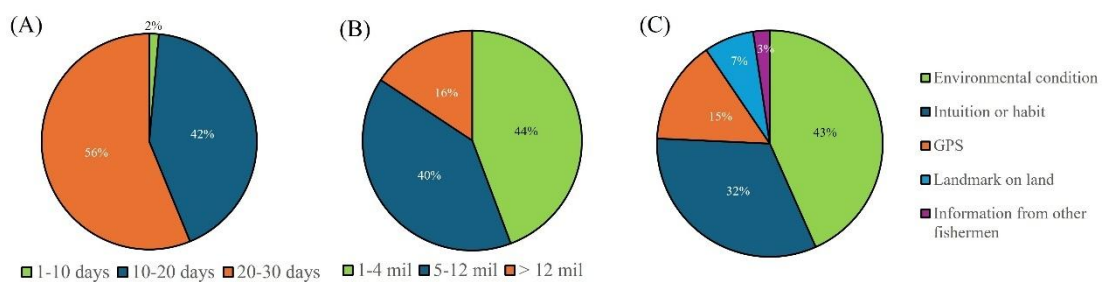


Figure 5. Blue swimming crab fishing activities: (A) number of trips per month, (B) fishing distance, and (C) determination of fishing ground

In Figure 5C, the process of determining fishing grounds is illustrated. Several techniques for determining crab fishing grounds were identified, namely environmental conditions (43%), intuition and habits (32%), GPS (15%), landmark on land (7%), and information from other fishermen (3%) (Figure 3E). According to the fishermen, the environmental conditions that are considered to have many crabs include calm to moderately rough waters, sandy or muddy substrates, clear water (with some locations having turbid water), or area near coral reefs. This suggests that a majority of fishers rely on local ecological knowledge and environmental condition to identify fishing grounds

### Specifications of fishing gear

The specifications of the fishing gears used in blue swimming crab fisheries are presented in Table 1 and Figure 6. Respondent from the site locations of Batubara, East Lampung, Cirebon, Rembang, Gresik, and Pamekasan were found to use gillnets, while some respondents in Pamekasan and Tanjungpinang use traps.

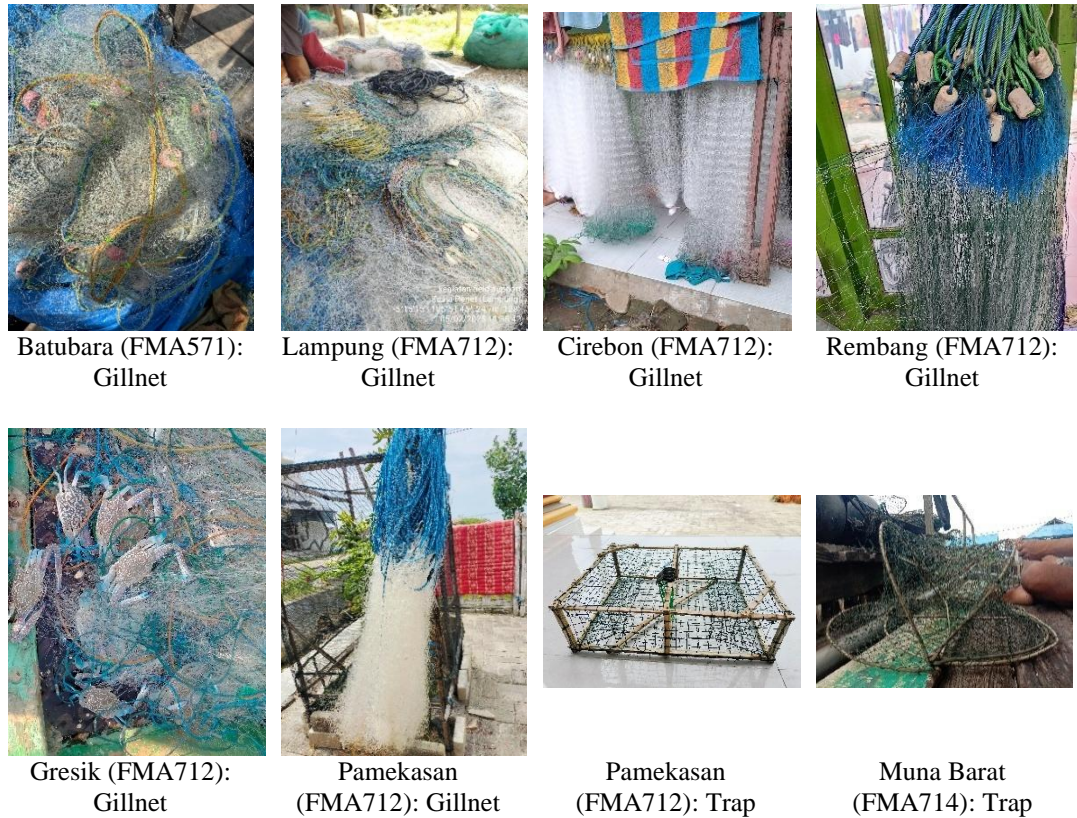


Figure 6. Fishing gears used by the blue swimming crab fishermen respondents

According to Table 1, gillnets and traps have various specifications. The nets are primarily made from nylon or cord materials. These materials are chosen based on factors like durability, cost, and the local availability of material. The mesh size ranges from 3-4.5 inches. The dimensions of the gillnet varied, with the length ranging between 12-1000 m and the width ranging between 0.5-2.5 m. The number of gillnets used in a single fishing operation varies between 10-120 pieces. Fishing nets are commonly colored white, while ropes are typically red, orange, green, or blue.

Table 1. Specifications of the fishing gear used in blue swimming crab fisheries

No	Site Location	Material and Color of Fishing Gear	Mesh Size	Dimension (Length, Width, Height)	Number of Fishing Gear	Length of the Rope	Color of the Rope
1	Batubara (FMA571)	Gillnet: Nylon, white	4 inch	1000 m x 1.5 m	50 pcs	63 m	Green, orange
2	Lampung (FMA712)	Gillnet: Chord, white	3.5-4 inch	200 m x 0.5 m	12-25 pcs	2400-5000 m	Red, yellow, green, blue
3	Cirebon (FMA712)	Gillnet: Nylon, white	3.5 inch	500 m x 2.5 m	3-11 pcs	500 m	Yellow, orange, green
4	Rembang (FMA712)	Gillnet: Chord, white	3 inch	25-35 m x 1.5-2 m	30-120 pcs	900-3600 m	Blue, orange, green
5	Gresik (FMA712)	Gillnet: Chord, white	3.5 inch	12-16 m x 1 m	10-15 pcs	200-1000 m	Blue, red, green
6	Pamekasan (FMA712)	Gillnet: Chord, white	3.5 – 4.5 inch	20-35 m x 1-1.2 m	20-48 pcs	20-40	Orange, blue
7	Pamekasan (FMA712)	Trap: Bamboo	2 cm, 30 cm	40 x 32 x 12 cm	160-250 pcs	60-75 m	Blue
8	Muna Barat (FMA714)	Trap: Wire	10-20 cm	50 x 30 x 25 cm	170-500 pcs	300-3000 m	Green, blue, orange

Meanwhile, the crab traps (bubu) are used by fishermen in Pamekasan and Tanjung Pinang. The crab traps used in Pamekasan and Muna Barat have different specifications. The traps in Pamekasan are square-shaped and made of bamboo, while the traps in Muna Barat are dome-shaped and made of wire. The number of traps used ranges from 160 to 500 pieces. The ropes used for the crab traps are colored blue, green, or orange.

Variations in soaking time and depth settings of gillnets and traps is shown in Table 2. The soaking time for the nets ranges from 3 to 10 hours, while for the traps, it ranges from 12 to 24 hours. The depth of the fishing gear setting ranges from 4 to 35 m. Crab fishing with gillnets does not require bait, while fishing with traps uses bait such as common ponyfish (petek), grunter fish (kerong-kerong), big anchovies, and fringescale sardinella (tembang). Both gillnets and traps does not require attractor. This variety in gear types reflects the different fishing methods employed across the respondents' locations and fishing habits.

Table 2. Information on blue swimming crab fishing techniques

No	Site Location	Fishing Gear	Soaking Time of Fishing Gear (hours)	Setting Depth (m)	Bait	Atractor	Fishing Duration (hours)
1	Batubara (FMA571)	Gillnet	4	7-10	-	-	10
2	Lampung (FMA712)	Gillnet	8-12	4-20	-	-	3-12
3	Cirebon (FMA712)	Gillnet	1-2	4.5-10	-	-	6
4	Rembang (FMA712)	Gillnet	4-5	7-40	-	-	10
5	Gresik (FMA712)	Gillnet	3-5	5-7	-	-	4
6	Pamekasan (FMA712)	Gillnet	5-10	4-30	-	-	5-10
7	Pamekasan (FMA712)	Trap	24	10-35	Common ponyfish, grunter fish	-	6-9
8	Muna Barat (FMA714)	Trap	12-14	3-30	Big anchovies, sardinella	-	2-3

### Target and non-target species of blue swimming crab fisheries

BSC fisheries primarily target crab species of *Portunus pelagicus* for commercial purposes. Based on the responses from 210 respondents, the average crab catches caught per trip varies significantly depending on the fishing season and area (Table 3). Fishermen generally perceive the West Season (rainy season), as the period with the highest catch rates. Conversely, during the East Season (dry season), from mid to late year, catch rates are considerably lower. A majority of fishers handle crabs on board for about 30 minutes to 1.5 hours. Most of the crabs are still alive after being caught.

Table 3. Fisher's perspective on average catch of blue swimming crabs per trip, fishing season, and crab handling activities (n=210 ind)

No	Site Location	Average Catch per Trip (kg/trip)	Fishing Season	Crab Handling from Fishing Gear
1	Batubara (FMA571)	2.5	Uncertain	Crab handling was carried out on the ship that lasts for about 1-2 hours. Some crabs are alive, while others are dead
2	Lampung (FMA712)	5.2	The peak catches typically occurs at the beginning of the year during the West Season (rainy season), from January to April. The catch is usually lowest in the middle of the year during the dry season, from June to September.	Crab handling was carried out on the ship that lasts for about 30 minutes to 1.5 hours (depending on the catch). The crabs are in a dead condition.

No	Site Location	Average Catch per Trip (kg/trip)	Fishing Season	Crab Handling from Fishing Gear
3	Cirebon (FMA712)	3.0	The peak catches typically occurs during the dry season, while the lowest catch was observed during the wet season.	Crab handling was carried out on the ship that lasts for about an hour. The crabs are still alive.
4	Rembang (FMA712)	3.9	Peak catches typically occurs during the West Season (Desember-Januari). The lowest catches was observed in August-October.	Crab handling was carried out on the ship that lasts for about an hour. The crabs are still alive.
5	Gresik (FMA712)	3.4	The peak catches typically occurs in the middle of the year during the dry season, while the lowest catch was observed during the wet season.	Crab handling was carried out on the ship that lasts for about 30 minutes to an hour (depending on the catch). The crabs are still alive.
6	Pamekasan (FMA712)	1.8	The catch is highest during the West Season (rainy season) from early to mid-year. The lowest catches occurs during the East Season (dry season) from mid to end year.	Crab handling was carried out on the ship that lasts for about 30 minutes to an hour. The crabs are still alive.
7	Tanjung Pinang (FMA714)	4.9	The catch varies in West Season, transitional season, and East Season	Crab handling was carried out on the ship, and then transferred to a holding bucket. The crabs are alive.

Table 4 presents fishermen's perspectives on the non-target species (bycatch) captured during blue swimming crab fisheries and their utilization. Several non-target species, such as demersal fishes, crabs, sea snails, are commonly caught alongside blue swimming crab. Some bycatch species, such as long tongue sole (*Cynoglossus lingua*), sixbar grouper (*Epinephelus sexfasciatus*), Belanger's croaker (*Johnius belangerii*), crucifix crab (*Charybdis feriata*), and three-spot swimming crab (*Portunus sanguinolentus*), are commonly found in many locations, suggesting that these species may share the same habitat as blue swimming crab (*Portunus pelagicus*).

As shown in Table 4, the utilization of bycatch varies. The majority of bycatch is used for commercial purposes, such as consumption, sale, or as bait. However, some fishermen prioritize ecological balance by releasing certain bycatch species, particularly horseshoe crabs, back into the sea, reflecting conservation efforts and the recognition of their ecological importance. These varying methods of bycatch utilization indicate a combination of sustainable practices and opportunistic approaches.

Table 4. Fishermen's perspective on the non-target species (bycatch) captured during blue swimming crabs fisheries and their utilization

No	Site Location	Non-target Species (Bycatch)*	Bycatch Utilization
1	Batubara (FMA571)	<b>Fish and crabs</b> Bartail flathead ( <i>Platycephalus indicus</i> ), Long tongue sole ( <i>Cynoglossus lingua</i> ), Striped goatfish ( <i>Upeneus vittatus</i> ), Soldier croaker ( <i>Nibea soldado</i> ), Fourfinger threadfin ( <i>Eleutheronema tetradactylum</i> ), Crucifix crab ( <i>Charybdis feriata</i> ), Smoothshelled swimming crab ( <i>Charybdis affinis</i> ).	Consumed or sold
2	Lampung (FMA712)	<b>Fish, crabs, and lobster</b> Long tongue sole ( <i>Cynoglossus lingua</i> ), Sixbar grouper ( <i>Epinephelus sexfasciatus</i> ), Blue-spotted stingray ( <i>Neotrygon kuhlii</i> ), Peacock flounder ( <i>Pseudorhombus argus</i> ), Indian halibut ( <i>Psettodes erumei</i> ), Flathead lobster ( <i>Thenus orientalis</i> ), Crucifix crab ( <i>Charybdis feriata</i> ), Yellow moon crab ( <i>Ashtoret lunaris</i> )	Consumed or sold
3	Cirebon (FMA712)	<b>Fish, crabs, and cuttlefish</b> Belanger's croaker ( <i>Johnius belangerii</i> ), Long tongue sole ( <i>Cynoglossus lingua</i> ), Spotted scat ( <i>Scatophagus argus</i> ), Silver pomfret ( <i>Pampus argenteus</i> ), Fourfinger threadfin ( <i>Eleutheronema tetradactylum</i> ), Cuttlefish ( <i>Sepia recurvirostra</i> ), Crucifix crab ( <i>Charybdis feriata</i> ), Three-spot swimming crab ( <i>Portunus sanguinolentus</i> ), Long-eyed swimming crab ( <i>Podophthalmus vigil</i> ), Peregrine crab ( <i>Varuna litterata</i> )	Consumed or sold
4	Rembang, Central Java (FMA712)	<b>Fish, crabs, sea snails, cuttlefish, and shrimp</b> Marine catfish ( <i>Arius</i> sp.), Belanger's croaker ( <i>Johnius belangerii</i> ), Long tongue sole ( <i>Cynoglossus lingua</i> ), Soldier croaker ( <i>Nibea soldado</i> ), Cuttlefish ( <i>Sepia recurvirostra</i> ), Long-eyed swimming crab ( <i>Podophthalmus vigil</i> ), Rare-spined murex ( <i>Murex trapa</i> ), Mantis shrimp ( <i>Harpisquilla harpax</i> ).	Consumed or sold
5	Gresik, East Java (FMA712)	<b>Fish, crabs, shrimp, and sea snails</b> Soldier croaker ( <i>Nibea soldado</i> ), Long tongue sole ( <i>Cynoglossus lingua</i> ), Marine catfish ( <i>Arius</i> sp.), Belanger's croaker ( <i>Johnius belangerii</i> ), Mantis shrimp ( <i>Harpisquilla harpax</i> ), Horseshoe crab ( <i>Tachypleus gigas</i> ), Mud crab ( <i>Scylla serrata</i> ), Spiral babylon ( <i>Babylonia spirata</i> )	Consumed, used as bait, or returned to the sea (i.e. horseshoe crabs, spiny snails).
6	Pamekasan, East Java (FMA712)	<b>Fish, crabs, sea snails, and sea stars</b> Sixbar grouper ( <i>Epinephelus sexfasciatus</i> ), Orange-spotted grouper ( <i>Epinephelus coioides</i> ), Largescaled terapon ( <i>Terapon theraps</i> ), Crucifix crab ( <i>Charybdis feriata</i> ), Three-spot swimming crab ( <i>Portunus sanguinolentus</i> ), Horseshoe crab ( <i>Tachypleus gigas</i> ), Rare-spined murex ( <i>Murex trapa</i> ), Long-eyed swimming crab ( <i>Podophthalmus vigil</i> ), Ridged swimming crab ( <i>Charybdis natator</i> ), Common sea star ( <i>Archaster typicus</i> )	Consumed, used as bait, or returned to the sea (i.e. horseshoe crabs, spiny snails).
7	Tanjung Pinang, South Sulawesi (FMA714)	<b>Fish, crabs, and shrimp</b> Ornate threadfin bream ( <i>Nemipterus hexodon</i> ), Peacock flounder ( <i>Pseudorhombus argus</i> ), Ornate emperor ( <i>Lethrinus ornatus</i> ), Sixbar grouper ( <i>Epinephelus sexfasciatus</i> ), Crucifix crab ( <i>Charybdis feriata</i> ), Twospined arm swimming crab ( <i>Charybdis anisodon</i> ), Flathead lobster ( <i>Thenus orientalis</i> ), <i>Thalamita prymn</i>	Consumed, sold, or used as bait

Note: Bycatch species was identified by the APRI field support

### Marine mammals sightings

Figure 7 presents the proportion of respondents who reported sightings of marine mammals during their fishing activities. Approximately 59% of respondents have seen marine mammals during their fishing activities, while 41% have never had seen (Figure 6A). Figure 6B reveals that the highest percentage of respondents who have seen marine mammals was in Batubara and Lampung (100%), while the lowest was recorded in Tanjung Pinang (6%) and Gresik (13%). The majority of fishermen in Tanjung Pinang and Gresik operate in nearshore areas (within 4 miles), with only a few respondents reporting sightings of marine mammals passing through at a greater distance, around 10 miles. These findings offer valuable insights into the distribution and visibility of marine mammals in blue swimming crab fishing areas.

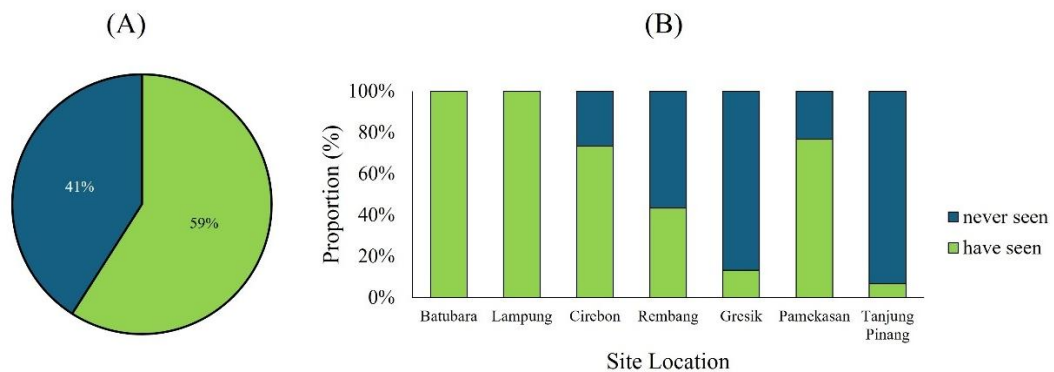


Figure 7. Proportion of respondents who reported sightings of marine mammals during fishing activities

Table 5 presents a list of marine mammal species that were reported by fishermen during interviews, based on pictures provided to assist in species identification (Appendix 2). Marine mammal species varies across different regions. A total of nine species have been identified, which include the Pantropical spotted dolphin (*Stenella attenuata*), Long-snouted spinner dolphins (*Stenella longirostris*), Short-beaked common dolphin (*Delphinus delphis*), Indo-Pacific humpbacked dolphin (*Sousa chinensis*), Indo-Pacific finless porpoise (*Neophocaena phocaenoides*), Short-finned pilot whale (*Globicephala macrorhynchus*), Killer whale (*Orcinus orca*), Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), and Rough-toothed dolphin (*Steno bredanensis*). The most commonly reported species are the

Pantropical spotted dolphin, which was sighted in Batubara, Lampung, and Rembang, and Short-beaked common dolphin, reported in Lampung, Pamekasan, and Tanjung Pinang. The least commonly reported species are the Killer Whale, which was only sighted in Rembang, and Rough-toothed dolphin, reported in Pamekasan. These sightings highlight the diversity of marine mammal species seen by local fishermen during their fishing activities in different regions.

Table 5. List of marine mammal species sightings reported by blue swimming crab fishermen

No	Site Location	Marine Mammal Species	Length	No. of Individuals
1	Batubara (FMA571)	Pantropical spotted dolphin <i>Stenella attenuata</i>	1–1.5 m	In a group of 5-10 ind
		Long-snouted spinner dolphins <i>Stenella longirostris</i>		
2	Lampung (FMA712)	Short-beaked common dolphin <i>Delphinus delphis</i>	1–2 m	In a group of 2-5 ind
		Long-snouted spinner dolphins <i>Stenella longirostris</i>		
		Indo-Pacific humpbacked dolphin <i>Sousa chinensis</i>		
		Pantropical spotted dolphin <i>Stenella attenuata</i>		
		Indo-Pacific finless porpoise <i>Neophocaena phocaenoides</i>		
		Short-finned pilot whale <i>Globicephala macrorhynchus</i>		
3	Cirebon (FMA712)	Indo-Pacific bottlenose dolphins <i>Tursiops aduncus</i>	1–7 m	In a group of 2-3 ind
		Indo-Pacific finless porpoise <i>Neophocaena phocaenoides</i>		
		Indo-Pacific humpbacked dolphin <i>Sousa chinensis</i>		
4	Rembang (FMA712)	Pantropical spotted dolphin <i>Stenella attenuata</i>	1–5 m	In a group of 1-5 ind
		Indo-Pacific finless porpoise <i>Neophocaena phocaenoides</i>		
		Short-finned pilot whale <i>Globicephala macrorhynchus</i>		
		Killer Whale <i>Orcinus orca</i>		
5	Gresik (FMA712)	No data available	1–1.5 m	No data available
6	Pamekasan (FMA712)	Short-beaked common dolphin <i>Delphinus delphis</i>	1–1.5 m	In a group of 2-7 ind
		Indo-Pacific bottlenose dolphins <i>Tursiops aduncus</i>		
		Rough-toothed dolphin <i>Steno bredanensis</i>		
7	Tanjung Pinang (FMA714)	Short-beaked common dolphin <i>Delphinus delphis</i>	1 m	1 ind

Table 6 provides an overview of the time, frequency, and environmental conditions under which marine mammal sightings were reported by blue swimming crab fishermen. Marine mammal sightings was observed at all times of the day (morning, afternoon, evening, or night) depending on the fishing

operation. Based on the frequency of sightings, the highest sightings were reported in Batubara (FMA571) and Rembang (FMA712), while the lowest sightings were reported in Gresik (FMA712) and Tanjung Pinang (FMA714). High-frequency sightings may suggest that marine mammals are common in the area, potentially indicating healthy ecosystems and abundant food sources. On the other hand, low-frequency sightings may be associated with the differences between fishing locations and marine mammal habitats. Regarding the environmental conditions during sightings, marine mammals were observed at distances greater than 7 miles from shore, ranging from 20 to 50 m in depth. Wave conditions varied from calm to rough.

Table 6. Time, frequency, and environmental conditions under which marine mammal sightings were reported by blue swimming crab fishermen

No	Site Location	Sighting Time	Sighting Frequency	Environmental Condition
1	Batubara (FMA571)	Afternoon and evening (Sept 2024)	1 to 2 times per month	Approximately 7 miles from shore, depth > 50 m. Calm waters and waves. Near Salahnama Island
2	Lampung (FMA712)	Morning, afternoon, evening (Juni 2024)	1 to 5 times per year	Approximately 10 miles from shore. Calm waters and waves. Near Kiluan Bay
3	Cirebon (FMA712)	Night, afternoon (2023)	1 to 2 times per year	Approximately 12 miles from shore. Calm waters and waves
4	Rembang (FMA712)	Morning (Aug 2024)	1 to 2 times per month	Approximately 10 miles from shore, depth > 40 m. Calm waters and waves. Near Gosong Lasem Island
5	Gresik (FMA712)	Morning (last seen in 2020)	Rarely seen	Approximately 10 miles from shore. Calm waters and waves. Near Nyamukan Island and Karang Jamuang Island
6	Pamekasan (FMA712)	Afternoon	1 to 3 times per year	Approximately 8 miles from shore, depth 20-50 m. Calm to rough waves
7	Tanjung Pinang (FMA714)	Morning, Evening	Rarely seen	Approximately 7-10 miles from shore. Calm to rough waves

According to Table 6, some respondents reported sightings of marine mammals near the small island. Small islands, particularly those with shallow waters or nearby seagrass beds, provide essential habitats for marine mammals. They can

serve as resting, breeding, or feeding areas for species like dugongs or dolphins. Islands also often have rich marine ecosystems, including fish and other prey, making them attractive feeding grounds for marine mammals. For example, areas near reefs or mangroves can have abundant fish populations.

### **Marine mammal bycatch**

Table 7 presents the bycatch incidents of marine mammal reported by respondents from 2022-2024. All respondents from Batubara, Lampung, Cirebon, Rembang, Gresik, Pamekasan, and Tanjung Pinang reported no marine bycatch incidents during 2022-2024. Some fishermen only observed marine mammals passing by while they were fishing, without any physical contact or direct interaction with the animals. For example, a group of dolphins leaping out of the water from a distance. The interaction between the blue swimming crab fishery and marine mammals is typically non-interactive or observational, involving minimal engagement or disturbance to the animals.

Table 7. Marine mammals bycatch incidents reported by the respondents from 2022-2024 (n=210 respondents)

No	Site Location	Incident	Time	Marine mammal species	Marine mammals condition	Handling Technique
1	Batubara (FMA571)	0	-	-	-	-
2	Lampung (FMA712)	0	-	-	-	-
3	Cirebon (FMA712)	0	-	-	-	-
4	Rembang (FMA712)	0	-	-	-	-
5	Gresik (FMA712)	0	-	-	-	-
6	Pamekasan (FMA712)	0	-	-	-	-
7	Muna Barat (FMA714)	0	-	-	-	-

### **Perspective and attitudes toward marine mammals**

Figure 8 illustrates the blue swimming crab fishermen’s perceptions of marine mammals. The data indicates that a significant proportion of fishermen (88.7%) view the presence of marine mammals as a common or normal thing, with marine mammals often observed “playing”, “leaping”, or “swimming” while they were

fishing. Less than 3% of respondents consider marine mammals can potentially damage fishing gear and serve as indicators of fish abundance, while none of the respondents consider marine mammals to consume the crab catch (depredation).

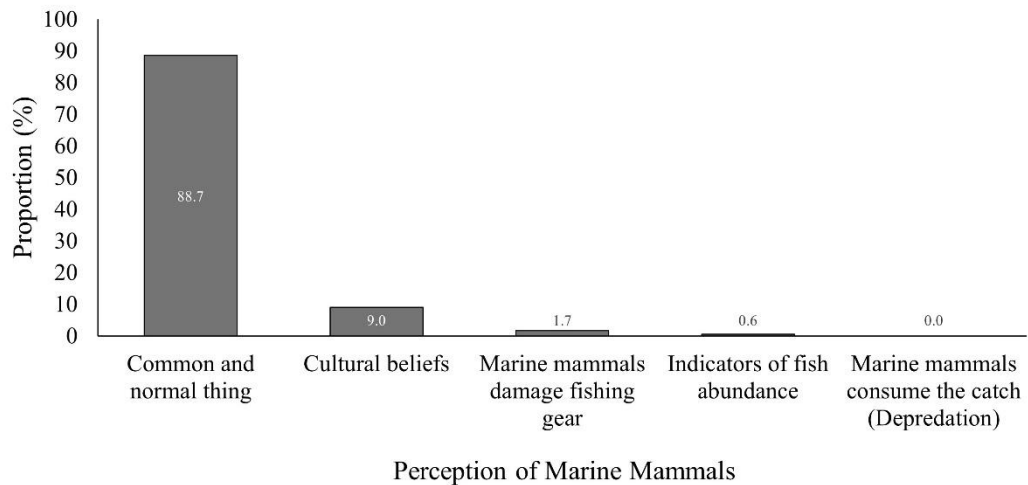


Figure 8. Blue swimming crab fishermen's perceptions of marine mammals

About 9% of respondents associate marine mammals with cultural beliefs. In Lampung and Rembang, for example, some fishermen believe that the appearance of dolphins or whales is a sign of bad weather approaching, including strong winds and rough waves. Meanwhile, in Cirebon, marine mammals are considered sacred animals, believed to be descendants of gods and seen as omens or reminders for celebrating significant events, such as the Nadran festival. Nadran is a traditional ceremony held by fishermen along the northern coast of Java Island, including areas such as Subang, Indramayu, and Cirebon. This ceremony is performed to honor the sea and its resources, with the aim of ensuring a prosperous and safe fishing season for the coming year.

Figure 9 presents the attitudes of blue swimming crab fishermen towards marine mammals. This figure visually depicts the distribution of fishermen's opinions on marine mammals, whether they view them as beneficial, neutral, or harmful to their fishing activities. The majority of respondents (95%) appear to be indifferent to the presence of marine mammals, focusing primarily on their fishing activities. This suggests that they believe marine mammals do not significantly impact their fishing operations. Fishermen have not faced significant challenges with marine

mammals to warrant active attention. A small percentage (3%) of fishermen attempt to drive marine mammals away, by waving the wood into the water or tapping the ship to make a sound. It was likely to prevent them from becoming stranded on the beach, fearing that marine mammals were unable to swim freely at shallow waters.

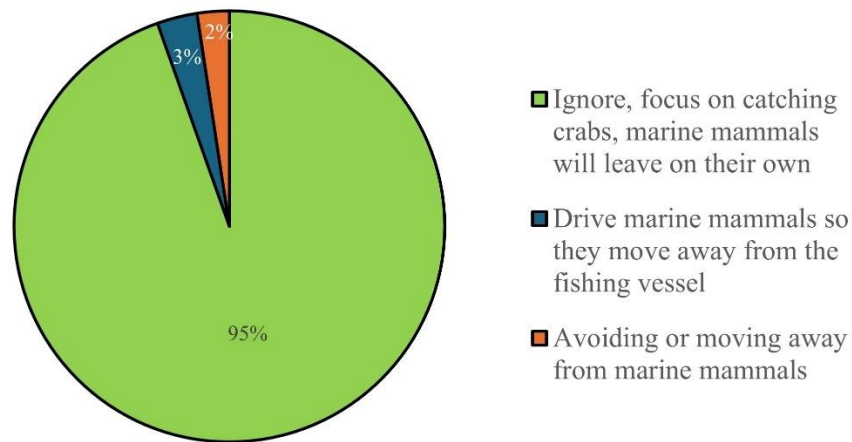


Figure 9. The attitudes of blue swimming crab fishermen towards marine mammals

A very small percentage (2%) of fishermen choose to avoid or move away from marine mammals. This could indicate that these fishermen prefer to avoid any potential conflicts with marine mammals and reflects awareness of the ecological role these animals play.

#### **Awareness and efforts to minimize interactions with marine mammals**

Figure 10 illustrates the level of knowledge that fishermen have regarding the protection of marine mammals. The majority of respondents (97%) understands that marine mammals are protected animals. This suggests that education programs or outreach efforts have been effective in raising awareness among the fishing community. According to the fishermen, their knowledge comes from previous socialization and training sessions, as well as posters and banners displaying marine mammals species at community gathering points. In this context, APRI, in collaboration with DKP, NGOs, and universities, regularly conducts socialization and training to raise fishermen's awareness of the

importance of protecting marine mammals. A very small percentage (3%) of fishermen are still unaware of the protection of marine mammal species. Therefore, it is important to conduct regular socialization, training, and active community engagement to improve fishermen's awareness and foster more sustainable fishing practices.

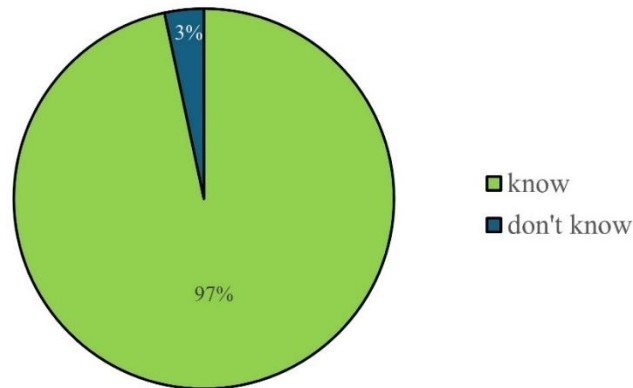


Figure 10. Fishermen's awareness regarding the protection of marine mammals

Figure 11 illustrates the various strategies employed by fishermen to reduce interactions with marine mammals. These efforts include avoiding or moving away from marine mammals (64.7%), altering fishing locations to avoid areas of marine mammal sightings (34.3%), and slow down the fishing vessel (1%). The data suggests a growing awareness and responsibility among fishermen to balance fishing activities with the conservation of marine mammals.

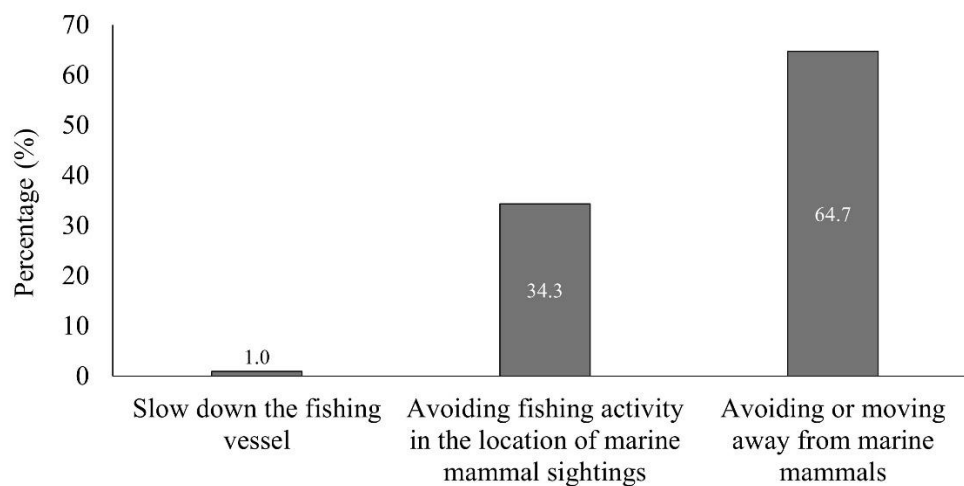


Figure 11. Fishermen's efforts to minimize interactions with marine mammals

## **CONCLUSION**

The study reveals that marine mammal sightings are relatively common among blue swimming crab fishermen, with approximately 59% of respondents reporting have seen marine mammals during their fishing activities. Marine mammal species vary across regions, with a total of nine species identified, based on pictures provided to assist in species identification. Fishermen reported minimal marine mammal bycatch incidents over the period 2022-2024, highlighting the non-interactive and passive nature of their interactions with marine mammals. The majority of fishermen (97%) are aware of marine mammal protection laws, and their efforts to minimize interactions, such as avoiding fishing locations with frequent marine mammal sightings, demonstrate a proactive approach to conservation and sustainable fishing practices.

## **SUGGESTIONS FOR FURTHER STUDY**

Further research should involve a longer-term monitoring program to better assess trends in marine mammal bycatch, especially in different seasonal conditions. This could help determine if bycatch incidents vary over time and how they relate to specific fishing practices or environmental changes. Conducting a more detailed mapping study of marine mammal distribution, both spatially and temporally, across fishing grounds could help identify critical habitats and migration routes. This information would be essential for designing more effective conservation strategies that minimize conflicts between fishing activities and marine mammal populations. Given that fishermen are already largely aware of marine mammal protection laws, future research could focus on evaluating the effectiveness of current awareness programs and identify areas for improvement. This could involve assessing how well the fishermen understand the specific actions they can take to avoid bycatch and whether they feel equipped with the necessary tools and knowledge.

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## **APPENDIX**

Appendix 1. Reseach questionnaire

## Interaksi Mamalia Laut dengan Perikanan Rajungan (*Gillnet* dan *Bubu*) di Indonesia

Target Responden : 30 nelayan (kapal) per lokasi  
 Field Support :  
 Lokasi :  
 Tanggal :

### A. Karakteristik Responden dan Perikanan

Parameter	Jawaban
Nama	
Jenis kelamin (L/P)	
Umur	
Lokasi (desa)	
Pengalaman melaut (sejak kapan? tahun berapa?)	
Lokasi melaut (mil) (+ jika ada titik koordinat)	
Jumlah hari per trip (hari)	
Jumlah trip dalam 1 bulan	
Cara nelayan mengetahui <i>fishing ground</i> rajungan	
Apakah perairan tersebut ada terumbu karang, mangrove, atau lamun?	
<b>Alat tangkap Bubu</b>	
*Dimensi bubu (PxLxT) (+foto)	
*Bahan bubu	
*Ukuran celah masuk rajungan (cm)	
*Panjang tali bubu (m), warna tali	
*Jumlah bubu setiap melaut	
*Lama perendaman bubu (jam .. s/d jam ...)	
*Kedalaman setting bubu (m)	
*Umpan	
*Jenis alat bantu penangkapan ikan (atraktor)	
*Lama operasi penangkapan (jam) (dari jam brp sd jam brp)	
<b>Alat tangkap Jaring</b>	
*Jenis jaring (+foto)	
*Bahan jaring, warna jaring	
*Mesh size jaring (inch)	
*Dimensi jaring (PxL) (m)	
*Jumlah set jaring yang digunakan	
*Panjang tali ris, warna tali	
*Lama perendaman jaring (jam... s/d jam...)	
*Kedalaman setting jaring (m)	
*Umpan	

*Jenis alat bantu penangkapan ikan (atraktor)	
*Lama operasi penangkapan (jam) (dari jam brp sd jam brp)	

### B. Identifikasi Hasil Tangkapan Utama dan Bycatch

Parameter	Jawaban
Rata-rata hasil tangkapan rajungan per trip (kg)	
Dalam setahun ini, kapan biasanya hasil tangkapan rajungan banyak dan kapan sedikit?	
Apakah pelepasan rajungan dari jaring/bubu dilakukan di kapal? Berapa lama waktu yang dibutuhkan? Apakah kondisi rajungan masih hidup?	
Selain rajungan, apakah ada hasil tangkapan lain yang biasanya ikut tertangkap dalam bubu/jaring?	
Apakah bycatch tersebut dikembalikan ke laut? Atau dijual?	

### C. Interaksi dengan Mamalia Laut

Parameter	Jawaban
Selama melaut apakah Bapak pernah melihat/ berpapasan dengan lumba-lumba atau paus? Seberapa sering? (+berapa kali seminggu/sebulan/setahun? Ada berapa ekor?	Ceklis jika pernah bertemu (√) (+info nama lokal) Lumba-lumba Paus
Seberapa besar lumba-lumba, paus yang Bapak lihat? (estimasi panjang)	
Di mana Bapak ketemu hewan tersebut? (+gali informasi spesifik, seberapa jauh dari darat, kedalaman perairan, dll)	
Waktu pertemuan dengan lumba-lumba, paus (pagi, siang, sore, atau malam) (+gali info kondisi perairannya, berombak atau tenang?)	
Ketika berpapasan dengan hewan tersebut, apa yang Bapak lakukan? a. Mengusir hewan itu agar menjauh dari kapal (+gmn caranya) b. Mengikuti hewan itu karena pasti banyak ikan c. Cuek saja, mereka akan pergi dengan sendirinya d. Alasan lainnya	
Apakah lumba-lumba, paus tersebut memakan ikan hasil tangkapan Bapak?	
Apakah lumba-lumba, paus tersebut merusak alat tangkap Bapak?	
Apakah pernah ada kejadian lumba-lumba,	

Parameter	Jawaban
paus <b>tidak sengaja</b> terjaring alat tangkap Bapak? Atau terlilit tali bubu? (+tulis info spesifiknya)	
Jika iya, bagaimana kondisi lumba-lumba, paus ketika <b>tidak sengaja tertangkap</b> (sehat, lemas, terluka, atau mati)	
Apa yang Bapak lakukan pada lumba-lumba, paus, hiu, atau penyu tersebut ketika tertangkap a. Dilepaskan tanpa ada tanda luka/goresan b. Dilepaskan dengan tanda-tanda luka (+gali info lukanya di mana? apakah serius) c. Kondisinya sudah mati, dibuang ke laut d. Bangkai dibawa ke darat (+dikubur/dibuang/ dijual/dimakan/dijadikan umpan dsb)	
Bagaimana cara Bapak melepaskan lumba-lumba, paus yang terlilit jaring/tali bubu?	
Bagaimana pendapat Bapak mengenai kemunculan hewan-hewan ini saat bapak sedang melaut? Apakah itu hal yang wajar? Apakah ada kepercayaan masyarakat setempat?	
Apakah Bapak tahu bahwa beberapa jenis lumba-lumba, paus, hiu, atau penyu adalah hewan yang dilindungi?	
Upaya apa saja yang sudah Bapak lakukan untuk mencegah interaksi dengan hewan-hewan tersebut yang dapat menyebabkan luka atau kematian? (konservasi)	

Dengan ini saya menyatakan dengan sesungguhnya bahwa semua informasi yang disampaikan dalam seluruh dokumen serta lampiran ini adalah benar dan dapat dibuktikan keasliannya.

Field Support APRI	Nelayan Rajungan

Appendix 2. Identification of marine mammal species



1.Lumba-lumba  
(*Delphinus delphis*)



2.Lumba-lumba pemintal  
(*Stenella longirostris*)



3.Lumba-lumba hidung botol  
(*Tursiops aduncus*)



4.Lumba-lumba gigi kasar  
(*Steno bredanensis*)



5.Lumba-lumba totol  
(*Stenella attenuate*)



6.Lumba-lumba punggung bungkuk  
(*Sousa chinensis*)



7.Gondal nirsirip Indo-Pasifik  
(*Neophocaena phocaenoides*)



8.Pesut  
(*Orcaella brevirostris*)



9.Dugong



10.Paus Balin/Paus Bungkok



11.Paus sperma  
(*Physeter macrocephalus*)



12.Paus Pembunuh Palsu  
(*Pseudorca crassidens*)



13.Paus kepala melon  
(*Peponocephala electra*)



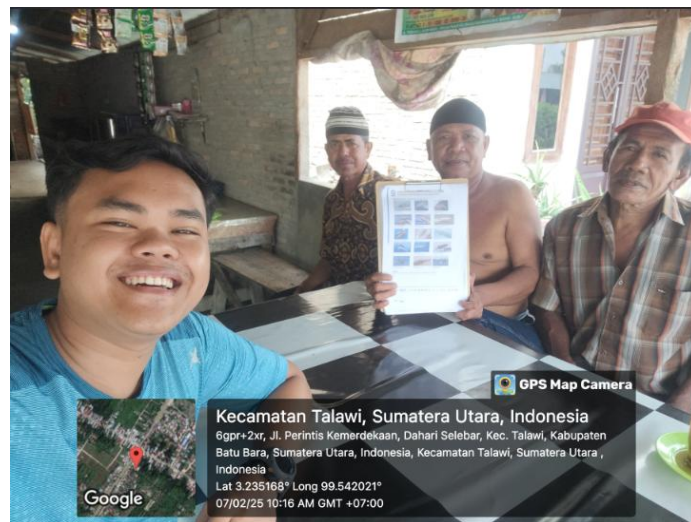
14.Paus Pilot  
(*Globicephala macrorhynchus*)



15.Paus Pembunuh  
(*Orcinus orca*)

### Appendix 3. Documentation

Site Location: Batubara, North Sumatera (FMA571)



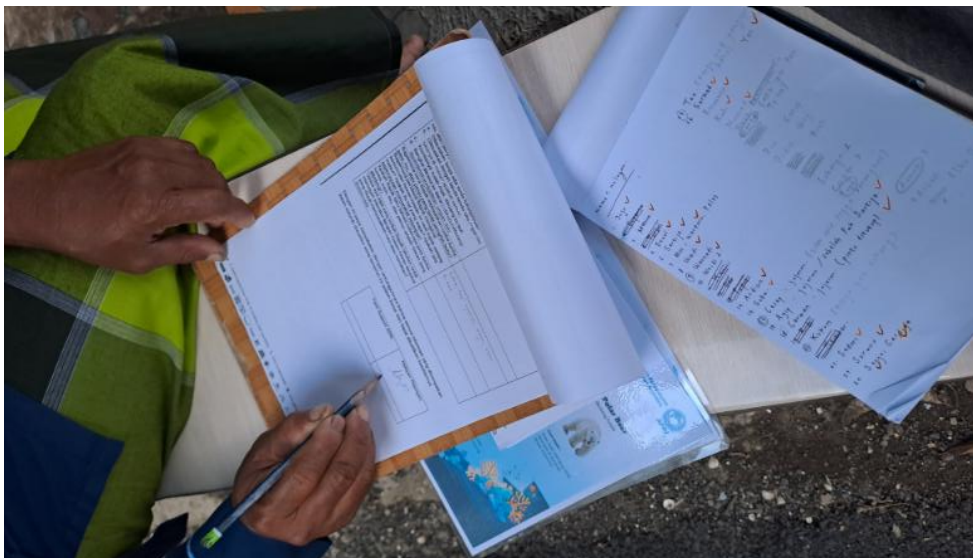
Appendix 3. Documentation

Site Location: Lampung (FMA712)



Appendix 3. Documentation

Site Location: Cirebon, West Java (FMA712)



Appendix 3. Documentation

Site Location: Rembang, Central Java (FMA712)



Appendix 3. Documentation

Site Location: Gresik, East Java (FMA712)



### Appendix 3. Documentation

Site Location: Pamekasan, East Java (FMA712)



Appendix 3. Documentation

Site Location: Muna Barat, Southeast Sulawesi (FMA714)

