The potential of the spiny lobster fishery in Aceh waters: A short review

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Abstract. The western-southern and northern coastal waters of Aceh are the potential fishing areas of spiny lobster, which faces the Indian Ocean and the Andaman Sea. Fishing gears that are widely used are lobster gill nets and hand-picking with compressors. In Indonesia, seven species of spiny lobsters are caught in these waters, including Panulirus homarus, P. penicillatus, P. versicolor, P. ornatus, P. polyphagus, P. longipes longipes, and P. longipes femoristiga. The habitat for spiny lobsters is spread from coral reefs, rock, sand, and muddy sand. Panulirus homarus is the most frequently caught species in these waters, followed by P. penicillatus and P. longipes. Panulirus homarus is mainly caught during the dry season (southwest wind) and high waves (May to July), where other lobster species experience a significant decrease in the catch. The stock of spiny lobster in Fisheries Management Area (FMA) 572 (including Aceh coastal waters) has been in an overfishing condition since 2008. Maximum sustainable yield (MSY) of spiny lobster in Aceh coastal waters part of Malacca Strait (FMA 571) is 188.60 tons.yr⁻¹ with a total allowable catch (TAC) of 151.10 tons. yr⁻¹. Furthermore, the MSY for Aceh coastal waters part of Indian Ocean is 292.09 tons.yr⁻¹ with a TAC of 233.92 tons.yr⁻¹. Spiny lobster fishing in Aceh coastal waters must ensure its use in the future, both ecologically, socially, and economically.

1. Introduction

Crustacean resources in Indonesia have been the object of research for several years. The crustaceans that became the target of research were mostly marine crustaceans, such as Penaeid shrimps (family Penaeidae), portunid crabs (family Portunidae) and spiny lobsters (family Palinuridae). The spiny lobsters are one of the leading fishery export commodities in Indonesia. Its production reached 1,514,653 tonnes or equivalent to US$ 28,452,601 in 2018. The export value of consumption size lobster for the 2014-2018 period grew by an average of 20.42% per year in the 2014-2018 period [1]. Spiny lobster production in Indonesia is 99.5% produced from the capture fisheries sector and the remaining 0.5% comes from the aquaculture sector. This percentage shows that the spiny lobster business is still very dependent on the catch in nature [2, 3].

In Aceh, the spiny lobster is the top five contributor to province fisheries export. This commodity contributes 0.13% to the national level. Regions that contribute to spiny lobster production include Aceh Besar, Aceh Jaya, West Aceh, and Simeulue Island. Simeulue Island and Aceh Jaya still provide the
highest production contribution until now. Its exploitation has been going on for a long time with a small fishing boat. The fishing gears used are dominated by gill nets specifically for lobsters.

The spiny lobster in Indonesia has been the object of research for several years. In general, the aspects studied include species diversity [4], habitat [5], biological aspects [6-10], growth pattern [11, 12], abundance and population dynamic [13-16], reproductive biology [17, 18], genetics [19], and management and conservation [20, 21]. The purpose of this review article is to review scientific information about spiny lobster in Aceh coastal waters from previous studies, especially research conducted in the western-southern of Aceh.

2. Species Diversity

Six species of spiny lobster found in Indonesian waters were also found in Aceh waters, particularly the south-west coast (Table 1). These species were found in Lhok Kruet, Lhok Rigaih and Sampoiniet [4, 22, 23]. These three areas are located in Aceh Jaya Regency.

Table 1. Spiny lobster species found in Aceh coastal waters.

| Scientific name        | English name          | Local name    |
|------------------------|-----------------------|---------------|
| *Panulirus homarus*    | Scalloped spiny lobster | Lobster pasir |
| *Panulirus penicillatus* | Pronghorn spiny lobster | Lobster batu |
| *Panulirus versicolor* | Painted spiny lobster  | Lobster bambu |
| *Panulirus ornatus*    | Ornate spiny lobster  | Lobster mutiara |
| *Panulirus polyphagus* | Mud spiny lobster     | Lobster pakistan |
| *Panulirus longipes longipes* | Longlegged spiny lobster | Lobster batik |

The discovery of these six species was also reported on the coast of Aceh Besar Regency and Simeulue Island, but there has been no scientific publication that has written about this. Another species found in Indonesian waters, *P. femoristriga*, has never been reported on spiny lobster fisheries in Aceh. This species has only been reported to be found in the waters of the Celebes and Seram Islands [24].

![Figure 1](image_url). Distribution of spiny lobster *Panulirus* spp. in Indonesia waters. A compilation sources was used Tewfik [22], Berry [25], George [26], Prescott [27], Holthuis [28].

*Panulirus penicillatus* and *P. longipes longipes* can be found in rocky shores. *Panulirus versicolor* prefers coral reefs. *Panulirus homarus* and *P. ornatus* are distributed in sandy beaches, while *P. polyphagus* is distributed in the sand-muddy areas. Knowledge of the spatial distribution of spiny lobster based on the pattern of fisher access to the resources can help in better management of this commodity.
The spatial distribution of spiny lobster in these habitats is strongly influenced by nearshore hydrodynamics and turbidity originating from terrestrial areas [25, 26, 32].

3. Catch Composition

Spiny lobster catches in Aceh were dominated by *P. penicillatus* at 34%, followed by *P. homarus* 26%, *P. longipes* 20%, *P. versicolor* 13%, *P. ornatus* 6%, and *P. polyphagus* 1%. *Panulirus penicillatus* has a dark blue and black body. Males are darker in color than the females. There are less obvious spots on the abdomen. The antenna stalk has a blue line. This species generally lives on coral reefs with water depths of 1-4 m and a maximum depth of 16 m [33]. *Panulirus penicillatus* also live in association with *P. homarus* so that *P. homarus* is also caught in large numbers, namely 26% [4, 34].

![Figure 2](image2.png)

**Figure 2.** Catch composition of spiny lobster *Panulirus* spp. landed in Aceh coastal areas.

Aceh coastal waters, especially the west and south coasts, are potential areas for spiny lobster habitat. This condition causes six spiny lobster species to be caught in this area. These six species were also caught on the southern coast of Java, Bali and Nusa Tenggara [10, 14, 35, 36]. Most of the fishing gear used in these areas are gillnets specifically for catching lobster, but in some areas fishing gear such as traps, known as *krendet* are also used [14, 37].

![Figure 3](image3.png)

**Figure 3.** Monthly fishing season of spiny lobster *Panulirus* spp. in Aceh Jaya Regency, Indonesia [22].
4. Exploitation Status
The calculation of the spiny lobster exploitation rate in Aceh waters uses the Fisheries Management Area (FMA) 571 and 572 data approach. The data used are fishery statistics for the period 2007-2016. The results of the calculation using the Surplus Production Model of the data are shown in Figure 4.

Figure 4 shows the stock of spiny lobster in FMA 572 has been in biologically unsustainable condition (overfishing and overfished) since 2008. The same status has also occurred in FMA 571 since 2011. Overfishing and overfished does not mean that the lobster cannot be caught, but the fishing must be controlled. The calculation of exploitation status in Figure 4 is then derived to calculate the maximum sustainable yield (MSY) of spiny lobster in Aceh waters. The calculation results are shown in Table 2.

Table 2. Catch potential of spiny lobster *Panulirus* spp. in FMA 571 and 572.

| FMA                     | Province         | Catch Potential (ton) |
|------------------------|------------------|-----------------------|
| 571 Malacca Strait     | Aceh             | MSY: 188.60, TAC: 151.10 |
|                        | North Sumatra    | MSY: 23.91, TAC: 19.16 |
|                        | Riau             | MSY: 270.48, TAC: 216.72 |
| FMA 572 Indian Ocean   | Aceh             | MSY: 103.49, TAC: 82.82 |
| (Western Sumatra)      | North Sumatra    | MSY: 31.57, TAC: 25.26 |
|                        | West Sumatra     | MSY: 660.61, TAC: 528.69 |
|                        | Bengkulu         | MSY: 500.98, TAC: 400.93 |
|                        | Lampung          | MSY: 36.06, TAC: 28.86 |
|                        | Banten           | MSY: 4.29, TAC: 3.43 |

Note: MSY = Maximum Sustainable Yield; TAC = Total Allowable Catch
Table 2 shows the MSY of spiny lobster in Aceh coastal waters part of Malacca Strait (FMA 571) is 188.60 tons.yr\(^{-1}\) with a TAC of 151.10 tons. yr\(^{-1}\). Furthermore, the MSY for Aceh coastal waters part of Indian Ocean is 292.09 tons.yr\(^{-1}\) with a TAC of 233.92 tons.yr\(^{-1}\). Spiny lobster fishing in Aceh coastal waters must ensure its use in the future, both ecologically, socially, and economically [38-40].

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