Lobster aquaculture business in East Lombok Regency: challenges and prospects

T Apriliani*, C Yuliati, R Yusuf, R Triyanti, and A Zulham

Research Center for Marine and Fisheries Socio Economics. Jl. Pasir Putih I. Ancol Timur – Jakarta Indonesia.
*Corresponding Author: apriliani.tenny@gmail.com

Abstract. Lobster aquaculture plays a significant part of coastal communities in East Lombok Regency, some farmers' activities to on-grow lobster started in early 2000 at several sites. Lobster aquaculture development has begun to carry out since government policy support through Marine and Fisheries Regulation No. 12/2020. This study aims to identify some opportunities and challenges lobster aquaculture, especially in East Lombok Regency, based on SWOT analysis as a recommendation considered for lobster aquaculture development in the future. The results show that stakeholders have a relatively positive perception about developing the lobster aquaculture business in East Lombok because they believe the strengths and opportunities outweigh the weaknesses and threats. Suitable natural conditions are considered the most crucial power. Simultaneously, many untapped markets and government's support for the sector are critical opportunities for further developing lobster aquaculture. Limitations of aquaculture technology, provision of feed, a supply of seeds and mortality, and lobsters' disease rates are weaknesses in developing lobster aquaculture. Besides, reliance on the markets of China, Taiwan, and Hong Kong is considered a substantial threat that must be faced. The findings of this study can be used by policymakers to develop the lobster aquaculture business further.

1. Introduction
Lobster is an important trading commodity and one of the most common fishery products in international trade [1]. Apart from its ability to meet domestic needs, Indonesia has been exporting lobster to many countries in Asia, Australia, and America since 1989. Asia is the largest market for Indonesian lobsters, including China, Hong Kong, Japan, Malaysia, Singapore, Vietnam, the Republic of Korea, and Thailand. These exports not only provide a return on income but also make it possible to develop markets. Indonesian lobster production in 2014 is around 5-10 tons or 72% of the national production target [2]. More significant sales and production volumes can be made possible through exports to achieve economies of scale and increase labor productivity and management efficiency, impacting competitiveness.

Indonesia is a significant exporter of lobster seeds, mainly to export destination countries such as Vietnam, Hong Kong, Singapore, Thailand, Brunei Darussalam, and Malaysia [3]. The types of lobsters that generally export are Panulirus homarus (sand lobster) and P. ornatus (pearl lobster). The high demand for lobster seeds and rising prices have caused the catch of lobster seeds to continue to increase. It has resulted in a decrease in the environment's carrying capacity and the price of consumption of seeds and lobsters because they are related to competitors from Vietnam [4].

The enforcement of Permen KP No. 56 the year 2016 concerning the Prohibition of Catching and Exporting Lobster (Panulirus Spp.), Crab (Scylla Spp.), and blue swimming crab (Portunus Spp.) from Indoensia Territory causing new problems for Lombok Island's coastal communities. Based on the
results of research by [5], this rule caused various impacts on the community's condition, especially on the island of Lombok, both economically and socially, especially the loss of community livelihoods. When the Ministry of Marine Affairs and Fisheries (MMAF) issued a policy through Permen KP No. 12/2020 concerning the management of lobsters, crabs, and small crabs, it provides opportunities for developing a lobster aquaculture in NTB. The limited use of lobster seeds expected to encourage lobster aquaculture development by considering fishery resources and aquatic environment sustainability. This study aims to identify some opportunities and challenges lobster farming, especially in East Lombok Regency, based on SWOT analysis as a recommendation considered for lobster farming development in the future.

2. Methods
Primary and secondary data use in this study. The primary data collected from 30 respondents consist of stakeholders involved in lobster farming, namely academics (Mataram University), Fisheries Agency, fisheries extension, and lobster farmers in East Lombok Regency. The secondary data obtained from National Statistik Bureau, Coastal Village data, and Fisheries Agency in East Lombok Regency. This study conducted from April to August 2020 and using SWOT analysis. Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is a qualitative method typically used to support strategic planning and decision-making [6, 7].

3. Results and Discussion
3.1. Key SWOT factors influencing the development of marine lobster aquaculture in East Lombok
Factors influencing the development of lobster aquaculture in East Lombok were identified based on literature review, focus group discussion with stakeholders, and field visits. Economic and environmental perspectives consider as the two most important angles of the development of lobster aquaculture in this case. The results show the factors identified by the stakeholders are in line with other studies and reports, such as [4, 8, 9].

All participants consider the suitable natural conditions in East Lombok, including the long coastline and the many bays such as Ekas, Jukung, and Seriwe Bay for developing lobster aquaculture. The natural availability of seeds, one of the crucial inputs for the lobster aquaculture development, is also regarded as one of the strengths. After lobster aquaculture is developing, more attention paid to finding pueruli within the bagan catch. There are three main sites with potential as seed sources in Lombok island [8], namely Awang Bay, Gerupuk Bay, and Telong Elong Bay. Trash fish is an important input for aquaculture, including lobster farming. Lobsters are fed entirely with trash fish caught as a by-product of other fishing activities, particularly from fish traps (bagan). It is roughly chopped and fed each morning after the night’s fishing activity is completed. Moreover, labor availability with a very open for new technology innovation in lobster aquaculture is also another strength in developing this industry.

Although seeds and trash fish for lobster aquaculture are available in the study area, all participants are concerned about their stability in terms of quality, quantity, and price. All stakeholders agreed that although seeds and feeds are available from capture fisheries, the coastal resource appears overexploited. It implies that there will be less trash fish available for feeding lobsters and/or that the feed price might increase in the future. Seasonal fishing affects the availability of trash fish feed and also seeds prices. The activity of exporting lobster seeds also causes competition to get seeds for aquaculture needs; fishers prefer to sell seeds for export at a higher price. Also, various diseases that cause lobster death are still one of the obstacles in lobster aquaculture. Underdeveloped aquaculture technologies such as feed technology, disease management, hatchery, marketing, and trade are also weaknesses for developing sustainable lobster aquaculture. The current trash fish diet is not ideal, and it may describe as pale pigmentation in adult lobsters. A comprehensive study of feed composition and their nutritional quality required before recommendations made about what other foods are must add to the diet.

One of Indonesia's fishery commodities with great potential to be developed is lobster, which has high economic value with the aim of marketing both domestically and on the international market [10,
The demand from markets for spiny lobster continues to grow, particularly from China [12, 13]. The high demand of lobster encourages fishers to catch lobsters as many as possible. In recent years there has been a decline in population marked by a decrease in the number of catches and the size of lobsters caught in the wild [4, 14]. According to all stakeholders, the overexploited condition of lobster from capture fisheries is a very good opportunity for lobster aquaculture development.

Moreover, there are still many markets around the world with high demand for lobster products. These untapped markets could be opportunities for lobster aquaculture to expand its exports. In the opinion of the respondents, unlike other marine aquaculture production, the lobster sector receives a high level of attention and is a priority for the Indonesian government. Through the implementation of Marine and Fishery Decree (Permen KP No 12 Year 2020) where one of the obligations of investors, entrepreneurs, groups and anyone exporting lobster seeds to carry out aquaculture activities.

The absorption of labor in lobster aquaculture activities is very potential. Various derivative businesses that will grow with the development of lobster cultivation will support the absorption of local labor including aquaculture input business (seeds, feed, aquaculture equipment), processing, marketing, packaging/transportation of lobsters and other supporting businesses. This business activity will absorb a large number of workers, so that the economic growth of the community will increase.

Moreover, over-reliance on the Chinese market is recognized as a threat for the sustainable development of this Lobster industry. Taiwan, China and Hongkong are the primary market for farmed tropical lobster. Farmed *P. ornatus* and *P. homarus* from Indonesia are nearly all sold to these markets as live lobster. This supply joins wild fishery product of the same species from Vietnam, Australia, India, the Philippines and other South-East Asian countries [15]. Many studies also mention that lobster aquaculture requires substantial capital inputs for the purchase of cages, seeds and feed [4, 16-19]. However, the respondents stated that due to the high risk, lobster farmers find it difficult to obtain loans from banks or credit institutions. They all agreed that limited access to credit is likely to be a barrier to the development of lobster aquaculture in the future.

Table 1. Analysis results of the strategic internal and external factors in lobster aquaculture development in East Lombok Regency

| Internal Factor | Strenght-S | Score | Weakness – W | Score |
|-----------------|------------|-------|--------------|-------|
| Suitable natural condition for lobster aquaculture | 0,117 | Unstable seeds | 0,257 |
| Availability of wild-caught seeds | 0,317 | Unstable and seasonal feed | 0,068 |
| Availability of trash fish feed | 0,075 | Recent frequent disease and increased mortality | 0,075 |
| Fish farmers who are open for technological innovation | 0,076 | Underdeveloped lobster aquaculture technology | 0,551 |
| **Sub Total** | **0,586** | **0,951** |

| External Factor | Opportunity – O | Score | Threat – T | Score |
|-----------------|-----------------|-------|------------|-------|
| Market potential is quite large | 0,243 | Decreasing quality of water resources | 0,114 |
| Demand is quite high and increasing | 0,242 | Rely on Chinese Market | 0,209 |
| Government support in policies and programs | 0,335 | Less accessible to credit | 0,095 |
| Absorption of labor for aquaculture | 0,138 | Space competition with tourism and fishing activities | 0,159 |
| **Sub Total** | **0,958** | **0,578** |
3.2. Internal and external factor analysis for lobster aquaculture development in East Lombok Regency

Based on the identification of the strategic internal factors, then an assessment of the weight, rating, and score of each identified element in the strength component (S) and the weakness component (W) is 0.586 and 0.951, respectively; or aggregate of the strategic internal factors is 1.537 as shown in Table 1.

The availability of wild-caught seeds is the greatest strength that owns to support the development of lobster aquaculture. Meanwhile, underdeveloped lobster aquaculture technology is a significant weakness that must be follow up immediately so that lobster development can develop rapidly. The opportunity factor is factors from an outside entity that will affect lobster aquaculture development in East Lombok. This opportunity should utilize optimally to support the success of the lobster aquaculture business in East Lombok Regency. The threat factor in this study is a condition originating from outside and can weaken the performance of lobster aquaculture development efforts in East Lombok. For strategic external factors as shown in Error! Reference source not found.1, it can be seen that the composite score for the opportunity component (O) is 0.958. and for threat component (T) is 0.578, or aggregate of strategic external factors is 1.536. Government support in policies and programs is the highest value for opportunity factor. This factor must be put to good use because it shows that both central and local governments have a strong commitment to developing lobster aquaculture.

3.3. Strategy for lobster aquaculture development in East Lombok Regency

Based on the results of the analysis of strategic internal factors (IFAS) and strategic external factors (EFAS), the strategy chosen is the WO strategy, this is because the score obtained is dominated by the component of weakness (W) and opportunity (O) factors. Thus it can be said that the strategy for developing lobster aquaculture in East Lombok is the WO Strategy. The map for determining this strategy can be seen in Figure 1. Strategic Map of lobster business development in East Lombok.

Thus, based on the formulation of strategies and calculations of IFAS and EFAS, the strategies that can be taken in developing lobster aquaculture in East Lombok are strategies that are dominated by weakness (W) and opportunity (O) factors, which are: (1) Encouraging integrated research activities related to lobster aquaculture in terms of biological, ecological, aquatic resources, processing, social and economic aspects; (2) Formulate sustainable wild-caught lobster seed resource management; (3) Increasing the amount of lobster aquaculture production by increasing the number of lobster farmers and lobster cage by considering the environmental carrying capacity and market absorption; and (4) Formulation of policies, programs and regulations in the development of sustainable and equitable lobster aquaculture.
4. Conclusion
The results by using SWOT analysis on internal and external factors in the development of lobster aquaculture show that the suitable natural conditions, the presence of government support are the main factor that supports the development of lobster culture. However, technological limitations and innovations regarding lobster aquaculture and the Chinese market's reliance are significant challenges that must resolve immediately. These factors should take into account in designing interventions and in policy-making. Several strategies for developing lobster aquaculture in East Lombok Regency which formulated from the results of this study are WO strategies. The findings of this study can be used by policymakers to develop the lobster aquaculture business further.

Acknowledgement
The author acknowledges the support of colleagues and associates of the Research Center for Marine and Fisheries Socio Economic (RCMFSE). This activity funded by RCMFSE budget year 2020. Thank you to the Head of RCMFSE, who provided support for this activity and the East Lombok Fisheries Extension in providing data, insights, and advice.

Reference
[1] Josupeit H, Wang W, and Dent F 2017 European price report (p 24) Rome - FAO
[2] Directorate General of Capture Fisheries, Ministry of Marine Affairs and Fisheries 2015 Statistik perikanan tangkap berdasarkan Wilayah Pengelolaan Perikanan Negara Republik Indonesia (WPP NRI) 2005-2014 Jakarta 966 hlm
[3] Badan Karantina dan Pengendalian Mutu Kelautan dan Perikanan 2015 Lalu Lintas Produk Perikanan http://www.bkipm.kkp.go.id
[4] Jones C M 2018 Progress and obstacles in establishing rock lobster aquaculture in Indonesia. Bulletin of Marine Science 94 :1223-33. https://doi.org/10.5343/bms.2017.1157
[5] Erlania, Radiarta I N, and Haryadi J 2016 Status Pengelolaan Sumberdaya Benih Lobster Untuk Mendukung Perikanan Budidaya: Studi Kasus Perairan Pulau Lombok Jurnal Kebijakan Perikanan Indonesia 8 : 85-96
[6] Oreski D 2012 Strategy development by using SWOT–AHP TEM J 1: 283–290 http://tem-journal.com/documents/vol1no4/pdf/Strategydevelopment_by_using_SWO-T-AHP.pdf
[7] Kurttila M, Pesonen M, Kangas J, and Kajanus M 2000 Utilizing the analytic hierarchy process (AHP) in SWOT analysis — a hybrid method and its application to a forestcertification case Pol. Econ. 1 : 41–52, https://doi.org/10.1016/S1389-9341(99)00004-0.
[8] Priyambodo B 2015 Development of the lobster farming industry in Indonesia. ACIAR Proceedings : Spiny lobster aquaculture development in Indonesia, Vietnam and Australia. 114-118p.
[9] Priyambodo B 2015 Building Indonesia’s lobster farming industry ACIAR Proceedings : Spiny lobster aquaculture development in Indonesia, Vietnam and Australia. 145-147p.
[10] Pereira G and Josupeit H 2017 The World Lobster Market, FAO, Rome, Italy http ://www.fao.org/3/a-i6816e.pdf.
[11] Giap V N, Terrill R H, and Curtis M J 2013 A demand analysis for crustaceans at the U.S. Retail store level, Aquacult. Econ. Manag. 17 (2013) : 212–227, https://doi.org/10.1080/13657305.2013.812157.
[12] Kadafi M, Widaningroem R, and Soeparno 2006 Aspek biologi dan potensi lestari di perairan pantai Kecamatan Ayah Kabupaten Kebumen Jurnal Perikanan 8 : 108-117. https://doi.org/10.22146/jfs.171
[13] Phillips B F 2013 Lobsters: biology, management, aquaculture and fisheries Second Edition Oxford: Wiley- Blackwell 474 p
[14] Hart G 2009 Assessing the South-East Asian tropical lobster supply and major market demands ACIAR Final Report (FR-2009-06). Australian Centre for International Agricultural Research, Canberra.
[15] Jones C M 2015 *Market perspective on farmed tropical spiny lobster* Chapter 5.9. In: Jones CM, editor. Spiny lobster aquaculture development in Indonesia, Vietnam and Australia. *Proceedings of the International Lobster Aquaculture Symposium* held in Lombok, Indonesia, 22–25 April, 2014 Australian Centre for International Agricultural Research, Canberra, Australia. p 142–144

[16] Alit A, Aslianti T, and Slamet B 2006 Preliminary economic analysis of spiny lobster, Panulirus homarus culture in floating net cage in Ekas Bay East Lombok *Indonesian Aquaculture Journal* 1 : 67-70

[17] Rogers P P, Barnard R, and Johnston M 2010 Loster aquaculture a commercial reality : A review *J. Mar. Biol. Ass. India* 52 : 327 – 335

[18] Jones C M 2010 Tropical spiny lobster aquaculture development in Vietnam, Indonesia and Australia *J. Mar. Biol. Ass. India*, 52 : 304 – 315

[19] Jeffs A, and Hooker 2007 Economic feasibility of Aquaculture of Spiny lobster Jasus edwardsii in temperate waters *Journal of the World Aquaculture Society* 31 https://doi.org/10.1111/j.1749-7345.2000.tb00695.x