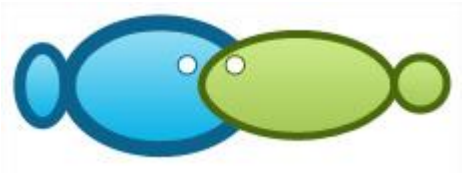

Development strategy of tiger shrimp (*Penaeus monodon*) cultivation in traditional ponds in East Aceh District, Aceh Province, Indonesia

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Abstract. East Aceh is known as the producer of the best quality of tiger prawn (*Penaeus monodon*) broodstock in Indonesia. However, based on data from the Fish Resources Recovery Research Center in 2016, the availability of broodstock in East Aceh has decreased by 10-13% due to several factors such as the use of non environmentally friendly fishing gear, reduced area of mangrove habitat, and decreased quality of coastal waters which produce low quality seeds and increasing disease outbreaks in tiger prawn cultivation. This research was conducted using a survey method for data collection and using SWOT analysis to obtain a development strategy for tiger prawn cultivation in traditional ponds in East Aceh. The results of the SWOT analysis resulted 16 strategies that can be used for the development of tiger prawn cultivation in traditional ponds in East Aceh.
Key Words: SWOT, decision making, internal factors, external factors.

Introduction. East Aceh District is one of the regions in Aceh Province that has high aquaculture production. East Aceh has a brackish water pond area of 17,942.5 hectares and is capable of producing 25.3% of the total fisheries production of Aceh Province (BPS Aceh 2016). The vast area of ponds in East Aceh has generated aquaculture activities, especially the cultivation of tiger prawns (*Penaeus monodon*) in traditional ponds, as the main livelihood of many.

Tiger shrimp (*Penaeus monodon*) is a fishery commodity that has a high economic value because it is very popular with local consumers and even foreign consumers. This is due to the delicious and tasty taste of tiger prawns and their high nutritional content. According to Amri (2003) and Mahmud et al (2009), the fat content of tiger prawns is 1.0 - 1.1 grams in 100 grams of meat, cholesterol levels is 125 mg for 100 grams of meat eaten, high protein content is 90%, and has a complete amino acid content for both essential and nonessential amino acids.

Farmers in East Aceh Regency have complained of several problems that have caused failure in tiger prawn farming. The failure is usually caused by lack of capital, availability of food, diseases (viruses and bacteria), and water quality. Therefore, a research is important to investigate the strengths, weaknesses, opportunities and threats (SWOT) for tiger prawn cultivation in traditional ponds in East Aceh District, Indonesia. Based on the SWOT analysis, an alternative strategy will be provided for the development of tiger prawn cultivation.

Material and Method

Description of research location and data collection. This research was conducted in East Aceh District, Aceh Province, Indonesia from February to March 2019. Data collection in this study was carried out through depth interviews with 25 respondents that are tiger shrimp cultivators and 5 respondents that are village officials. Each respondent was given a questionnaire containing 15 questions regarding the internal and external factors faced by shrimp farmers.

Data analysis. This study used a SWOT analysis (Strength, Weaknesses, Opportunities, Threats) to identify internal factors (weaknesses and strengths) and external factors (opportunities and threats) (Hidayat 2017) regarding tiger prawn cultivation in traditional ponds in East Aceh Regency. Several stages are carried out in the SWOT analysis, namely (Marimin 2004):

(1) Identification of internal and external factors
This stage is carried out to determine internal factors (strengths and weaknesses) as well as external factors (opportunities and threats) for the development of tiger prawn cultivation in increasing traditional pond harvest production in East Aceh District.

(2) Assessment of internal and external factors
This stage is carried out using an internal factor analysis summary (IFAS) matrix and an external factor analysis summary (EFAS) matrix. In both matrices, a rating and weighting assessment is used. Rating indicated the level of influence that can be provided by these factors. The rating value ranges from 1 to 4 . The value of the rating for strength and opportunity was described as the following: rating 1 means no effect, rating 2 means little influence, rating 3 means influential, and rating 4 means very influential. Meanwhile, the value rating for weaknesses and threats has the following order: 1 means very influential, rating 2 means influential, rating 3 means little influence, and rating 4 means no effect. Furthermore, the weight for each of the internal and external factors starts from 0.0 (not important) to 1.0 (very important). The weight indicates the level of importance of developing tiger prawn cultivation in increasing traditional pond harvest production in East Aceh District. An analysis of internal and external variables was carried out based on the criteria proposed by Umar (2001), to observe the position of East Aceh Regency in the competition. The criteria for the range of variable values were listed in Table 1.

Table 1

Internal and external variable analysis

Value	*Competitive position*
1.00 – 1.66	avoid
1.67 – 2.33	weak
2.34 – 3.00	tenable
3.01 – 3.67	favorable
3.68 – 4.34	strong
4.35 – 5.00	dominan

(3) Decision Making
Decision making is carried out using SWOT matrix (Kurohman et al 2020). The SWOT matrix is powerful tool in describing on how the strengths, weaknesses, opportunities, and threats faced by tiger prawn farming in increasing traditional pond harvest production in East Aceh District. The alternative strategies for S-O, S-T, W-O and W-T (Table 2) can be generated from this matrix.

Table 2

SWOT matrix diagram and possible suitable strategies

SW / OT	*Strengths (S)*	*Weaknesess (W)*
Opportunities (O)	Strategy SO Creating strategy by utilizing strengths to take advantage of opportunities.	Strategy WO Creating strategy by minimising weaknesses to take advantage of opportunities.
Threats (T)	Strategy ST Creating strategy by utilizing strength to overcome threats.	Strategy WT Creating strategy by minimising weaknesses and avoid threats.

Results. The tiger prawn cultivation is the main source of livelihood for fishpond farmers in East Aceh. The rearing processes are carried out traditionally with several characteristics: utilizing natural feed in the pond (without artificial feed), the shrimp were left alone until ready to be harvested and the pond used were directly from original land, the required production costs were not high with low yields and high mortality rate. Geographically, the location of the ponds in the East Aceh area was still very natural with many mangrove communities which may support the continuity of tiger prawn cultivation.

Internal and external factors. The identification results indicated that there are 10 internal and external factors for the development of tiger prawn cultivation in traditional ponds in East Aceh Regency. The main internal factors related with the strengths are: (1) sufficient availability of labor; (2) availability of adequate land; (3) availability of natural food in the ponds; (4) availability of electricity at the pond location; (5) strategic pond location. While the main weaknesses are: (1) lack of capital owned by the farmers; (2) lack of experience and skills; (3) low professionalism; (4) no cultivation group; and (5) low tiger shrimp production. Meanwhile, the main external factors that provide opportunities are: (1) broad market demand; (2) stable and competitive selling price of tiger prawns; (3) high number of capital providers from outside the village; (4) affordable means of transportation; (5) the water environment has not been polluted. Moreover, the external factors relater with the threats are: (1) uncertain climate/weather conditions; (2) there is no availability of certified fry; (3) the number of pest and disease outbreaks; (4) lack of local government support; (5) the absence of regulation of the water circulation system.

The results of internal factor assessment shows that the major influence on strength component for the development of tiger prawn cultivation in traditional ponds in East Aceh Regency is the availability of sufficient labor and the availability of natural food in the ponds with the each score of 0.52, and the major weakness is the low production of tiger prawns and the absence of cultivation groups with the each score of 0.16. The total weighting score of the strengths and weaknesses are 1.58 and 1.71. Furthermore, the total weighting score of the internal variables (strengths and weaknesses) is 3.29. Table 3 shows in detail the results of the internal factors assessment for the development of tiger prawn cultivation in traditional ponds in East Aceh District.

Table 3

Weights, ratings and scores of internal factors in the development of tiger prawn (*Penaeus monodon*) aquaculture in traditional ponds in East Aceh Regency

No.	*Internal factor (IFAS)*			
	Strengths	*Weight*	*Rating*	*Score*
1	Sufficient labor availability	0.13	4	0.52
2	Availability of adequate land	0.08	3	0.24
3	Availability of natural food in the pond	0.13	4	0.52
4	Availability of electricity at the pond location	0.03	2	0.06
5	Strategic location of the pond	0.08	3	0.24
	Strength total score			1.58
	Weaknesses	*Weight*	*Rating*	*Score*
1	Lack of capital owned by pond farmers	0.13	1	0.13
2	Low experience and skills of aquaculture farmers	0.13	1	0.13
3	Low human resource professionalism	0.13	1	0.13
4	No availability of cultivation group	0.08	2	0.16
5	Low production of tiger prawns	0.08	2	0.16
	Weakness total score	1.00		1.71
	Total internal factor (Strength-Weakness)			3.29

The external factors assessment shows that the major opportunity in determining the development of tiger prawn cultivation in traditional ponds in East Aceh Regency is a wide market demand, stable and competitive selling price of tiger prawns, affordable means of transportation, with each with a score of 0.52. Furthermore, the major threat is erratic climate/weather conditions and the absence of regulation of water recirculation system with each having a score of 0.16. The total weighted score of the opportunity is 2.04 and the threat is 0.67. Moreover, the total sum of the two (opportunities and threats) is 2.71. Table 4 shows the results of the assessment of external factors for the development of tiger shrimp culture in traditional ponds in East Aceh District.

Table 4

Weights, ratings and scores of external factors on the development of tiger prawn (*Penaeus monodon*) in Traditional Tambak Farms, East Aceh Regency

No.	*External factors (EFAS)*			
	Opportunities	*Weight*	*Rating*	*Score*
1	Wide market demand	0.13	4	0.52
2	The selling price of tiger prawns is stable and competitive	0.13	4	0.52
3	The large number of farmers from outside the village who are interested in becoming a provider of capital	0.08	3	0.24
4	Affordable means of transportation	0.13	4	0.52
5	The water environment has not been polluted	0.08	3	0.24
	Opportunities total score			2.04
	Threats	*Weight*	*Rating*	*Score*
1	Uncertain climate / weather conditions	0.08	2	0.16
2	No availability of certified fry	0.13	1	0.13
3	The number of pest and disease outbreaks	0.13	1	0.13
4	Lack of local government support	0.03	3	0.09
5	No regulation of the water recirculation system	0.08	2	0.16
	Threats total score	1.00		0.67
	Total of external factors (Opportunities-Threats)			2.71

Decision-making. The SWOT matrix is used for decision making through the formulation and determination of alternative strategies for the development of tiger prawn cultivation in traditional ponds in East Aceh District as indicated in Table 5. Furthermore, the strategic alternative priorities in the development of tiger prawn cultivation in traditional ponds in East Aceh Regency are determined by adding up the scores of the SO, ST, WO and WT strategies. It can clearly be seen the strategic priorities based on the SWOT ranking according to the weighting assessment. The ranking of alternative strategies in the development of tiger prawn cultivation in traditional ponds can be seen in Table 6.

Table 5

Formulation of alternative strategies for the development of tiger prawn cultivation in traditional ponds in East Aceh Regency

SW / *OT*	Strengths (S): 1. Sufficient labor availability. 2. Availability of adequate land. 3. Availability of natural food in the Pond. 4. Availability of electricity at the location of the pond. 5. Strategic pond location.	Weaknesess (W): 1. Lack of capital owned by pond Farmers. 2. Low experience and skills of aquaculture farmers. 3. Low human resource professionalism. 4. No cultivation group. 5. Low production of tiger prawns.
Opportunities (O): 1. Broad market demand. 2. The selling price of tiger prawns is stable and competitive. 3. The large number of farmers from outside the village who are interested to provide capital. 4. Affordable means of transportation. 5. The water environment has not been polluted.	SO strategy: • Take advantage of the availability of human resources in tiger shrimp farming. • Utilizing the potential of land and existing facilities and infrastructure to reduce product competition. • Technology development for tiger shrimp farming. • Improve the quality of cultivated tiger prawns to meet the demand for shrimp in the local and international markets.	WO strategy: • Increase the competence of knowledge, skills and professionalism of pond farmers through training facilitated by the government. • Prepare human resources who are competent in national and global competition and ready to compete with other regions. • Increase the volume of tiger prawn production to meet the increasing demand for shrimp products. • Development of access to capital.
Threats (T): 1. Climate / weather conditions are uncertain. 2. No availability of certified fry. 3. The number of pest and disease outbreaks. 4. Lack of local government support. 5. The absence of regulating water recirculation system	ST strategy: • Improve pond management activities by taking into account environmental factors, biosecurity concepts, and Best Management Practices (BMP). • Collaborating with business partners and also the government to realize environmentally friendly and sustainable tiger prawns. • Adding other business partners related to cultivation activities and other sectors such as investors and stakeholders. • Specific training for handling disease outbreaks in ponds.	WT strategy: • There is a need for extension assistance for pond farmers. • Optimizing aquaculture environmental factors to reduce the threat of shrimp disease. • Improve pond management activities, especially the problem of waste management. • Creating agency / group for tiger prawn cultivation.

Table 6

The ranking of alternative strategies for the development of tiger prawn cultivation in East Aceh District

Alternative strategy	*Value*	*Total score*	*Rangking*
ST (Strengths-Threats)	1.58 + 0.67	2.25	4
SO (Strentghs-Opportunities)	1.58 + 2.04	3.62	2
WT (Weakness-Threats)	1.71 + 0.67	2.38	3
WO (Weakness-Opportunities)	1.71 + 2.04	3.75	1

After obtaining alternative rankings, the quadrant strategy for developing tiger prawn cultivation in traditional ponds in East Aceh Regency is located in Quadrant III (WO) with a total score of internal factors ((total score of strength (1.58) - total score of weakness (1.71)) = -0.13 and the total score of external factors ((total opportunity score (2.04) - total threat score (0.67)) = 1.37 (Figure 1). This indicates that traditional shrimp farming in East Aceh District have various weaknesses and opportunities.The strategy adopted is to create a strategy that minimizes weaknesses and to take advantage of the opportunities that exist in carrying out tiger prawn cultivation.

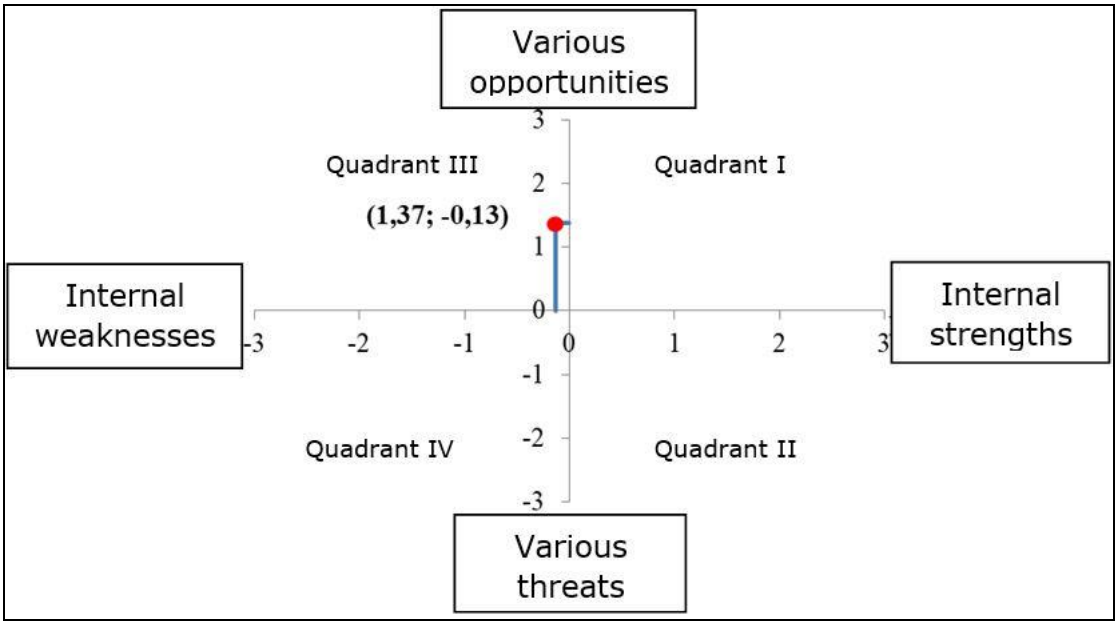

Figure 1. Quadrant strategy for the development of tiger prawn cultivation in East Aceh District.

Discussion. Tiger prawns are one of three types of shrimp that has economic value in Indonesia (Syahfdi et al 2010; Arief et al 2015), which are commonly meant for export. The tiger prawn cultivation (*Penaeus monodon*) became a massive activity carried out by shrimp cultivators in Indonesia, including in East Aceh District, Aceh Province. The cultivation of tiger prawns in East Aceh Regency is carried out in traditional ponds because the level of maintenance is easier so that the risk of shrimp getting disease is quite small.

Tiger prawn cultivation activities in East Aceh Regency have a strategic pond location, sufficient availability of labor, adequate pond land, natural food in the ponds, and electricity in the pond locations. These five things are important in the development of tiger prawn cultivation. Geographically, East Aceh District is located in a coastal area that is directly connected to the ocean, so it is very helpful in the recirculation of water in and out of the pond area. Sufficient manpower is important because all activities will be carried out by this workforce. The tiger prawn cultivation activities that are generally carried out by workers are land preparation, fertilization, irrigation, seed distribution, feeding, and harvesting (Salsabila et al 2019). Meanwhile, pond land is a factor that determines the potential development of tiger prawn cultivation. Both large ponds and land quality have good potential for the development of tiger prawn cultivation. Another advantage possessed by tiger prawn cultivators in East Aceh Regency is the availability of natural feed in traditional ponds, thus helping farmers to minimize capital for purchasing commercial feed. The availability of electricity in the ponds in East Aceh Regency helps the process of tiger prawn cultivation, such as driving waterwheels as oxygen supply, lighting, and supplying fresh water.

In order to develop tiger prawn cultivation in East Aceh District, it is necessary to identify its weaknesses to be identified and evaluated for the development of tiger prawn cultivation. Some of the weaknesses that have been identified in tiger prawn cultivation activities in East Aceh Regency are lack capital accessibility, low experience and skills of

cultivators, low professionalism, no cultivation group, and low production of tiger prawns. The lack of capital in tiger shrimp farming is often a complaint of tiger prawn cultivators (Ismail et al 2014; Febri et al 2017). One of the consequences is minimum supporting technology for tiger prawn cultivation, such as waterwheels, water quality tools (dissolved oxygen, pH meter, refractometer, and thermometer). Apart from capital, experiences and skills of cultivators also have an important role in the success of tiger prawn cultivation as it can help solve a problem faced in the cultivation process, such as water quality, disease, applying fertilizers, administering toxins, providing superior shrimp seeds and others. In addition, the low professionalism has an effect of low training and counseling activities provided by the Local Government for cultivators as well as no cultivation group has been formed, which creates another weakness. With this, there is no collaboration between cultivators, and it affects the assistance that can be obtained by cultivators, whether in the form of seeds or feed that has been provided by the government for cultivation groups. Another weakness is that the cultivation of tiger prawns that has occurred so far is still in low category because of the frequent infections caused by the lack of good water quality control in the aquaculture pond.

Opportunities and threats in tiger prawn farming activities also need to be considered in developing tiger prawn cultivation in East Aceh Regency. Opportunities that can be exploited are broad market demand (Mufa'ah & Hayati 2016) and stable and competitive selling prices. Both have an impact on the large number of farmers from outside the village who are interested in becoming capital providers in shrimp cultivation in East Aceh Regency. In addition, affordable means of transportation provide an opportunity for marketing/sale of tiger prawns outside the district of East Aceh. Another opportunity is that the aquatic environment in the pond location is classified as not polluted because the water environment is far from the urban center, low household waste and absence of industry factory so that it is very supportive for tiger prawn cultivation. The condition of the waters is very different from the waters in Langsa City even though it is directly adjacent to the East Aceh district. The waters of Langsa City, especially on the coast, have started to become polluted with a large amount of domestic waste disposal such as plastics, detergents and others originating from fishermen's households which have an impact on marine pollution (Febri 2017).

The threats that need to be considered in developing tiger prawn cultivation in East Aceh Regency are unpredictable weather, availability of uncertified fry, the presence of disease outbreaks, low local government support, and the absence of regulating water recirculation. It is known that weather conditions greatly affect the success of cultivation whereby the rainy season can increase the PH water and decrease the DO. Furthermore, sudden weather changes can cause increased stress on tiger prawns which can cause mass death. As such, an intervention is required to neutralize the PH and DO of the water. Apart from the weather, pond farmers complain about the lack or even the absence of certified fry that are free from disease, since this is the current problem in tiger prawn cultivation, especially those caused by viruses such as White Feces Disease and White Spot Syndrome Virus (Taslihan 2017). The low level of support from the local government is a threat because the activeness of the related agencies in conducting training/coaching affects the quality of the human resources of the pond farmers so that it greatly affects the production of tiger shrimp. In addition, the existence of fisheries groups that are still not yet formed causes a lack of assistance provided by the government since the government prioritizes assistance for aquaculture groups over individual businesses. If further identified, it is known that the quality of human resources is still low and the lack of support from the government, both in the form of assistance and counseling, causes cultivation farmers to not understand the importance of management of water recirculation systems in and out of water such as reservoirs to minimize the spread and occurrence of disease.

Several internal factors (strengths and weaknesses) and external factors (opportunities and threats) described above have calculated values in the IFAS matrix (Table 3) and the EFAS matrix (Table 4). The IFAS matrix value in this study is 3.29, which means that the position of East Aceh Regency in the competition is in a favorable position (Umar 2001). Safe position means that East Aceh Regency is still in a good

condition in carrying out tiger prawn cultivation activities. This is because other competitors are also in the same condition, namely in a condition of decreased shrimp production caused by disease factors such as white defecation. This position must be addressed wisely, because at any time conditions can change. Therefore, tiger shrimp cultivators in East Aceh District must immediately improve their cultivation system, especially pond management and shrimp production.

Meanwhile, the EFAS value in this study is 2.71 which means that the position of East Aceh Regency is in a tenable business. This indicate that the level of threat caused by external factors is still low, and has a high opportunity for the development of tiger prawn cultivation in East Aceh Regency. This outcome is in accordance with research conducted by Faisal et al (2017) regarding the quality of waters in Alue Kumba Village, East Aceh Regency, where the quality of the waters is still good for cultivation, especially shrimp and milkfish (*Chanos chanos*) commodities. However, even though the level of competition is in a safe position, cultivators must be able to anticipate the threats that exist as early as possible, especially related to diseases, as well as erratic climate/weather. Given the fact that many diseases in adult shrimp are caused by bacteria (Rungrassamee et al 2014). In addition, the erratic climate can cause the quality of pond waters to also be disturbed, such as low oxygen and water temperature which can experience stress to death (Duan et al 2015). This existing threat can be minimized by utilizing the existing strengths and opportunities for the realization of the development of tiger prawn cultivation in traditional ponds in East Aceh Regency, such as by providing probiotics as antibodies to shrimp so that they are not susceptible to disease (Verschuere et al 2000).

The quadrant strategy analysis for the development of tiger prawn cultivation in East Aceh Regency indicated that the appropriate strategy is to minimize weaknesses in order to take advantage of the opportunities in carrying out tiger prawn cultivation (Figure 1). Therefore, the most relevant alternative strategy (from 16 items in SWOT strategy) to be considered is the WO strategy. As has been discussed that low human resources in tiger prawn farming in East Aceh Regency are caused by a lack of skills and professionalism, so there is a need for efforts to improve human resource competence through training facilitated by the government. Increased competence is useful in competing regionally and nationally as well as being ready to compete with other nations. Finally, tighter competition can provide motivation to increase the volume of tiger prawn production to meet market needs. These conditions will provide opportunities for tiger shrimp cultivators in East Aceh Regency to gain access to capital.

Conclusions. There are 16 strategies for the development of tiger prawn cultivation in traditional ponds in East Aceh Regency based on the SWOT analysis, namely: 1) utilizing the availability of human resources in tiger prawn cultivation; 2) utilize the potential of land and existing facilities and infrastructure to reduce product competition; 3) developing technology for tiger prawn cultivation; 4) improving the quality of cultivated tiger prawns to meet the demand for shrimp in local and export markets; 5) increasing the competence of knowledge, skills and professionalism of pond farmers through training facilitated by the government; 6) prepare human resources who are competent in regional and national competition and ready to compete with other countries; 7) increasing the volume of tiger prawn production to meet the high demand for shrimp products; 8) development of access to capital; 9) improving pond management activities by taking into account the environmental factors, biosecurity concepts, Best Management Practices (BMP); 10) collaborating with business partners and also the government to realize environmentally friendly and sustainable tiger shrimp cultivation; 11) adding other business partners related to cultivation activities and other sectors such as investors and stakeholders; 12) training for handling disease outbreaks in the ponds; 13) extension assistance for pond farmers; 14) optimizing aquaculture environmental factors to reduce the threat of shrimp disease; 15) improve pond management activities, especially the problem of waste management; 16) establish an agency/group for tiger prawn cultivation.

Conflict of Interest. The authors declare that there is no conflict of interest.

References

Amri K., Khairuman, 2003 [Making consumption fish feed]. Agromedia Pustaka, Tanggerang, 45 pp [in Indonesian].

Arief M., Mahasri G., Mukti A. T., 2015 To increases the shrimp harvesting in traditional shrimp farmer in Permisan Village, Jabon District, Sidoarjo Region that losted harvesting for a long time by using best management practise (BMP) methode. Jurnal Ilmiah Perikanan dan Kelautan 7(1):17-23.

Badan Pusat Statistik (BPS) Aceh, 2016 Aceh in numbers. Badan Pusat Statistik (BPS) Provinsi Aceh.

Duan Y., Zhang J., Dong H., Wang Y., Liu Q., Li H., 2015 Oxidative stress response of the black tiger shrimp *Penaeus monodon* to *Vibrio parahaemolyticus* challenge. Journal Fish & Shellfish Immunology, 46:354-365.

Faisal T. M., Putriningtias A., Kusnafizal T., 2017 [Analysis of the feasibility of brackish water cultivation based on analysis of water quality in the management of the Alue-Kumba Coastal Area, East Aceh Regency]. Jurnal Samudra Akuatika, 1(2):1-10 [in Indonesian].

Febri S. P., Wiyono E. S., Wisudo S. H., Haluan J., Iskandar B. H., 2017 The role of women in small-scale fisheries of Langsa City, Aceh, Indonesia. Journal ACCL Bioflux, 10(2):402-409.

Febri S. P., 2017 Analysis of community awareness in Kuala Langsa Fishing Settlements on the impact of domestic waste disposal in coastal and marine waters. Jurnal Ilmiah Samudra Akuatika, 1(1):39-44.

Hidayat A. S., 2017 Problem analysis and development strategy of shrimp culture in Tanah Laut Regency, South Kalimantan Province, Indonesia. Journal AACL Bioflux 10(4):850-860.

Ismail S. A., Yantu M. R., Dafina H., 2014 Development of business strategies of shrimp ponds on Pogoyuman Farmer Group at Kantanan Village, Bokat District, Buol Regency. Agrotekbis 2(5):548-556.

Kurohman F., Wijayanto D., Jayanto B. B., 2020 The strategy of capture fisheries development in Pamekasan Regency, Madura Island. Journal AACL Bioflux 13(5): 2816-2827.

Mahmud M. K., Hermana, Zulfianto N. A., Apriyantono R., Ngadiarti I., Hartati B., Bernadus, Tinexcelly, 2009 [Indonesian food composition table]. PT. Elex Media Komputindo Kompas Gramedia, Jakarta, Indonesia [in Indonesian].

Marimin, 2004 Multiple criteria decision making techniques and applications. Grasindo, Jakarta, Indonesia.

Mufa'ah, Hayati M., 2016 [Analysis of export competitiveness of Indonesian shrimp commodities]. Agrifo 1(1):1-20 [in Indonesian].

Rungrassamee W., Klanchui A., Maibunkaew S., Chaiyapechara S., Jiravanichpaisa P., Karoonuthaisiri N., 2014 Characterization of intestinal bacteria in wild and domesticated adult black tiger shrimp (*Penaeus monodon*). Journal PLoS ONE 9(3):1-11.

Salsabila, Zulkarnain, Indra, 2019 [Production and revenue analysis of windu shrimp tambak in Kecamatan Jaya, Aceh Jaya District]. Jurnal Ilmiah Mahasiswa Pertanian 4(1):474-485 [in Indonesian].

Syahfdi O. F., Siregar M. A., Hamid A., 2010 [Demand analysis of export market for Indonesian frozen shrimp products]. Jurnal Perikanan Kelautan 7(2):128-139 [in Indonesian].

Taslihan A., 2017 [Technical guidelines for control of white feces disease (WFD) in vanname shrimp in ponds]. Jepara Center for Brackish Water Aquaculture Fisheries (BBPBAP Jepara). Ministry Of Marine Affairs And Fisheries Republic Of Indonesia [in Indonesian].

Umar H., 2001 [Strategic management in action]. Gramedia Pustaka, Jakarta, Indonesia [in Indonesian].

Verschuere L., Rombaut G., Sorgeloos P., Verstraete W., 2000 Probiotic bacteria as biological control agents in aquaculture. Journal Microbiolgical and Molecular Biology 64:655-671.

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