UNIVERSITI PUTRA MALAYSIA

PERCEIVED IMPACT ON COASTAL RECLAMATION ACTIVITIES IN A FISHING COMMUNITY IN JOHOR, MALAYSIA

NORA AZURA JUMAIN

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PERCEIVED IMPACT ON COASTAL RECLAMATION ACTIVITIES IN A FISHING COMMUNITY IN JOHOR, MALAYSIA

By

NORA AZURA JUMAIN

Thesis submitted to School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

December 2018

DEDICATION

This is for you

Mom, Dad

Siblings

Amir Azrizal

Amir Haiqal

Abstract of this thesis presented to the senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

PERCEIVED IMPACT ON COASTAL RECLAMATION ACTIVITIES IN A FISHING COMMUNITY IN JOHOR, MALAYSIA

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Chairmen : Assoc. Prof. Nitty Hirawaty Kamarulzaman, PhD
Faculty : Agriculture

Fisheries community is the community that highly depends on the fisheries sector and they usually live near the coastal area. This is because the coastal area has natural ecosystem that is vital for the productivity of fisheries such as seagrass beds and mangrove. However, reclamation activities are conducted at the coastal area for the sake of development and urbanization due to the increasing population. Consequently, the reclamation activities had degraded the habitat of the fishes and cause the decreasing in the productivity of fishes.

Thus, the specific objectives of this study were to examine the differences between fishing operations, fish catch and income of fishermen before and after reclamation; to determine the perception of fishermen towards reclamation activities; to explore the most influential factors that influence the fish catch of fishermen and to determine the relationship between the number of crew, fish catch and income of fishermen.

A total of 79 fishermen that catch fish near the Merambong Shoal were selected as respondents whereby a structured questionnaire was constructed to conduct the study. The Paired Sample t-test result showed that there was a difference in mean between fishing operations, fish catch and income before and after reclamation. The mean of fish catch before reclamation activity started was 23.6 kg whereas the mean of fish catch decreased to 12.9 kg after the reclamation activity started. This showed that the fish catch of fishermen had decreased as an impact of reclamation activities. The mean ranking analysis results showed that fishermen had a negative perception towards the reclamation activities that was conducted at the coastal area.

The multiple regression analysis revealed that the number of trips, duration of fishermen to catch fish, distance of fishing ground from the coast, number of crew and government incentives were the factors that affected the fish catch. Meanwhile, number of crew became the most influential factor that affected the quantity of fish catch. These independent variables have significant relationships with the quantity of fish catch which directly impacted the income and at the same time affected the livelihoods.

Pearson correlation analysis was conducted to determine the strength of relationship between the fish catch, income, and number of crew. The results showed that these three variables have a positive significant relationship with each other. There was a weak relationship between fish catch and income while the relationship between number of crew and income showed a medium relationship. This indicated that the quantity of fish catch and number of crew in a vessel affected the income of the fishermen. With regard to the findings, the role of government in improving the fish catch of fishermen was highly recommended. It is recommended that the government should increase the monetary incentives and subsidies to improve the fishing operations of the fishermen.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

TANGGAPAN KESAN AKTIVITI PENAMBAKAN PANTAI TERHADAP MASYARAKAT NELAYAN DI JOHOR, MALAYSIA

Oleh

NORA AZURA JUMAIN

Disember 2018

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Komuniti nelayan adalah komuniti yang sangat bergantung kepada sektor perikanan dan tinggal berhampiran dengan kawasan pantai. Hal ini kerana kawasan pantai mempunyai ekosistem semulajadi yang sangat penting untuk produktiviti perikanan seperti rumput laut dan pokok paya bakau. Walau bagaimanapun, aktiviti penambakan telah dilakukan di kawasan pantai dengan tujuan pembangunan dan pembandaran. Aktiviti penambakan ini telah menyebabkan habitat ikan musnah dan mengurangkan produktiviti pembiakan ikan.

Oleh yang demikian, objektif spesifik bagi kajian ini adalah untuk menyelidik sekiranya terdapat perbezaan antara operasi penangkapan ikan, hasil tangkapan ikan dan pendapatan nelayan sebelum dan selepas penambakan; untuk mengetahui persepsi nelayan terhadap aktiviti penambakan; untuk mengenal pasti faktor yang paling mempengaruhi penangkapan ikan oleh nelayan dan untuk menentukan hubungan antara bilangan awak-awak, tangkapan ikan dan pendapatan nelayan.

Sejumlah 79 orang nelayan yang menangkap ikan berhampiran Beting Merambong dipilih untuk menjadi responden dan soal selidik berstruktur dibentuk dan digunakan dalam kajian ini. Hasil dapatan daripada analisis ujian T berpasangan (*Paired sample t-Test*) menunjukkan terdapat perbezaan antara aktiviti penangkapan ikan, hasil tangkapan ikan dan pendapatan sebelum dan selepas penambakan. Sebelum aktiviti penambakan dilakukan, purata hasil ikan yang ditangkap berjumlah 23.6 kg dan tangkapan ikan tersebut berkurang kepada 12.9 kg selepas aktiviti penambakan berlaku. Hal ini menunjukkan bahawa hasil tangkapan ikan nelayan berkurang kesan daripada aktiviti penambakan. Analisis purata kedudukan (*mean ranking analysis*) menunjukkan nelayan berpandangan negatif terhadap aktiviti penambakan yang dilakukan di kawasan pantai.

Dapatan kajian daripada analisis regresi berganda (*multiple regression analysis)* memperlihatkan bilangan trip, tempoh masa nelayan untuk menangkap ikan, jarak kawasan tangkapan dari pantai, bilangan awak-awak dan bantuan dari kerajaan adalah faktor yang mempengaruhi penangkapan ikan. Sementara itu, bilangan awak-awak adalah faktor yang sangat mempengaruhi bilangan tangkapan ikan. Pemboleh ubah bebas ini mempunyai hubungan yang signifikan dengan bilangan hasil ikan yang ditangkap seterusnya memberi kesan kepada pendapatan dan kehidupan nelayan.

Analisis korelasi Pearson dilakukan untuk menentukan kekuatan hubungan antara hasil tangkapan ikan, pendapatan dan bilangan awak-awak. Hasil daripada analisis ini menunjukkan ketiga-tiga pembolehubah mempunyai hubungan yang positif antara satu sama lain. Kekuatan hubungan korelasi antara hasil tangkapan ikan dan pendapatan adalah lemah manakala, kekuatan hubungan korelasi antara bilangan awak-awak dan pendapatan adalah sederhana. Hal ini menunjukkan bilangan tangkapan ikan dan bilangan awak-awak mempengaruhi pendapatan nelayan. Oleh yang demikian, peranan kerajaan dalam meningkatkan hasil tangkapan ikan nelayan sangat digalakkan. Kerajaan disyorkan untuk meningkatkan insentif berbentuk wang ringgit dan subsidi bagi memperbaiki aktiviti penangkapan ikan oleh nelayan.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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This is to confirm that:

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LIST OF ABBREVIATIONS

CGPV	Country Gardens Pacific View Sdn Bhd
DEIA	Detailed Environment Impact Assessment
DID	Department of Irrigation and Drainage
DOE	Department of Environment
DOF	Department of Fisheries Malaysia
DOSM	Department of Statistics Malaysia
EFA	Exploratory Factor Analysis
EIA	Environment Impact Assessment
FDA	Fisheries Development Authority Malaysia
FDAM	Fisheries Development Authority of Malaysia
GDP	Gross Domestic Product
GRT	Gross Registered Tonage
JPBD	Federal Department of Town and Country Planning Peninsular
KMO	Kaiser-Meyer-Olkin
LKIM	Lembaga Kemajuan Ikan Malaysia
MAB	Multi-agency Brief
MOA	Ministry of Agriculture and Agro-based Industry
NCZPP	National Coastal Zone Physical Plan
NEKMAT	Persatuan Nelayan Kebangsaan
NGO	Non-governmental Organization
nmi	Nautical miles
NPP	Malaysian National Physical Plan
PCA	Principal Component Analysis
PNK	Fishermen Association
PTP	Port Tanjung Pelepas

CHAPTER 1

INTRODUCTION

The discussion in this chapter covers introduction on fisheries sector in Malaysia, coastal reclamation activities, problem statement, research questions and objectives of the study. Fisheries industry, reclamation activities and the issues related to reclamation activities are discussed in the introduction section. The problem that occurred in the reclamation activities is explained in the problem statement. The research questions become the guideline for developing the objectives of the study. The significance of the study is discussed to express the impact of the study to the respective parties.

1.1 Overview of Fisheries Sector in Malaysia

Agriculture is an important sector in Malaysia, contributing 8.1% to Malaysian Gross Domestic Product (GDP) in 2016 and providing about 444,531 job opportunities to the citizen (Department of Statistics Malaysia [DOSM], 2017). Fishing sector is one of the major contributors to the GDP of agriculture sector with 11.5%. Based on the data from the Ministry of Agriculture and Agro-based Industry (MOA, 2011), self-sufficiency level of food fish has achieved a surplus since 2010. Dulvy and Allison (2009) highlighted that at least 20% of the one third of the world's population protein intake derived from fish and other aquatic products. Moreover, about 17% of total global protein consumption in poor and undernourished countries are from aquaculture and wild fisheries (Garcia and Rosenberg, 2010). Furthermore, Prein and Ahmed (2000) revealed that 30% of animal protein consumed in Asia is from fish. The demand for food fish continues to increase due to the increasing number of populations. However, major challenges to face in the future include climate change, rising input prices, factors that can limit the production, trade liberalization and food stuff competition (Abu Dardak, 2015). The development of fishing industry in Malaysia followed closely the guidelines of national agriculture policies, with the latest being the National Agro-Food Policy 2011-2020 (Bakar *et al.*, 2012).

Table 1.1 demonstrates that the fisheries sector contributed RM13,108.78 million in 2015, which is a significant increase from previous years by RM418.64 million, consisting of food fish and non-food fish. The food fish sector comprises the marine capture fisheries and aquaculture sector while non-food fish comprises seaweed, ornamental fish and aquatic plants. The quantity of food fish had significantly dropped for three years consecutively from 1,775,126.32 tonnes in 2012 to 1,731,755.95 tonnes in 2015, but the quantity increased dramatically in 2016 to 1,775,845.11 tonnes. For the non-food fish sector, they contributed RM620.69 million in 2015, decreased RM17.39 million (0.14%) compared to 2014. The values increased in the following year in 2016 with a total value of RM846.58 million. According to the Department of Fisheries Malaysia (DOF, 2016), non-food fish production had been identified as high-value

products that can raise the national income. Non-food fish can be categorized into seaweeds, ornamental fish and aquatic plants.

Marine capture fisheries sub-sector including inshore and deep sea fisheries are still the major contributors of the fisheries sector producing 1,472,240 tonnes (82.9%) valued at RM7,981.66 million 2012. However, the quantity fluctuated from 2012 to 2015 but a total of 1,574,447.00 tonnes was produced in 2016. Despite the yearly fluctuation in quantity, the amount of total value for this subsector showed clear rising trends from RM7,981.66 million in 2012 to RM10,176.26 million in 2016. The production quantity when compared to 2015 had increased by 5.95% while the production value had increased by 9.16% in 2016. Inshore fisheries are the larger contributor towards the marine capture fisheries throughout the year since 2012 to 2016 compared to the deep sea fisheries. Inshore fisheries quantity slumped from 1,193,006 tonnes in 2014 to 1,1,48,729 tonnes in 2015 but then increased drastically to 1,195,360 tonnes in 2016. The aquaculture sub-sector in 2015 (excluding seaweed) recorded a decline in total contribution with 10.72% and 3.08% in terms of quantity and value, respectively. This sub-sector produced 245,704.95 tonnes at RM3,166.09 million in 2015.

Table 1.1: Production and Value of Fisheries in Malaysia (2012-2016)

Year		2012		2013		2014		2015		2016	
Fisheries sector		**Quantity (tonnes)**	**Value (RM mil)**	**Quantity (tonnes)**	**Value (RM mil)**	**Quantity (tonnes)**	**Value (RM mil)**	**Quantity (tonnes)**	**Value (RM mil)**	**Quantity (tonnes)**	**Value (RM mil)**
Food Fish	In shore	1,135,495	6,312.36	1,155,584	6,609.83	1,193,006	7,458.39	1,148,729	7,659.76	1,195,360	8,417.23
	Deep-sea	336,745	1,669.31	327,316	1,726.08	265,122	1,327.00	337,321	1,662.23	379,087	1,759.03
	Total Marine Capture Fisheries	**1,472,240.00**	**7,981.66**	**1,482,900.00**	**8,335.92**	**1,458,128.00**	**8,785.39**	**1,486,051.00**	**9,322.00**	**1,574,447.00**	**10,176.26**
	Fresh Water	163,756.81	992.39	132,892.42	880.45	106,731.41	749.96	112,145.15	788.86	103,348.21	1,091.46
	Brackishwater	139,129.51	1,566.78	127,881.42	1,538.83	168,450.68	2,516.71	133,559.80	2,377.23	98,049.90	2,334.62
	Total Aquaculture	**302,886.32**	**2,559.16**	**260,773.84**	**2,419.28**	**275,182.08**	**3,266.67**	**245,704.95**	**3,166.09**	**201,398.11**	**3,426.09**
	Total Food Fish	**1,775,126.32**	**10,540.82**	**1,743,673.84**	**10,755.20**	**1,733,310.08**	**12,052.06**	**1,731,755.95**	**12,488.09**	**1,775,845.11**	**13,602.35**
Non Food Fish	Seaweed	341,490.00	198.94	269,431.20	269.43	245,332.80	208.53	260,760.30	130.38	205,989.20	175.09
	Ornamental Fish	376,679,177*	631.51	346,592,173*	353.20	393,050,770*	352.66	383,689,326*	341.14	402,301,230*	456.41
	Aquatic Plants	114,453,668**	12.26	238,560,609**	25.29	306,539,337**	76.89	371,449,675**	149.17	339,519,589**	215.08
	Total non-food fish	**na**	**842.71**	**na**	**647.92**	**na**	**638.08**	**na**	**620.69**	**na**	**846.58**
	Grand Total	**na**	**11,383.53**	**na**	**11,403.12**	**na**	**12,690.14**	**na**	**13,108.78**	**na**	**14,448.93**

Note: *Quantity in pieces

**Quantity in bundles

Source: Department of Fisheries Malaysia (2017)

Table 1.2 shows the landing of capture fisheries by states in Malaysia from 2012 to 2016. As seen in Table 1.2, the highest quantity of fisheries landing came from Peninsular Malaysia followed by the East Malaysia which comprised Sabah, Sarawak and Federal Territory of Labuan. The total amount of fisheries landing (inshore and deep sea) declined from 1,482,900 tonnes in 2013 to 1,458,128 in 2014. Inshore fisheries showed the highest number of fish landing with an obvious rising trend from 1,135,495 tonnes in 2012 to 1,193,006 tonnes in 2014 but then declined drastically to 1,148,729 tonnes in 2015 and then rose to 1,195,360 tonnes in 2016. Inshore fishery is an important socioeconomic subsector and the vessel that took part in this subsector is normally less than 70 gross registered tonnage (GRT) operating within 30 nautical miles (nmi) from the coastline (Food and Agriculture Organization [FAO], 2001). West coast is the main contributor to the fisheries landing especially inshore fisheries and the total quantity of fisheries landing in west coast inshore had increased annually from 633,340 in 2012 to 721,534 in 2016. Unfortunately, several states in the west coast such as Pulau Pinang, Selangor and west Johor faced a slight slump in inshore fisheries landing in 2014.

Table 1.2: Landing of Capture Fisheries by States, 2012-2016 (tonnes)

Year	2012		2013		2014		2015		2016	
Zone	**Inshore**	**Deep-sea**	**Inshore**	**Deep-sea**	**Inshore**	**Deep-sea**	**Inshore**	**Deep-sea**	**Inshore**	**Deep-sea**
West Coast	**633,340**	**108,923**	**625,397**	**90,287**	**667,447**	**81,259**	**681,377**	**78,367**	**721,534**	**92,224**
Perlis	93,950	24,499	82,687	16,905	85,158	11,293	73,678	11,821	87,269	12,597
Kedah	93,238	5,956	105,138	7,739	152,174	3,936	154,361	2,740	159,467	4,411
Pulau Pinang	52,235	358	58,201	-	45,880	-	49,783	-	56,748	264
Perak	237,858	77,959	242,236	64,950	264,120	65,224	283,047	63,806	292,395	74,952
Selangor	120,632	151	104,867	693	91,632	805	90,026	-	93,460	-
Negeri Sembilan	573	-	568	-	806	-	704	-	717	-
Melaka	1,787	-	1,790	-	1,936	-	2,019	-	1,790	-
West Johor	33,067	-	29,911	-	25,742	-	27,759	-	29,687	-
East Coast	**214,500**	**146,547**	**206,335**	**131,361**	**181,383**	**130,377**	**165,880**	**218,898**	**195,391**	**240,023**
Kelantan	26,297	50,160	27,586	29,525	28,477	33,761	39,095	107,348	69,819	148,939
Terengganu	67,650	13,076	61,326	10,898	51,618	7,167	46,025	5,160	40,833	3,869
Pahang	60,458	51,628	61,159	46,189	45,267	45,879	49,134	62,403	62,471	57,947
East Johor	60,094	31,682	56,263	44,749	56,021	43,570	31,626	43,987	22,267	29,268
Peninsular Malaysia	**847,841**	**255,470**	**831,732**	**221,647**	**848,830**	**211,635**	**847,257**	**297,265**	**916,925**	**332,247**
EAST MALAYSIA	**287,654**	**81,275**	**323,852**	**105,669**	**344,176**	**53,487**	**301,472**	**40,057**	**278,435**	**46,840**
Sarawak	93,132	47,970	114,029	45,797	115,620	41,630	116,426	31,153	111,861	36,132
Sabah	169,821	8,242	187,107	9,414	205,686	8,990	167,870	7,573	150,314	9,459
Federal Territory of Labuan	24,701	25,062	22,716	50,457	22,871	2,867	17,176	1,331	16,260	1,249
Grand Total	**1,135,495**	**336,745**	**1,155,584**	**327,316**	**1,193,006**	**265,122**	**1,148,729**	**337,321**	**1,195,360**	**379,087**
	1,472,240		**1,482,900**		**1,458,128**		**1,486,051**		**1,574,447**	

Source: Department of Fisheries Malaysia (2017)

1.1.2 Fishermen in Malaysia

According to the DOSM (2017), population in Malaysia had slightly increased annually from 29,510,000 in 2012 to 32,022,600 in 2017. Less than 1% from the amount worked as fishermen. There are about 520 million people who are depending on fisheries and aquaculture in this world (FAO, 2009) and it provides 260 million jobs including 50 million fishermen and 210 million employed indirectly in fishing industry (Teh and Sumaila, 2013). Furthermore, De Graaf *et al.* (2011) claimed that small scale fishermen had ensured incomes for millions people worldwide. A report from SeaWeb (2005) confirmed that since 1950, the number of fishermen in the world has grown by 400% and majority of the growth contribution are from small scale fishermen. In the past, Ramli *et al*. (2013) and Shaffril *et al.* (2013) discovered that small scale fishermen comprised more than 65% of the overall fishing population. Usually they operate their fishing operations by using vessel not more than 40 GRT.

Besides, they used traditional fishing gear such as drift nets or gill nets, seine nets, bagnet, barrier nets, fishing rods and spent about five to nine hours for fishing trips. Mohd Arief and Bakeri (2002) revealed that fishermen tend to operate their fishing operations within 26 to 31 days per month. Petrol or diesel, and ice block are mainly included as operational cost for the fishermen whenever they travel to catch fish. More often than not, fishermen tend to sell their fish catch to middlemen, instead of selling it to the fishermen association. The income from fish catch activity is between RM500 to RM1,000 per month.

Table 1.3 shows the number of fishermen in Malaysia comprising of local and immigrants from Thailand, Vietnam and Indonesia. The number of fishermen had risen vertically from 136,514 in 2012 to 144,019 in 2013. Later, it decreased progressively to 143,421 in 2014, 140,149 in 2015 and 132,305 in 2016. Out of the total value, 84,342 fishermen come from Peninsular Malaysia while 47,963 fishermen come from Sabah, Sarawak and Federal Territory of Labuan. The number of fishermen that come from Peninsular Malaysia decreased by 10.57% whereas the fishermen that come from the Sabah, Sarawak and Federal Territory of Labuan increased slightly by 2.84% in 2016 when compared to 2015. In 2016, Bumiputeras including Malays and other indigenous groups made up more than half of the total number of fishermen (60.5%). The next outstanding group is the foreign fishermen (25.7%), followed by Chinese (12.8%) meanwhile Indians cover less than 1% of the fishing population.

Table 1.3: Number of Fishermen, 2012-2016

Year	Peninsular Malaysia			Sabah	Sarawak	F.T. Labuan	Subtotal	Total
	East Coast	West Coast	Subtotal					
2012	34,501	54,941	**89,442**	29,043	16,813	1,216	**47,072**	**136,514**
2013	36,175	60,978	**97,153**	29,440	16,210	1,216	**46,866**	**144,019**
2014	34,755	62,477	**97,232**	29,602	16,349	1,238	**47,189**	**143,421**
2015	36,149	58,160	**94,309**	29,739	15,666	1,235	**46,640**	**140,949**
2016	34,226	50,116	**84,342**	29,820	16,905	1,238	**47,963**	**132,305**

Note: F. T. = Federal Territory
Source: Department of Fisheries Malaysia (2017)

Greatest number of fishermen operates using gill nets, working using trawlers, utilizing hook-and lines and other traditional gears (bagnets, lift nets, seine nets, traps, barrier nets and scoop nets). Table 1.4 provides the number of licensed fishing gears in Malaysia. The most of licensed fishing gear came from gill nets followed by trawl nets and hooks and lines. West Coast of Peninsular Malaysia had licensed the highest number of gill nets with 19,020 in 2014 and the value decreased to 15,176 in 2016. Scoop net was the least licensed fishing gear, being used only in Sarawak. The use of lit nets fishing gear was being licensed in West Coast of Peninsular Malaysia only during the year 2016 with a total of 134. The number of all fishing gear licensed in West coasts decreased significantly each year.

Table 1.4: Number of Licensed Fishing Gears in Malaysia (2014-2016)

Gear Group	Year	Peninsular Malaysia			Sabah	Sarawak	F.T. Labuan	Grand Total
		East Coast	West Coast	Subtotal				
Trawl Nets	2014	1,092	2,944	**4,036**	1,515	512	2	**6,065**
	2015	1,118	2,892	**4,010**	1,515	505	2	**6,032**
	2016	1,040	2,861	**3,901**	1,515	503	2	**5,921**
Fish Purse Seines	2014	438	345	**783**	242	34	4	**1,063**
	2015	457	323	**780**	245	34	4	**1,063**
	2016	420	210	**630**	250	34	4	**918**
Anchovy Purse Seines	2014	48	71	**119**	23	-	-	**142**
	2015	36	71	**107**	23	-	-	**130**
	2016	37	59	**96**	27	-	-	**123**
Other Seines	2014	15	15	**30**	52	9	5	**96**
	2015	17	10	**27**	52	9	5	**93**
	2016	21	6	**27**	43	9	5	**84**
Gill nets	2014	4,446	19,020	**23,466**	8,255	6.099	155	**31,882**
	2015	4,545	17,962	**22,507**	8,373	6,059	176	**37,115**
	2016	4,404	15,176	**19,580**	8,445	6,167	155	**34,347**
Lit Nets	2014	53	-	**53**	391	-	-	**444**
	2015	41	-	**41**	394	1	-	**436**
	2016	32	134	**166**	396	1	-	**563**
Stationary Traps	2014	13	27	**40**	133	7	-	**180**
	2015	20	22	**42**	135	7	-	**184**
	2016	19	27	**46**	133	7	-	**186**
Portable Traps	2014	228	75	**303**	741	37	16	**1,097**
	2015	255	70	**325**	744	37	16	**1,122**
	2016	269	41	**310**	744	37	15	**1,106**
Hooks & Lines	2014	2,891	173	**3,064**	3,538	150	172	**6,924**
	2015	2,771	145	**2,916**	3,544	147	186	**6,793**
	2016	2,521	91	**2,612**	3,546	147	172	**6,477**
Bag Nets	2014	-	256	**256**	-	207	-	**463**
	2015	-	277	**277**	-	205	-	**482**
	2016	-	185	**185**	-	205	-	**390**
Barrier Nets	2014	-	9	**9**	5	153	-	**167**
	2015	-	4	**4**	5	158	-	**167**
	2016	-	5	**5**	5	158	-	**168**
Scoop Nets	2014	-	-	**0**	-	17	-	**17**
	2015	-	-	**0**	-	17	-	**17**
	2016	-	-	**0**	-	17	-	**17**
Crab traps	2014	-	274	**274**	650	-	-	**924**
	2015	-	274	**274**	-	-	-	**274**
	2016	-	83	**83**	659	-	-	**742**

Note: F. T. = Federal Territory

Source: Department of Fisheries Malaysia (2015-2017)

Table 1.5 shows the number of fishing vessels being licensed to fishermen. The license includes vessel that used inboard-powered, outboard-powered and non-powered vessels. Inboard-powered means that the motor is mounted inside the hull of the boat while the motor of outboard-powered is mounted outside the hull of the vessel. Inboard-powered is more powerful and usually is used to catch fish at deep sea area while non-powered vessel is used by fishermen that catch fish at inshore area. The total number of fishing vessels licensed (Peninsular Malaysia, Sabah, Sarawak and Federal Territory of Labuan) increased from 54,235 units in 2012 to 57,095 units in 2013. Then, this value plummeted from 57,927 units in 2014 to 53,190 units in 2016. The fishing vessels in Peninsular Malaysia contributed 57.35% of the total nation's fleets. The total increased slightly from 2012 to 2013 but soon declined from 34,078 units to 29,063 units in 2016. A total 23,975 units of licensed fishing vessels were recorded in 2015 from the state of Sabah, Sarawak and Federal Territory of Labuan, contributing 42.65% of the total nation's fleet in Malaysia. Sabah had the highest number of licensed fishing, increasing from 16,402 units in 2015 to 16,483 units in 2016.

Table 1.5: Number of Fishing Vessels Licensed (2012-2016)

Year	Peninsular Malaysia	Sabah	Sarawak	F.T. Labuan	Sub total	Total
2012	**31,597**	15,706	6,574	358	**22,638**	**54,235**
2013	**33,476**	16,103	7,157	359	**23,619**	**57,095**
2014	**34,078**	16,265	7,226	358	**23,849**	**57,927**
2015	**32,236**	16,402	7,180	393	**23,975**	**56,211**
2016	**29,063**	16,483	7,286	358	**24,127**	**53,190**

Note: F. T. = Federal Territory
Source: Department of Fisheries Malaysia (2017)

Based on DOF (2014), four fishing zones were established in Malaysia's fishing water. The zones are designated for specific fishing gear and vessel classes (Table 1.6). No restriction was imposed for fishermen in zone A to fish in other zone but it would be difficult and dangerous without proper gear.

Table 1.6: Malaysia's Fishing Water Zone

Zone	Explanation
A	Situated at less than 5 nautical miles from coast. Reserved for small scale fishermen that used traditional fishing gear with vessels less than 40 GRT.
B	Situated at 5 to 12 nautical miles from coast. Suitable for owner operated that use purse seine and trawlers with vessels less than 40 GRT.
C	12 to 30 nautical miles from coast It is for commercial vessels 40 to 70 GRT that used trawlers and purse seiner.
C2	Situated at more than 30 nautical miles from the coast. Suitable for the commercial vessel that have gross tonnes more than 70 GRT

Source: Department of Fisheries Malaysia (2014)

1.2 Organization of Fisheries in Malaysia

1.2.1 Department of Fisheries Malaysia

Department of Fisheries Malaysia began in 1894 when Colonial Fisheries Unit was formed by British government and was known as British-Malaya Department of Fisheries. It was responsible to control the fisheries activities along the straits and Allied Malay States. The main focus of this department was to protect the fishing resource, increase production, and diversify production from fish resources. It changed its name into Department of Fisheries in 1946. Aquaculture sector became the main important sector and many research and training activities had been developed to enhance the productivity of this sector. Due to the awareness of the possibility for trawling, the government had introduced the Fisheries Act 1963. In addition, the department had been given responsible to eliminate poverty and restructure the fishermen community once the new economic policy (NEP) was launched in 1970. The licenses and rational resource management, construction of the artificial reefs and establishment of the marine park was developed to repair and protect fisheries resources as it became the responsibility of the department.

The vision of the department was ensuring Malaysia to become sustainable and competitive in the fishery sector. In order to achieve the vision; the department had laid several objectives as follows:-

i. To realize the production of 3.02 million tonnes of food fish through an optimum contribution of 1.577 million tonnes from capture fisheries and 1.443 million tonnes from aquaculture,
ii. To attain an average annual growth rate of 10% and 12% for seaweed and ornamental fish respectively,
iii. To increase private investment by RM10 billion by the year 2020, and
iv. To attain ISO Certification by the year 2015 for all principal activities of the Department through good and proper governance
v. To develop and commercialise 10 new technologies by the year 2020
vi. To ensure the minimum monthly income of the fisheries target group is more than RM3,000.

1.2.2 Fisheries Development Authority of Malaysia (FDAM)

Fisheries Development Authority of Malaysia (FDAM) is one of the fisheries agencies in Malaysia and is known as Lembaga Kemajuan Ikan Malaysia (LKIM) in Malay. FDAM is an authorized body under the Ministry of Agriculture and Agro-Based Industry that was incorporated under Act 49, Malaysia Fisheries Development Board Act 1971. The act was enforced in on all states in Peninsular Malaysia on November 1st, 1971; Sarawak on July 1st, 1973; and Sabah on August 1st, 1995 with the following objectives to upgrade the socio-economic status of the fishermen community, particularly to enhance their income and to develop and expand the fishing industry for the country. Thus, in order to achieve those objectives, FDAM's functions have been specified as follows:

i. To promote and develop efficient and effective management of fishery enterprises and fish marketing,
ii. To create and provide credit facilities for fish production and to ensure that such facilities are being ultimately utilized,
iii. To engage in fishery enterprises through boat construction, and the production and the supply of fishing gear and equipment,
iv. To promote, facilitate and undertake economic and social development of Fishermen's Associations,
v. To register, control, and supervise Fishermen's Association and Fisheries Cooperatives and to make provision for matters related thereto, and
vi. To control and coordinate the implementation of the aforesaid activities.

FDAM also enforces fish marketing regulations under the FDAM Act, 1971 to ensure more efficient and healthy fish marketing system. These regulations also provide licensing of all fish dealers, wholesalers, exporters, and importers to provide for designation of fish marketing control areas and management of fish trade. A fishermen market was also developed by FDAM that acts as marketing channel alternative to reduce the involvement of middlemen, thereby ensuring better income for the fishermen and fresh fish supply at affordable price for the consumer. Fishermen who participated in this programme were able to increase their income from below RM1,000 to more than RM1,500. Fisheries development and legislation are stipulated by the Fisheries Act 1985 as implemented by the Department of Fisheries.

A sum of RM200 will be given to the owner of the licensed vessels and local fishermen who worked at the licensed vessels as living allowances from the government. In 2015, the living allowance for fishermen in Zone A had been increased to RM300 whereas fishermen in Zone B and C received an increase in their allowance amounted of RM250. Furthermore, FDAM also organized market development and promotion programme that can help expansion in the market and demand of fisheries products. The activities educated the consumer in indirectly manner on the new and innovative value added products that exist in the market. Besides, FDAM had organised a lot of development programmes that can improve the social life of the fishermen. Table 1.7 shows the list of the development programmes that FDAM had conducted.

Table 1.7: The Development Programmes

Unit Programmes	Programmes
Fishermen Village and Residence Development Unit Programmes/Activities	1. Fisherman Village Development (Physical Project) 2. Citizen Well-being Development Scheme (SPKR) 3. Fishermen / Fishermen Housing Relocation 4. Maintenance and Monitoring Programme of LKIM Jetties 5. Desa Wawasan (Visionary Village) Programme
Community Development Unit Programmes/Activities	1. Kumpulan Wanita Nelayan (KUNITA) Economy Programme 2. Human Capital and Income Enhancement of Kumpulan Belia Nelayan (Youth Fishermen Group) (KUBENA) 3. Subject Tuition for Fishermen's Children 4. Natural Disaster Aid Scheme and Fishermen Welfare
Wellbeing Development Unit	1. Azam Tani (Agro Determination) Programme 2. E-Kasih

Programmes/Activities	Programme 3. Fishing Community Excellence Mobilisation Awards Programme 4. Social Contributions Scheme
Fund Management Unit Programmes/Activities	1. Course and Talks for participants of Fishermen Funds loan. 2. Visit and Monitoring of Fishermen Association projects 3. Nelayan Jaya (Successful Fishermen) Fund Competition 4. Fishermen Institution Development Loan Scheme (SPIN) -suitable for fishermen association for processing purpose -Financing limit: RM10,000 - RM30,000 with 2% interest -Loan period is 8years. 5. Commercial Fishermen Loan Scheme (SNEK) -Suitable for fishermen that involve in processing and marketing the inputs that relates in fisheries prospect. -financing limit: RM10,000 - RM3,000,000 with 2% interest rate - loan period is 6 years 6. Inboard Engine Fishermen Loan Scheme (SNED) - suitable for fishermen in Zone A, B,and C that want to improve their operation input and buying suitable gear - financing limit: RM5,000 - RM70,000 with 2% interest rate. - loan period is 6 years 7. Inshore Fishermen Loan Scheme (SNEP) - suitable for inshore fishermen - financing limit: RM1,000 - RM25,000 - loan period is 6 years. 8. Fishermen Housing Loan Scheme (SPEN)

Source: Fisheries Development Authority of Malaysia (2018)

1.2.3 National Fishermen Association or Persatuan Nelayan Kebangsaan (NEKMAT)

Another fishing agency that involved in fishing industry in Malaysia is National Fishermen Association or Persatuan Nelayan Kebangsaan (NEKMAT). This association was established in 30 November 1985 under Fishermen Association Act 1971 with the participation of fishermen association from 13 states as its member. NEKMAT is a statutory body that acts as the leader for the state fishermen association with the objectives in enhancing the social and economic status of fishing communities, adding revenue and earnings through increased in production, skill and effort and provide well-being of its members and to create a community of fishermen that are persistent, progressive, independent and united.

One of the projects organized to help the fishermen was a subsidized diesel and petrol oil supply. This project began operations in 1987 with the objective to supply fuel to all fishermen in the peninsular Malaysia, Sarawak and Labuan. Petronas Trading Limited and Shell Malaysia Trading Sdn. Bhd. became the supplier of the diesel. The sales of oil without duties were introduced in December 1997 and the response from the fishermen

community was encouraging. NEKMAT was only responsible for controlling the supply of diesel and petrol in fisheries sector in 1 January 2006. In managing the supply of petrol to fishermen community, NEKMAT channelled supplies through Fishermen Association (PNK) which acts as the centre of retail sales with 125 retail centres all over the Malaysia. About RM0.60 per litre is subsidized by the government. The quota was allocated to the fishermen based on their power of engine used and a limit of 5 to 60 litres per day was imposed for the petrol quota. In addition, NEKMAT also provided the input for fisheries sector such as insulated fish boxes to ensure the freshness of the fish catch, boat engines and trawl to catch fish. Such equipment would provide the fishermen to get and buy the input that can help in their fish catch easily. Moreover, in June 2008, incentives for fisheries landing had been approved. RM0.10 per kilogram will be given to the owner of licensed vessels.

1.3 The Ecological Importance of Coastal

Coast is the line that stands between two different entities consisting of solid and liquid that has provided mankind with valuable natural resources (Clark *et al.,* 1998; Clark, 1997). Usually coast is made up by broad sandy beaches, rocky cliffs and low lying wetlands. Every country has their own coastal zone boundaries. The total lengths of Malaysia's coastline are about 73% from the total length of Malaysia border (Ismail, 2014) which are 4,675 km comprising 2,068 km within Peninsular Malaysia and 2,607 km within East Malaysia (Geography Statistics of Malaysia, 2017) and it is 29th world's longest coastline (International Business Publications, Inc., 2015). As one of Malaysia's assets, the coastline has high potential to be developed physically, economically, and socially (Yusup *et al.,* 2015).

The east coast of Peninsular Malaysia comprises mainly sandy beaches while the west coast is made up of coastal plains. The coastlines of Sabah and Sarawak comprised roughly equal proportion of sandy and muddy formations (Silvestre, 2003). Coastal zone is rich with natural resources and have become the centre of economic activities in terms of agriculture, fisheries, aquaculture, recreation, and urbanisation (Nordin, 2006; World Research Institute [WRI], 2001). It has also natural protection that can protect the coast from the storms and tidal waves. Malaysia has seagrass bed and mangrove system as two examples of natural resources in the coastal zone.

Seagrass is flowering plants, rooted in sediments, on the sea bottom, with shoots appearing above the substrate. Duarte (2002) found that seagrass covering 0.1 to 2.0% of the global ocean floor. Seagrass community can be found at the environment with rocky shores, have a mangroves, lagoon, coral reefs, inter-tidal shores and sub-tidal seas (Bujang and Zakaria, 2003). A total of 60 seagrass species had been found world-wide, 18 of which were found in Malaysia (Bujang *et al.,* 2012). There are two seagrass species that are commonly found around the coast on muddy shores and areas exposed at low tide in Peninsular Malaysia which were *Enhalus acoroides* and *Halophila ovalis*. Both species can be found mostly in Johor, Negeri Sembilan, and Sabah (Bujang *et al.,* 2012).

Seagrass acts as ecological engineer and is known as one of most important fishery resources. It has the ability and capacity to stabilize the sediment, improve the water quality and nutrient cycling and can produce a lot of organic carbon (Fourqurean, 2002). Besides, the seagrass beds are highly productive ecosystem fulfilling a key role in the coastal zone. It is also a best nursery for the fry and invertebrates, providing shelter for fish to protect themselves from predator (Jackson *et al.*, 2001) and feeding area for the marine organism namely fish, shrimps, dugong, and green sea turtle (Arshad *et al.*, 2011; Unsworth and Cullen, 2010; Jimmy 2007; Duarte, 2002).

Mangroves grow along the coastal wetlands (Giri *et al.*, 2011) with 3.7% out of 15.62 million hectares of the mangrove forest is found in Malaysia (Abd Shukor, 2004). Giesen *et al.* (2007) reported that Malaysia possessed second largest of mangrove coverage (11.7%) in Southeast Asia. Sabah constitutes the highest total number of mangrove forest in Malaysia with 58.6% followed by Sarawak with 24.4% and west coast of Peninsular Malaysia with 17% (Goessens *et al.*, 2014). For Peninsular Malaysia, mangrove forests are largely to be found in the Northern coast of Perak with 40,711 ha, Johor with 25,618 ha and Klang in Selangor with 22,500 ha (Goessens *et al.*, 2014). There are about more than 30 mangrove tree species in the West coast of Peninsular Malaysia and the most common species are *Ceriops, Xylocarpus, Rhizophor, and Avicennia* (Ibrahim *et al.*, 2010).

Mangrove forest is considered as the most productive ecosystem, enriched with diversity of flora and fauna (Omar, 2012). The ecosystem becomes the natural habitat and nursery for different types of biotic with aquatic lives using mangrove forest as their spawning grounds. Coastal zone is usually abundant with great ecosystem importance such as maintaining the stability of coastal line, protecting the coastal area from storm, reducing the coastal erosion, managing the water quality by processing the waste and flushing away the pollutant (Alongi, 2008; Giri *et al.*, 2007).

1.4 Reclamation Activities in Malaysia

The total population of Malaysia in 2017 is 32,022,600 millions (DOSM, 2017). According to Hassan and Rahmat (2016), the placement of the population is concentrated in the coastal areas. Based on a report by National Coastal Zone Physical Plan 2012 (NCZPP) that the population of the coastal areas of Peninsular Malaysia is 6.65 millions (Federal Department of Town and Country Planning Peninsular [JPBD], 2012). Subsequently, the development is focused on the coastal areas to cater the population that keep on increasing at these areas (Hassan and Rahmat, 2016).

Hence, reclamation is conducted and had already played a significant role in the urban development process in coastal area in many parts of the world. Reclamation becomes an effective method to overcome the land shortage problem due to increasing number of people that lives along the coastal area and arises of development of the cities (Cui *et al.*, 2016; Zhang *et al.*, 2013). Reclamation is the activities that are related to the process of attaining or create new arable land that can be used by human for living and

development. Yilmaz (2015) referred reclamation activities as effort to create islands that remain above water at high tide from rocks or other marine features for construction.
There are two types of coastal reclamation namely island and peninsular. For island type, the reclamation is done at the sea and it is detached from the shore while for peninsular type, the reclamation is done with the shore connected. Peninsular type becomes the main type of reclamation activities but island type of reclamation is recently recognized due to its advantages in terms of reducing the environmentally adverse impact (Wang *et al.*, 2014; Kaparawi and Abdul Latif, 1996). The purpose of reclamation activities varied for each country and from time to time. Curtis and Campopiano (2014) mentioned that during the pre-industrial area, reclamation is used to bring the 'unused land' into 'productive land' by the development of irrigation system once the bushes and woods had been cleared. The irrigation system is important for the agriculture and cultivation purpose. Reclamation in Malaysia started since 18th century in Kedah for agriculture purposes when wet-rice cultivation was introduced (Hisham and Ghazali, 2006). Besides Kedah, states such as Penang, Melaka and Labuan are pioneers of coastal land reclamation project in Malaysia (Kaparawi and Abdul Latif, 1996).

According to Yusoff *et al.* (2006) there are about 76 coastline reclamation projects along the West coast of Peninsular Malaysia covering 97,000 ha. Many small-scale reclamation projects have been successfully implemented for various purposes in several parts of the country such as Penang, Malacca, Labuan, Langkawi and Kota Kinabalu, either as public sector or private sector projects. The purpose of land reclamation had changed and broadened into planning and development of the country especially the integrated rural communities. It is one of development process that many countries have done to develop their nation. This development is important and acts as a method to overcome the crisis of unemployment rate among the citizens and shortage of housing for living (Adriansen, 2009).

Moreover, coastal reclamation is conducted to retrieve the piece of land that was once destroyed by waves or abrasion, to develop new area in coastal areas as a method to avoid abrasion, to provide area for harbour and other public facilities, as well as mitigation effort for abrasion and for recreational areas (Wagiu, 2011). For example, the reclamation was conducted in Terengganu where beaches in Kuala Kemanan (Toriman, 2006), Dungun, Setiu and Tanjung Gelam (David, 2016), Kampung Kolam (Bahrum, 2017), were eroded and affected the safety of the community that living the nearby area. Reclamation is the best method to be pursued in order to overcome the problems. Moreover, reclamation activity is conducted to provide areas for port where trading between cargos of different countries take place. Port Tanjung Pelepas (PTP) in Johor, is an example of port that is built up by reclamation method. It was completed in 1999 after two years (Sulaiman *et al.*, 2011).

Alternatively, reclamation activity is conducted for housing and industrial and development. For example, a project under Penang Development Corporation in Bayan Lepas, Penang was organized involving 500 ha of area reclaimed. The Seri Tanjung Pinang project located within Tanjung Tokong is also one of the reclamation projects that is planned to fulfil the earlier purposes. There is about 307 ha of coastal area to be reclaimed and this project is expected to be completed in 2018 (Nadzir *et al.*, 2015). Port

Dickson, Negeri Sembilan, and Pulau Langkawi had reclaimed about 60 ha and 20 ha of coastal area, respectively for resort development. Another example of development project is Bagan Datuk Water City in Perak with 4,100 acres of development encircling commercial areas, educational and information technology hubs that can provide 30,000 job opportunities (Wilayah Perak Selatan [WPS], 2018).

In Johor, especially, there are a lot of development projects that involve the reclamation activities such as Danga Bay and Puteri Harbour. New reclamation projects had started in Johor at mid-January 2014 and this development is a joint venture between Country Garden Group and Iskandar Esplanade Danga 88 Sdn. Bhd. (Williams, 2016). The partnership gave birth to Country Gardens Pacific View Sdn. Bhd. (CGPV). This development project was named Forest City and will act as key to the potential opening international investment opportunity which would propel Johor's economy as the main getaway in the South country. Forest City was implemented into four phases. Four artificial islands compromised apartment and villa housing, office buildings, parks, hotels, shopping malls and international school were planned to be built in the Tebrau Straits, off Mukim Tanjung Kupang, Gelang Patah, Johor. This project intended to cover more than 14 km^2 and involve 20-year reclamation effort. There are about 300,000 units of housing will be constructed from this development and it is expected to create tens of thousands of jobs for civilians (Williams, 2016).

In its original plans, total areas of the sea to be reclaimed for the Forest City development are 1900 ha and it will be a single geometrically shaped block of land wedged between Singapore and Malaysia. In order to ensure minimal impacts on the natural habitats which are the seagrass bed (Merambong Shoal) and the mangrove area in the area that need to be reclaimed, more than 50 modelling simulation to revise the shape of the island had been carried out (Williams, 2016). The revised layout of development as shown in Figure 1.1 had reduced the project's total acreage by 30% to 1,380 ha. Development from the revised layout evolved into four separate islands around the seagrass beds (Rahman, 2017).

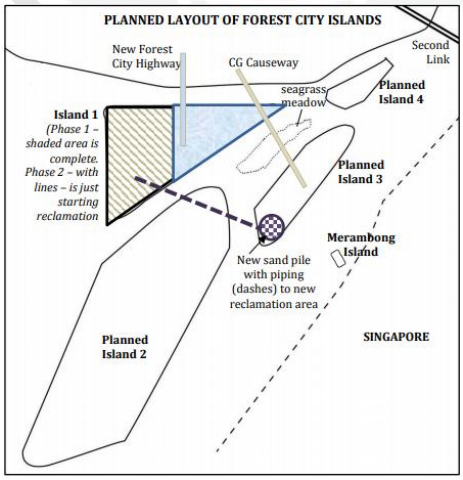

Figure 1.1: Forest City's Four Reclaimed Island's Plan, Indicating the Areas Already Reclaimed and Phase 2 of the First Island, Which is Still in Progress
Source: Rahman (2017)

According to Malaysian National Physical Plan (NPP), any reclamation projects larger than 50 ha must be approved specifically while Detailed Environment Impact Assessment (DEIA) is mandated by Malaysian Department of Irrigation and Drainage (DID) Guidelines for all coastal reclamation projects involving the area 50 ha or more. EIA is also required for the construction of new townships and all coastal resort facility or hotels with more than 80 rooms. The list of the reclamation projects in Malaysia from 1988 to 2016 that have been approved by Department of Environment (DOE) after being submitted to the Environmental Impact Assessment (EIA) is listed in Table 1.8.

Table 1.8: List of Coastal Reclamation Projects in Malaysia

State	Completed Project Location	Artificial islands projects (stage of project × number of islands)
Kedah	Entire coast Pulau Bunting, Daerah Yan	
Penang	Tanjung Tokong Bayan Lepas	Tanjung Tokong (underway × 2) Permatang Damar Laut (proposed × 3)
Perak	Lekir Coastal Development, Pulau Pangkor, Daerah Manjung Perak Heavy Industries Park (PHIP), Bagan Datoh Teluk Muroh Bagan Datoh	Teluk Muroh (completed × 1) Marina Island, Pangkor (completed × 1) Lukut (proposed × 1)
Selangor	Port expansion at Westport, Pulau Indah Kelang	
Negeri Sembilan	Entire coast	
Melaka	Pantai Kundur Malacca City Pulau Panjang, Daerah Melaka Tengah	Malacca City (completed × 2) Off Melaka (proposed × 3)
Johor	Southern International Gateway Project and Tanjung Puteri Lido Boulevard, Johor Bahru Independent Deepwater Petroleum Terminal, Pengerang Mersing Laguna Phase III Dredging and reclamation works at Pelabuhan Tanjung Pelepas Marine and Riverine Facilities on Lot PTD 504 and Lot 1668, Sungai Batu Pahat Integrated Hub and Maritime Industrial Park, Tg. Piai R&F Tanjung Puteri	Forest City Island Reclamation and Mixed Development (underway, × 4)

Kelantan	Jetty and Industrial zone constrution, Tumpat	
Sabah	Kudat	Kudat (completed × 1)
Federal Territory of Labuan	Integrated Port, Ranca-Ranca Oil and gas industrial base, Kg. Ranca-Ranca	

Source: Su *et al.* (2017)

1.5 Problem Statement

Reclamation is said to give positive impacts to the coastal areas by improving the existing excess condition for public (Regional Coastal Plan, 2014). For example, reclamation activities that are conducted for industrialization and development purposes can create job opportunities to the citizens and benefit to the economics of country (Williams, 2016). The creation of job opportunities attracts locals to work in the areas as well as encourage youth to remain in the areas instead of migrating out (Musa, 2018).

In Johor, Forest City development project began by making a causeway from mainland to main body of the incipient islands (Williams, 2016). However, there were several issues reported regarding the reclamation activities. For example, the path had bisected the Merambong Shoal seagrass bed and the developers had dumping sand directly on the seagrass that completely destroyed 3.96 hectares of the bed, splitting them into two (Hossain *et al*., 2018). According to Williams (2016), almost 2,000 hectares for the Forest City project were approved and launched without a Detailed Environment Impact Assessment (DEIA). In order to avoid the DEIA process, the project was purposely broke up into islands of 49.3 hectares each. Several months after reclamation starts, the Department of Environment (DOE) issued a stop work order and mandated the Country Garden to complete the DEIA process before this project can be proceeded. The project received an approval from the DOE in January 2015 after the project has been halted in June 2014 (Williams, 2016).

Reclamation activities had caused permanent loss of natural habitat within the reclaimed areas. According to Naser (2015), reclamation had caused reduction of mangrove ecosystem and destruction of seagrass bed. Mangrove ecosystem is the natural habitat for fishes and shrimps. Moreover, the ecosystem is important in protection coast from erosion due to the waves and acts as water filter that can maintain the quality of water. Meanwhile, seagrass bed became the main fishing grounds for the fishermen since this shoal is a vital part of the marine ecosystem in terms of productivity level, habitat, and nursery area for numerous marine species such fish, shrimps, and Dugong (Arshad *et al.*, 2011; Jimmy, 2007).

Moreover, reclamation materials and pollutants those come from reclamation activities where discharge into the sea had polluted the marine environment and cause undesirable affects towards the capacity of fishery resources and aquaculture industry (Ge and Jun-Yan, 2011). The situations affect the fisheries activities and simultaneously become

problematic for community that depends on marine aquaculture industry as their source of income. For instance, fish farmers in Johor had loss RM150,000 due to a probable 90% death of fish and fish fry (Yee, 2014).

Furthermore, damage to the marine habitat will lead to reduction of fish and shrimp catch, thus leading to reduction of annual income of fishermen and increase the number of unemployment (Priyandes and Majid, 2009). The income of fishermen also decreased and is expected to be reduced by 50% due to damage in marine habitat (Palansamy, 2015). Accordingly, Saleh *et al.* (2016) stated that reclamation activities had caused 50% decline in the amount of fish and other marine commodities that the fishermen catch before and after reclamation. This showed that the project is not sustainable in all-inclusive sense even though it is claimed that the development as an ecological development. In addition to this issue, fishermen need to make a detour in order to avoid the reclamation areas and are forced to go further out to sea to catch fish (Tan, 2014). As a result, expenses for the fishing operations increased compared to the expenses before reclamation activities took place.

In the light of the above discussions, all issues raised are related to the impacts of reclamation activities towards the fishing community at Merambong Shoal. The reclamation activities became the important role for the urban development in coastal areas and beneficial to the citizens in terms of providing job opportunities. Also the development can propel Johor's economy as the main getaway in the South country. However, the price to pay for this kind of development is incomparable high. The environmental surrounding that beneficial to the spawning and breeding of marine organism are affected and degraded. Because of that, the numbers of fish catch of fishermen had decreased and it affected their one and only sources of income. Thus, there is a need to identify the impacts of reclamation activities thoroughly towards the fishing community and the other factors that influence fishermen to conducting fishing operations. Hence, it can be statistically proved that reclamation activities gave negative impacts towards the fishing community.

1.6 Research Questions

Four (4) research questions are addressed in this study. The questions are as follows:

i. Is there any difference between income, fish catch and fishing operations of fishermen before and after reclamation activities?
ii. What would be the fishermen perception towards the reclamation activities?
iii. What are the factors that mostly influenced the fish catch of fishermen?
iv. Is there any relationship between the number of crew, fish catch and income of fishermen?

1.7 Objectives of the Study

General Objective

To determine the perceived impact on coastal reclamation activities in a fishing community in Johor, Malaysia.

Specific Objectives

i. To examine the differences between income, fish catch and fishing operations of fishermen before and after reclamation activities.
ii. To determine the perception of fishermen towards reclamation activities.
iii. To explore the most influential factors that influence the fish catch of fishermen.
iv. To determine the relationship between the number of crew, fish catch and income of fishermen.

1.8 Significance of the Study

The aim of the study is to expand the information regarding the reclamation impact towards the fishermen in terms of their fishing operations and fish catch. The information gathered from this study would be helpful for authorities such as Department of Fisheries (DOF), Fisheries Development Authority of Malaysia (FDAM) and National Fishermen Association to gain insights on the real situation of the fishing operations after the reclamation activities conducted. In addition, the results from this study will also help the authorities in providing the suitable solution and plan in order to improve the situation that had happened in the area of study while simultaneously focusing on the important factors that drive the quantity of fish catch.

1.9 Organization of the Thesis

The thesis is organized into five chapters. The first chapter begins with the introduction regarding the fisheries industry, reclamation activities and its issues, statement of problem, research questions and objectives. The second chapter reviews the literature on the past studies and information which are important to the study. The third chapter explains the research methodology includes sampling techniques, methods of data collection, description of the study areas and tools for data analysis. The fourth chapter provides discussion on findings of the study. The fifth chapter, it discussed about the conclusion and limitation of the research. Recommendation for future research is also addressed in the last chapter.

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LIST OF PUBLICATIONS

Research Paper

Jumain, N. A., Kamarulzaman, N. H., Abd Latif, I. & Md Yusoff, F. (2018). Impact of reclamation on fishery activities in Malaysia. *International Journal of Agriculture, Environment and Bioresearch, 3*(3), 87-97. (Published)

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