Local Authority Area/Mukim Southwest District	Population	
	2000	2010
Mukim I (Pulau Betung)	1,311	1,333
Mukim J (Dataran Ginting)	1,405	1,102
Mukim 7 (Bukit Ginting)	1,678	1,462
Mukim 8 (Bukit Pasir Panjang)	837	1,185
Mukim 9 (Bukit Gemuroh)	11,069	14,925
Mukim 10 (Bukit Relau)	2,195	2,673
Mukim 11 (Teluk Kumbar)	11,734	15,711
Mukim 12 (Bayan Lepas)	94,740	122,654
Total	**124,969**	**161,045**

T6.54
The population size of what become part of the study area, 2000 and 2010

Source:
1. Dept. of Statistics. 2001. *Population distribution by local authority areas and mukims, Population and Housing Census of Malaysia, 2000*. Kuala Lumpur.
2. Ibid. 2011. *Population distribution by local authority areas and mukims, Population and Housing Census of Malaysia, 2010*. Putrajaya.

6.4.1.3.2 General Population Age and Sex Structure

T6.55 shows the population age and sex structures of the State of Pulau Pinang and the Southwest District according to the 2010 Census. With the exception of Sabah, Selangor, WP Labuan and WP Putrajaya all the other states in Malaysia have a matured age structure as reflected by the matured age structure of Malaysia when the aged group of 65 years and above account for more than 5.1% of the total population. This applies to Pulau Pinang too when its matured age structure as reflected by the percentage of the old population is found to be 6.5% and that of the study district 5.2% (demographically an age structure is considered matured when the percentage of the aged population is between 4% and 7% of the total population).

One possible reason for this phenomenon would be the predominance of net in-migration of the young matured and matured population in seeking better opportunities in the area or a feature of returned migration involving retired migrants who return to their origin to spend the rest of their retirement days. Another plausible reason is the low vital processes of birth and death rates which may result in longevity among the adult populations.

The situation is also similar with sex ratio when it pointed to a situation of balanced sex ratio of relatively similar numbers of males and females. One would expect the sex ratio to be imbalanced considering it to be close to the fast developing area of Bayan Lepas and Bayan Baru area. But the potentially high population turnover would balance out when in-migration more or less equalised out-migration.

Characteristics	Pulau Pinang	Southwest District
Age Structure	**Matured**	**Matured**
0-14 years	15.7	17.8
15-64 years	77.8	77.0
65+ years	6.5	5.2
Total	100.0	100.0
Sex Ratio	Balanced	Balanced
Males/100 Females	101	100

T6.55
Population age and sex structures of the State of Pulau Pinang and the Southwest District, 2010

Source: Adapted and computed from 1. *Population and Housing Census of Malaysia 2010, Preliminary Count Report*. 2. *Population distribution by Local Authority Areas and Mukims 2010*. Dept. of Statistics. 2010.

6.4.1.4 Profile of the Overall Respondents

a) Demographic Background

The profile of the respondents is necessary to help one in discerning the type of population one is dealing with. It is the make-up of a society that often determines the kind of reaction, impacts and degree of acceptability. The analysis of data gathered from the questionnaire survey revealed the community profile in respect of its demography, social and economic characteristics.

b) Size and Ethnicity

According to the 2010 Population Census, the population of the Southwest District of Pulau Pinang comprised mainly Chinese (42.9%), 41.2% Bumiputra, 9.8% Indian and the rest were Others. However, the ethnicity of our respondents did not reflect the ethnic representation of the study District but an over-representation of Bumiputra, comprising more than half (simply due to the nature of our sampling frame), with the Chinese representation reduced to about half and the remaining 6% comprised Indians (T6.56). The over representation of Bumiputra was unavoidable due to the nature of our purposive sampling technique which favoured fishermen as the latter were seen to be the most impacted. Most of the fishermen in the area were Malays.

T6.56 Demographic characteristics of the respondents (%)

Characteristics		Fishermen	General Public	Business Operators	Beach Users
Ethnicity	Malay	80.5	90.6	75.0	68.5
	Chinese	19.5	5.7	19.0	22.9
	Indian	0.0	3.7	6.0	8.6
	Total	**100.0**	**100.0**	**100.0**	**100.0**
Age Group	Below 30 years	9.5	19.0	17.0	60.0
	30-39 years	24.0	25.0	29.0	28.6
	40-49 years	28.5	26.7	28.0	5.7
	50-59 years	27.5	18.0	18.0	2.9
	60-69 years	10.0	9.0	8.0	0.0
	70 +	0.5	2.3	0.0	2.9
	Total Median age	**100.0 45.3 years**	**100.0 42 years**	**100.0 40.5 years**	**100.0 27 years**
N		**200**	**300**	**100**	**35**

Source: Field data, 2016

c) Age Structure

As mentioned above, the age structure and sex ratio of the Southwest Pulau Pinang District in 2010 reflected one which was matured when 77% of its population were in the 15 to 64 years age group and the aged (65 years and above) making up 5.2% of the population (Dept. of Statistics 2011).

Accordingly, our respondents were generally in the mature age group too, with more than 80% of them being in the age group of 30 years and above (T6.56). Nevertheless, the fishermen were older, with more than half in the 50 years and above age group with a median age of 45 years, while the public group was slightly younger with the median age of between 40 to 42 years. The youngest is the beach users group, whose median age is 27 years. Contrarily, the age structure of the surveyed population (respondents' total household

members) showed one which was young when the proportion of the aged population 65 years and above does not even touch 1% (T6.57).

Contrarily to the sex ratio of the state and Southwest District which portray balanced ratio, the sex ratio in the study area is very much imbalanced for all the population components. The imbalances take the form of either excess of males over females as in the case of fishermen and general public, or likewise a shortage of males compared to females as reflected in the households of the business operators and beach users.

T6.57 Characteristics of respondents' household and household members

	Household Characteristics	Fishermen	General Public	Business Operators	Beach Users
Household Size	1-3 persons	30.0	30.4	30.0	28.6
	4-6 persons	67.0	65.3	63.0	71.4
	7+ persons	3.0	4.3	7.0	-
	Total Average h/h size	**100.0 4.17**	**100.0 4.11**	**100.0 4.2**	**100.0 4.03**
Age Group	0-14 years	37.7	37.8	16.0	22.0
	15-39 years	29.5	37.6	49.0	73.7
	40-64 years	32.2	23.6	34.3	3.6
	65+ years	0.6	1.0	0.7	0.7
	Total Age structure	**100.0 Young**	**100.0 Young**	**100.0 Young**	**100.0 Young**
Sex Distribution	Male	479	711	117	58
	Female	355	631	165	83
	Total	834	1,342	282	141
	Sex ratio	**135M/100F Imbalanced**	**113M/100F Imbalanced**	**71M/100F Imbalanced**	**70M/100F Imbalanced**

Source: Field data, 2016

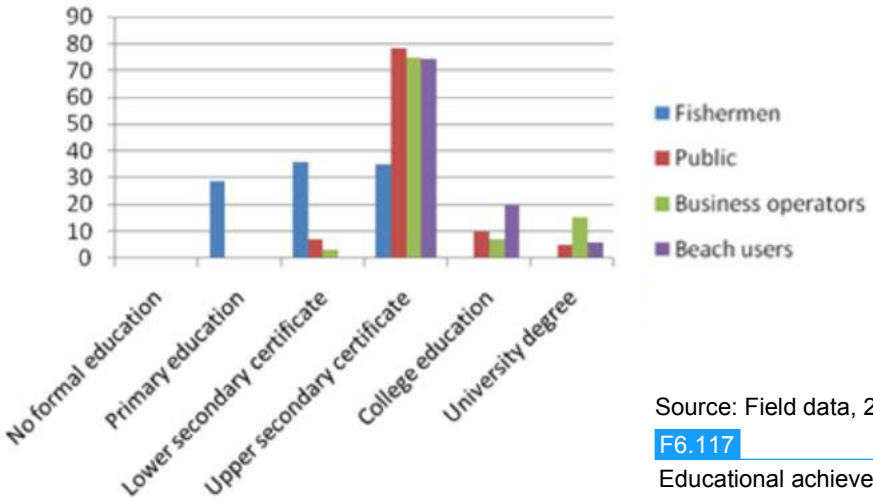
6.4.1.5 Socio-economic Background

a) Educational Background

With the majority of the respondents being matured adults need not also necessarily mean they had similar educational background. The fishermen were found to be comparatively less educated when more than 65% of them had no formal education or having education up to lower secondary only (F6.117). The beach users were found to be more educated as all of them had at least upper secondary education. Although all of the other groups had at least three-quarters of each group having upper secondary education, it is the beach users who had more members having gone through tertiary education (25.7% compared to 22% for the business operators and 15% for the general public).

b) Employment and Income Distribution

Economically, with the exception of the fishermen and the business operators who were solely employed in their respective sector, two occupational categories i.e. business and private sector employees stood out as main occupations of the general public and the beach users (T6.58). The largest employer among the public and the beach users was the wage sector which engaged about one-third and 91% of them respectively with the majority working in the private sector. Those engaged in business were relatively high too accounting for about one-fifth.



Source: Field data, 2016

F6.117
Educational achievement of the respondents

T6.58 Employment and income profile of the respondents (%)

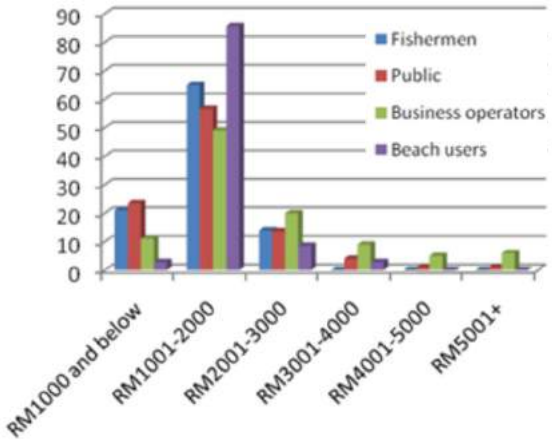
Characteristics		Fishermen	General Public	Business Operators	Beach Users
Occupation	Not working	-	4.3	-	2.1
	Fishermen	100.0	-	-	-
	Business person	-	17.0	100.0	-
	Public sector employee	-	4.7	-	8.6
	Private sector employee	-	27.7	-	82.0
	Driver	-	4.3	-	2.9
	Pensioners	-	3.3	-	-
	Seafood restaurant operator	-	3.3	-	2.9
	Others	-	35.0	-	-
	Total N	**100.0 200**	**100.0 300**	**100.0 100**	**100.0 35**
Main Income	RM1,000 and below	21.0	23.6	11.0	2.9
	RM1,001-2,000	65.0	56.7	49.0	85.7
	RM2,001-3,000	14.0	13.7	20.0	8.6
	RM3,001-4,000	-	4.0	9.0	2.9
	EM4,001-6,000	-	1.0	5.0	-
	RM5,000+	-	1.0	6.0	-
	Total Mean	**100.0 RM1,578**	**100.0 RM1,780**	**100.0 RM2,483**	**100.0 RM1,765**
Household Income	RM1,000 and below	10.5	9.0	3.0	0.0
	RM1,001-2,000	27.5	16.0	18.0	0.0
	RM2,001-3,000	30.0	25.3	26.0	22.9
	RM3,001-4,000	17.0	19.3	15.0	28.6
	EM4,001-6,000	8.0	10.7	11.0	14.3
	RM5,000+	7.0	19.7	27.0	34.4
	Total Mean	**100.0 RM2,710**	**100.0 RM3,683**	**100.0 RM4,073**	**100.0 RM4,665**

Source: Field data, 2016

On a whole, the income profile of the respondents showed one with slightly more than 85% of the fishermen earning less than RM2,000 a month with a mean monthly income of RM1,578 (T6.59 and F6.118). The general public's income distribution showed one which was slightly better with approximately 80% earning less than RM2,000 a month or a mean monthly income of RM1,780. The business operators tend to earn slightly more with an average of RM2,483. One would expect income from business would be much higher but with the kind of business captured in our survey which was mainly in the prepared food industry and small businesses, the managers and supervisors were the ones ended up being interviewed. So too the hotels, electric and electronic goods and gadgets outlets, apparel and the like. However, it is the household income (comprising respondents' income from the main and secondary occupations plus other household members' income) that really matters when measuring the economic standing of the households and the level of poverty.

When household income was computed for the respondents it was found that it had improved the total income earned by reducing those having income of less that RM1,000 and increasing the percentage of those having higher income of more than RM3,000 a month with a higher mean monthly household income of RM2,710 for the fishermen, RM3,683 for the general public, RM4,073 for the business operators and RM4,665 for the beach users (T6.59 and F6.119). However, the improvement was seen to be more pronounced in the household of the business operators and beach users.

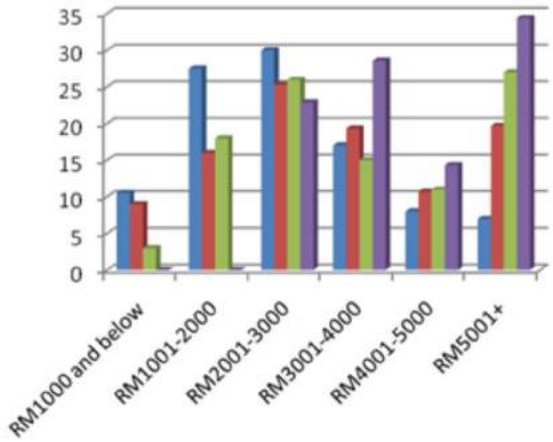
In a recent Finding of Household Income Survey of Malaysia 2012 published by the Department of Statistics, Malaysia, the mean monthly household income for three income groups of the top 20%, the middle 40% and the lowest 40% were found to be RM12,159; RM4,573 and RM1,847 respectively. The respective equivalent incomes for the urban dwellers were RM13,654, RM5,294 and RM2,235. Taking the cue from here, it can be said that the majority of the population in the study area belongs to the lower 40% income group.



Source: Field data, 2016

F6.118

Distribution of the respondents' main income



Source: Field data, 2016

F6.119

Household income of the surveyed population

6.4.1.6 Housing, Ownership and Efficiency of Public Facilities and Amenities

a) Housing

As the study area would potentially be faced by the impending fast developing area within the vicinity of the Southwest District of Pulau Pinang, it would be beneficial to know the type of residences, ownership and utilities and amenities enjoyed by its residents. T6.59 shows the state of affair as analysed from our survey data. It was found that more than two thirds of the houses in the area comprised traditional village houses, followed by modern housing (as in housing garden, flats and condominiums) accounting for about one-quarter as in the case of both the fishing settlements and the general public residential area, and the rest are detached bungalows. The business operators and beach users appeared to be living in modern housing comprising linked or terraced houses as well as flats or condominiums.

T6.59 Housing, house ownership and condition, utilities and amenities enjoyed by the households

Items		Fishermen	General Public	Business Operators	Beach Users
Type of House	Bungalow	3.0	6.7	4.0	-
	Semi-d	-	0.7	9.0	-
	Link/terraced house	1.0	7.3	30.0	20.0
	Traditional village house	78.5	62.0	17.0	25.7
	Flat/apartment/condominium	17.5	23.0	33.0	54.3
	Shop house/single-storey	-	0.3	7.0	-
	Others/stall	-	-	-	-
	Total	**100.0**	**100.0**	**100.0**	**100.0**
House/ Premises Ownership	Own house/premise	58.5	74.0	86.0	25.7
	Rented house/premise	1.0	26.0	14.0	74.3
	Lodger	34.0	-	-	-
	TOL/*wakaf*	6.5	-	-	-
	Quarters	-	-	-	-
	Total	**100.0**	**100.0**	**100.0**	**100.0**
House/ Premises Condition	New/sound	6.5	58.3	20.0	88.6
	Fair/moderate	92.5	41.0	80.0	11.4
	Old/poor	1.0	0.7	-	-
	Total	**100.0**	**100.0**	**100.0**	**100.0**
With Utilities/ Amenities	Electricity	100.0	100.0	100.0	100.0
	Water	100.0	100.0	100.0	100.0
	Proper toilet facilities	100.0	100.0	100.0	100.0
	Telephone	11.0	25.7	27.0	5.7
	Mobile telephone	99.0	99.4	100.0	100.0
Mobile Telephone	1-2	50.0	45.3	46.0	5.7
	3-4	42.6	40.7	40.0	65.7
	> 4	7.0	14.0	14.0	28.6

Source: Field data, 2016

Approximately 59% of the fishermen respondents owned the house they lived in which mainly featured village houses and flats, while it is 74% owner-occupied house for the general public. Almost one-quarter of the latter rented the house they lived in. As for the business operators, the percentage owning their own houses was higher at 84%, while the remaining14% rented them. Contrarily, majority of the beach users rented the house they lived in. The latter was mainly in good or fair condition, with all enjoying electricity, clean water and proper toilet facilities. Not many had fixed-line telephone services and almost everybody had mobile or cellular phones.

Data on ownership of vehicles and other household items, however, pointed one that reflected a relatively high level of affordability. As an example, the percentage owning motorised vehicles, cellular phones and other household gadgets was high (T6.60). Whilst these items could be considered as nowadays necessities, the high level of affordability could either reflect the readily available credit or hire purchase services offered and hence a degree of indebtedness, or that they were simply affordable to the locals.

T6.60 Ownership of vehicles and other household items among the respondents

Vehicles / Goods	Fishermen	General Public	Business Operators	Beach Users
Motorcar	76.0	87.0	100.0	100.0
Van	11.0	3.0	3.0	0.0
Lorry	1.5	3.7	4.0	0.0
Motorcycle	92.5	100.0	100.0	94.3
Bicycle	52.5	46.7	51.0	51.4
Powered Boat	88.5	0.0	0.0	0.0
Sampan	0.0	0.0	0.0	0.0
Television	100.0	100.0	99.0	94.3
Radio	100.0	96.0	98.0	100.0
Video player	100.0	90.7	95.0	100.0
Refrigerator	100.0	100.0	100.0	100.0
Electric fans	100.0	100.0	100.0	100.0
Lounge set	100.0	96.3	99.0	100.0
Gas stove	100.0	100.0	100.0	100.0
Electrical appliances	100.0	99.7	99.0	100.0

Source: Field data, 2016

That the area was highly urbanised could be partially gauged by the level of satisfaction that the locals had on the infrastructure and facilities found in the area. As can be seen in T6.61, not all of the respondents (except for the business operators) rated most of them as satisfactory. To the fishermen, all the facilities and services were considered as less satisfactory. To both the public and fishermen, the overall development of their area was also less satisfactory.

Types of Facilities, etc.	Fishermen	General Public	Business Operators	Beach Users
Electricity	32.0	64.7	46.0	NA
Piped water	30.5	61.7	100.0	
Public telephone	8.0	20.3	100.0	
Postal services	27.5	46.0	53.0	
Clinic	31.0	56.0	66.0	
Hospital	30.0	52.7	59.0	
Road network	26.5	43.3	66.0	
Bus services	29.0	57.7	62.0	
Taxi services	28.0	58.0	70.0	
Markets	32.5	61.0	73.0	
Shops	32.5	63.7	79.0	
Place of worship	31.5	64.3	76.0	
Community hall	32.0	63.0	75.0	
Garbage collection	31.5	62.0	74.0	
Sewerage	31.5	63.7	76.0	
Fire brigade	27.5	55.7	77.0	
Policing	27.0	54.7	72.0	
Entertainment	25.0	47.0	64.0	
Sports/recreation	14.5	39.0	59.0	
Overall development	23.0	47.0	65.0	

T6.61
Efficiency of facilities and services found as perceived by the respondents (% saying very satisfactory)

Source: Field data, 2016

b) Mobility and Migration

That the majority of the fishermen respondents had been living in the study area for the past 45 over years is testimony that they were locals. Among the general public, the percentage was only 36% (T6.62). The fact that 20% of the public and 54% of the beach users had been living in the area for 10 years or less implied that the population turnover in the study area is relatively high, thus further implying that most likely the area was a potential population receiving area. Those who moved in were trying to look for a job or on job transfer or following spouse or family. The latter were mainly from the neighbouring areas or other parts of Penang and the neighbouring states of Kedah and Perak. Purchase of land or house was also discerned among the public and business operators for reason of moving into the study area.

With regard to the beach users, 37% were found to be locals, mainly from Balik Pulau, Gelugor, Jelutong, Seberang Perai and Bukit Mertajam. The remaining 63% were from other states, mainly from Kedah and Perak.

6.4.1.7 Survey Results on Opinions and Perceptions

a) Level of Project Awareness

With respect to their knowledge of the proposed reclamation Project, it was found that the percentage among the respondents who were aware about it varied, with full awareness among the fishermen, 72% among the general public and 48% among the beach users. The business operators were the least aware. Those who were aware knew about it mainly from mass media and other villagers or neighbours (T6.63).

T6.62 Length of domiciliation and respondent's origin before moving to study area (%)

Length of Stay and Reasons for Migrating		Fishermen	General Public	Business Operators	Beach Users
No. of Years	<10	-	20.0	N/A	54.3
	11-20	0.5	16.0		11.4
	21-30	10.5	12.7		20.0
	31-40	25.5	14.7		11.4
	41-50	29.0	12.3		-
	51-60	26.0	16.3		-
	61 +	8.5	8.0		2.9
	Total Mean	**100.0 45 years**	**100.0 35 years**		**100.0 15 years**
Reasons	Looking for job	-	11.7	23.0	48.6
	Job transfer	-	1.7	-	5.7
	Following spouse	-	4.3	1.0	11.4
	Following family	-	2.7	2.0	8.6
	Resettlement	-	0.7	-	-
	Others (purchase land/house)	-	6.7	3.0	-
	Locals	100.0	72.3	71.0	25.7
	Total	**100.0**	**100.0**	**100.0**	**100.0**

Source: Field data, 2016

T6.63 Awareness and knowledge about the proposed Project (%)

Awareness and Knowledge		Fishermen	General Public	Business Operators	Beach Users
Awareness	Knew about the Project	100.0	72.0	43.0	48.6
	Did not know	-	27.7	56.0	51.4
	Not sure	-	0.3	1.0	0.0
	Total	**100.0**	**100.0**	**100.0**	**100.0**
Source of Knowledge	Mass media	28.0	34.3	29.0	37.1
	Village head and Penghulu	20.0	4.7	-	5.7
	Household member	4.5	5.7	1.0	-
	Other villagers/neighbours	35.0	25.7	10.0	8.6
	Politician	-	0.3	1.0	-
	Fishermen/Fishermen Association	12.5	1.3	2.0	-
	Not relevant	-	28.0	57.0	48.6
	Total	**100.0**	**100.0**	**100.0**	**100.0**

Source: Field data, 2016

b) Perceptions Towards the Proposed Project

■ Perception of Socio-economic Impacts

The study attempts to gauge the perceptions of the locals regarding the potential impacts of the Project, particularly with regards to the various environmental components. One of the perceptions sought was the socio-economic advantages and disadvantages of the Project as listed in T6.64.

If 60% and above is taken as relatively significant, then an analysis of the responses pointed to different levels of perceptions among the different population components of the respondents. To the fishermen, general public and the beach users, the proposed Project would not bring much advantage to the area as shown by the relatively low score in percentages of the kind of advantages listed, except for employment opportunities for the locals, improvement of basic amenities and increased value of land or property. Instead they, especially the fishermen and the beach users, perceived that all the disadvantages would befall them i.e. loss of employment, loss of source of income, displaced and loss of property as they foresee themselves to be directly impacted. Nevertheless, the business operators saw it to be most advantageous but for it being the source of the shrinkage of local fishing ground. None of the disadvantages was highly rated by the general public.

T6.64
Ratings of perceived socio-economic advantages and disadvantages brought about by the proposed Project (% saying "Yes")

	Perceptions	Fishermen	General Public	Business Operators	Beach Users
Advantages	Employment opportunities to own h/hold members	37.5	51.3	81.0	57.1
	Employment opportunities to local population	67.5	56.7	83.0	71.4
	Improvement of basic amenities	66.0	63.0	100.0	54.3
	Increased value of land/property	70.5	71.3	99.0	74.3
	Increased standard of living	42.0	54.0	100.0	4.3
	Increased business opportunities	48.5	53.0	42.0	37.1
	Increased opportunity for property ownership	7.0	32.0	32.0	5.7
	Increased international trade	16.5	36.3	72.0	11.4
Disadvantages	Loss of employment	100.0	19.3	0.0	85.7
	Loss of source of income	100.0	22.3	0.0	82.9
	Shrinkage of fishing ground	100.0	53.0	64.0	48.6
	Displaced	26.0	18.3	0.0	62.9
	Loss of property	61.0	20.0	0.0	71.4
	Probability of locals being marginalised	33.5	20.3	0.0	8.6

Source: Field data, 2016

■ Perception of Impacts on Health and Safety

T6.65 shows how the respondents perceived the impacts of the Project on their health and safety. As can be seen, the fishermen respondents were seen to be moderately to strongly certain that most of the possible impacts on health and safety listed would befall them. Impacts such as increase in water and noise pollution as well as increased accidents with small fishing boats were rated fairly strongly.

The general public perceived that the proposed Project would trigger all the environmental pollutions, especially water, air and noise and strongly perceived that it would also cause traffic congestion. The beach users also had similar perception as the general public but with a moderate undertone. The business operators seemed to perceive strongly that it would only bring about increased traffic congestion and marine water pollution.

T6.65
Ratings of perception of impacts on health and safety brought about by the proposed Project (% saying "Yes")

Characteristic	Fishermen	General Public	Business Operators	Beach Users
Increased traffic congestion	55.5	87.7	92.0	80.0
Increased accident with small fishing boats	73.0	56.7	-	22.9
Increased noise pollution	80.0	79.3	-	62.9
Increased air pollution	64.0	82.3	-	74.3
Increased water pollution	100.0	91.7	97.0	74.3
Hazardous to people	51.0	54.7	-	31.4
Disturb peace / tranquillity	53.5	60.3	-	48.6
Increased communicable diseases	25.0	42.0	29.0	14.3

Source: Field data, 2016

■ Perception of Impacts on Aesthetics and Culture

An analysis of the perception of impacts on aesthetics and culture revealed that all the respondents were fairly sure about the impacts of the development on the aesthetics and culture of the area. This was deduced when more than 80% of all the respondent groups perceived that the Project would affect the seascape of the area, the beauty of the landscape, water quality and the air quality of the area (T6.66). However, a noticeable percentage from among the fishermen, the general public and the beach users perceived that the Project would also affect tranquillity of the area.

T6.66
Ratings of perception of impacts on aesthetics and culture brought about by the proposed Project (% saying "Yes")

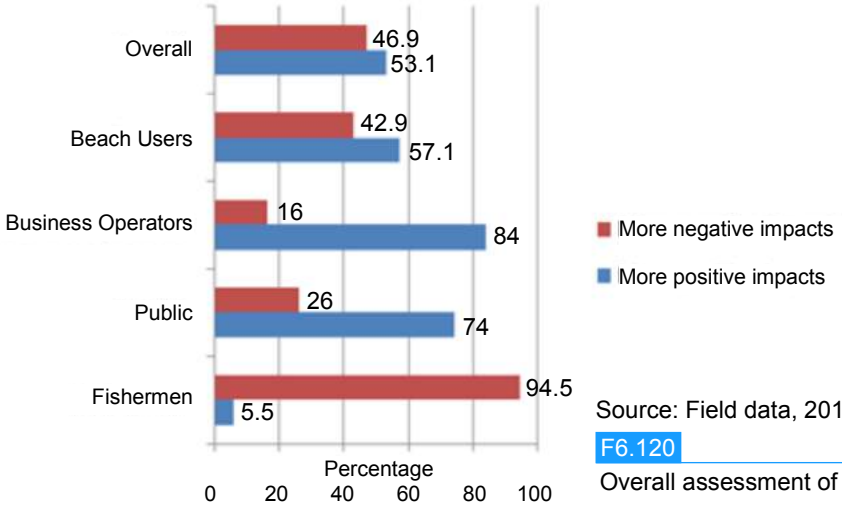
Perceptions	Fishermen	General Public	Business Operators	Beach Users
Affect seascape of the area	95.0	93.0	80.0	85.7
Affect beauty of landscape	93.5	92.7	81.0	80.0
Affect air quality	63.5	78.7	0.0	71.4
Affect water quality	100.0	94.0	97.0	97.1
Affect tranquillity of the area	73.0	69.7	52.0	68.6
Affect community integration	17.5	32.7	24.0	80.0
Affect local tradition	45.0	47.3	32.0	30.0
Affect historical places	16.0	24.7	15.0	0.0
Affect place of worship	12.0	21.0	14.0	0.0
Affect important buildings	13.0	21.3	15.0	0.0

Source: Field data, 2016

c) Assessment of Level of Acceptability

Analysis of the data on respondents' assessment of the Project showed that a significant percentage (94.5%) of the fishermen were of the opinion that the Project would bring about more disadvantages than advantages whilst among the general public and business operators the assessment was more (74 and 84% respectively) for the positive aspects or advantages (F6.120). Being indirectly impacted, the general public and the business operators were at a better position to make an independent assessment. Nevertheless, 57.1% of the beach users, being almost akin to being directly impacted, were of the opinion that it would bring more disadvantages than advantages. Taken as a whole, slightly more than half (53.1%) were of the opinion that the proposed Project would bring about more positive impacts as opposed to 46.9% saying there would be more negative ones.

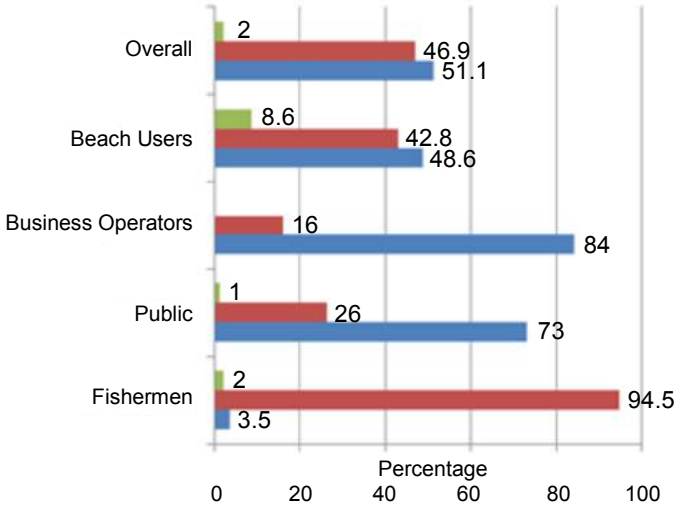
It is thus not surprising that there appeared to be a strong disagreement among the fisherman respondents as to its implementation, while a strong agreement among the business operators and general public for it, but the beach users seemed to be torn in two, being equally strong for and against it (F6.121). On the average, about 51.1% of the respondents agreed to the implementation of the Project, 46.9% disagreed and 2% not sure.



Source: Field data, 2016

F6.120

Overall assessment of the proposed Project



Source: Field data, 2016

F6.121

Level of acceptability of the different component of the respondents

The more significant reasons for agreeing or disagreeing vary from among the different groups of the respondents, commensurable with their different interests in life. The fishermen respondents seemed to agree if only they would be compensated although they also saw it as making Pulau Pinang more developed (T6.67). But their main contentions for disagreeing were its potential source of income loss, accounting for about half of them and the related reason of shrinkage of fishing ground.

T6.67 Reasons for agreeing and disagreeing to the proposed Project (%)

	Reasons	Fishermen	General Public	Business Operators	Beach Users
For Agreeing	Government Project, need to agree	14.3	-	1.2	-
	Business/employment opportunities for future generation	42.8	81.3	48.9	82.4
	If given new settlement	14.3	-	-	-
	Age factor	14.3	-	-	-
	Attract tourists/new opportunity as tourist boat operators	14.3	-	8.3	-
	Attract foreign investors to generate Penang's economy	-	12.3	8.3	5.9
	Increased growth and development for Penang	-	6.4	-	5.9
	Source of state economy/Penang becoming industrial city	-	-	14.3	5.9
	Beneficial to future generation	-	-	16.7	-
	Improved village area but preserve for heritage	-	-	1.2	-
	Able to support population increase	-	-	1.2	-
	Total N	**100.0 7**	**100.0 219**	**100.0 84**	**100.0 20**
For Disagreeing	Important fish and prawn spawning area	22.8	-	-	-
	Other source of funding not from reclamation	17.9	1.3	-	-
	Loss of livelihood	13.2	1.3	-	-
	Shrinkage of fishing ground/sea area	13.2	-	-	-
	Problem of marine water pollution and mud	11.6	30.8	37.5	40.0
	Malay fishermen will lose their village and lag behind	6.9	-	-	-
	Will benefit specific group only	4.8	1.3	6.3	-
	Not beneficial to fishermen/locals but foreigners	4.8	15.4	-	-
	Disturb marine ecosystem and life	4.8	-	-	-
	Fear of being relocated	-	29.5	-	-
	Marginalisation of locals/fishermen/Malays in the future	-	10.3	-	-
	More negative impacts will arise	-	10.3	-	-
	Will benefit foreign workers more	-	-	37.5	-
	Housing development not beneficial to the locals	-	-	18.8	-
	Loss of natural seaview, coastal aesthetics, water pollution	-	-	-	46.6
	Too many reclamation projects in Penang	-	-	-	6.7
	To discuss with the directly impacted surrounding population	-	-	-	6.7
	Total N	**100.0 189**	**100.0 78**	**100.0 16**	**100.0 15**

Source: Field data, 2016

To the general public, the proposed Project was mainly seen by 72.9% of them as providing an alternative route and thus would potentially reduce future traffic congestion. However, they seemed to be with the fishermen as their reasons for disagreeing were very much related to disrupting fishing activities such as shrinkage of fishing ground, marine water pollution and disturbing fishing activities.

The business operators would view from the business perspective of providing an alternative route, thus reducing traffic congestion and making Pulau Pinang more developed and as long as it does not affect business but promoting it. For those who disagreed, more than half were afraid that it would affect their businesses, but they were not partial to the fate of the fishermen when quoting marine water pollution and disturbance to fishing activities.

To the beach users, it is not surprising that their main concern would be due to aesthetics with almost half of them citing the loss of the aesthetic value of the natural environment that they had been coming to the place to enjoy and that it would also affect the environment and causing disaster. Like the general public and the business operators, they were also seen to have thought of the fishing communities around the area when they quoted loss of source of income, marine water pollution and disturbance to fishing activities as some of the reasons for disagreement.

Nevertheless, two main reasons for agreeing stood out, which are its role of providing alternative route and thus reducing traffic congestion, and in making Pulau Pinang more developed. The concern for marine water pollution and affecting fishing activities seemed to be the reasons mentioned across the board by a section of the respondents.

Finally, the respondents were asked for their views on the overall development in their part of Penang Island. The responses reflected a mixed view, with the majority of the general public and business operators accounting for 60 and 66%, respectively believing it to be developing very fast, whilst at the same time commenting on more luxury homes being built as opposed to affordable homes. The latter was strongly felt by the fishermen respondents followed by the business operators, beach users and general public (T6.68). All these pointed to the level of exposure and amount of information filtered by the respective group of respondents.

T6.68 Perception of overall development in South Pulau Pinang (%)

Characteristics	Fishermen	General Public	Business Operators	Beach Users
Developing very fast	7.5	60.0	66.0	11.4
More luxury homes built than affordable homes	77.5	15.3	32.0	28.6
Progressing fast and clean	1.5	7.0	-	37.1
Too many development and hill-cutting	2.0	6.3	-	-
Good but need to limit development	-	4.7	-	-
Traffic congestion, flooding due to development	2.0	3.0	-	22.9
More development now than before	-	1.0	-	-
Increased cost of living	-	0.3	-	-
Disappearance of village atmosphere	-	0.3	-	-
Too many road repairs	-	-	2.0	-
To develop urban area not disturbing rural area	8.0	-	-	-
Government only focuses on mega project	1.5	-	-	-
No response/view	-	2.0	-	-

Source: Field data, 2016

6.4.2 Fishing Community in the Study Area

This section is written to briefly highlight the background and other related information regarding the local fishermen and their fishing activities in the area, as they would be the ones to be directly impacted. There are at four fishermen units fronting the sea of the proposed reclaimed area identified in the study area namely at Kampung Permatang Tepi Laut, Kampung Sungai Batu, Kampung Teluk Kumbar and Kampung Gertak Sanggul with most fishermen mooring their boats by the coasts (F6.122).

F6.122 Fishing jetties found at the study area. A: Tanjung Permatang Tepi Laut Jetty, B: Kampung Sungai Batu Jetty, C: Kampung Teluk Kumbar Jetty, D: Boats mooring at Kampung Nelayan/Teluk Kumbar, E: Kampung Gertak Sanggul Jetty, F: Boats mooring at Gertak Sanggul

The fishing villages directly fronting the proposed reclaimed area fall under four Fishermen Unit areas of Permatang Tepi Laut, Sungai Batu, Teluk Kumbar and Gertak Sanggul. Together they support 805 registered and approximately 135 unregistered fishermen. T6.69 shows the distribution of the registered fishermen in these four unit areas. By far Kampung Teluk Kumbar is the largest fishing village measured in terms of number of active fishermen with 233 fishermen, followed by Kampung Permatang Tepi Laut with 207 fishermen. Sungai Batu and Gertak Sanggul have an almost equal number of fishermen with 183 and 182 respectively.

T6.69 Number of fishermen in the study area by Fishermen Unit

Fishermen Unit	No.	Percent
Permatang Tepi Laut	207	25.7
Sungai Batu	183	22.7
Teluk Kumbar	233	29.0
Gertak Sanggul	182	22.6
Total	**805**	**100.0**

Source: Lembaga Kemajuan Ikan Malaysia, 2016

6.4.2.1 Characteristics of the Fishermen Respondents

The local fishermen were mainly (84.5%) owner-operators by using their own boats to ply the coastal waters to fish, whilst 15% turned out as *awak-awak* or hired workers to assist the owners out. More than 95% went fishing more than 10 times or days per month and spending more than five hours on each trip (T6.70).

T6.70 Nature of involvement as fishermen

Characteristics	Percent
Type of Involvement	
Owner-operator	84.5
Tekong (Skipper)	0.5
Awak-awak (worker)	15.0
Total	**100.0**
No. of Years Involved as Fisherman	
< 19 years	24.0
20-29 years	26.5
30-39 years	28.5
40-49 years	14.5
50+ years	6.5
Total	**100.0**
Mean (years)	**27.0**

Characteristics	Percent
Hour Spent Fishing/Day	
Up to 5 hours	5.5
6-10 hours	93.5
11+ hours	1.0
Total	**100.0**
Mean (hours)	**6.9**

Source: Field data, 2016

T6.71 shows that the main fishing gear used in the area is *pukat* or trawl. This is shown when almost all of the fishermen in the study area admitted to using them to fish although there were a few others who had utilised other fishing gears such as *bubu* or fish trap and cast net. Their main landings were fish, prawn and also crab.

T6.71 Type of fishing gears used and marine resources landed

Fishing Gears Used	Percent
Pukat	53.0
Kail, pukat	20.0
Jala, pukat	8.0
Pukat, bubu	7.5
Jala, pukat, bubu	4.0
Pukat hanyut/tunda	3.0
Combination of 3 or 4 gears	4.5
Total	**100.0**

Type of Landing	Percent
Prawn (*udang putih/kaki merah)*	88.0
Fish, prawn and crab	12.0
Total	**100.0**

Source: Field data, 2016

Being inshore fishermen, they did not reap in much a day. Our survey revealed that currently the majority (93.5%) landed less than 200 kg a month, which happened to be only 45% in the last 5 years and 41% in the last 10 years (T6.72). What the statistics are telling is that fish/ prawn landing had deteriorated significantly over the past 10 years, especially now when compared to 5 years ago.

Landing (kg)	Monthly Landing		
	Present	Last 5 years	Last 10 years
< 200	93.5	45.0	41.0
201-400	4.5	49.0	28.5
401-600	-	1.0	14.5
601-800	-	1.0	2.0
801-1,000	2.0	4.0	14.0
Total	**100.0**	**100.0**	**100.0**

T6.72
Respondents' monthly landings in the last 10 years (%)

Source: Field data, 2016

The fishermen did not go far to fish as all of them were inshore fishermen combing their own territorial waters right up to Pulau Rimau and Pulau Kendi (T6.73). As such, the proposed reclamation Project was seen by them as a threat in shrinking their fishing ground further after that of the Second Crossing or Bridge. Hence the notion of forwarding a request for compensation is carried out to the Project Proponent.

Our survey also tried to capture how the fishermen respondents, as the directly impacted group, opined on the changes and differences in their fishing activities after the implementation of the Penang Second Bridge project. Their responses are as listed in T6.74. Accordingly, more than half felt that the main impact was pollution from mud resulting in decline in marine resources and landings followed by or could be related to shrinkage of fishing ground, causing competition for space with other fishermen.

T6.73 Local fishermen's normal fishing ground

Fishing Ground	Percent	Distance from Coast	Percent
Coastal waters up to Pulau Rimau and Pulau Kendi	99.0	1-5 nautical miles	83.0
		10+ nautical miles	1.0
Deep sea	1.0	Depending on availability of catch	16.0
Total	**100.0**	**Total**	**100.0**

Source: Field data, 2016

Opinion	Percent
Marine water pollution	5.0
Shallowing of coastal waters	4.5
Deposition of mud affecting marine ecosystem and landings	78.5
Shrinkage of fishing ground had to compete with others	12.0
Total	**100.0**

T6.74
Respondents' opinion on the differences that occur in their fishing activities after the implementation of the Penang Second Bridge

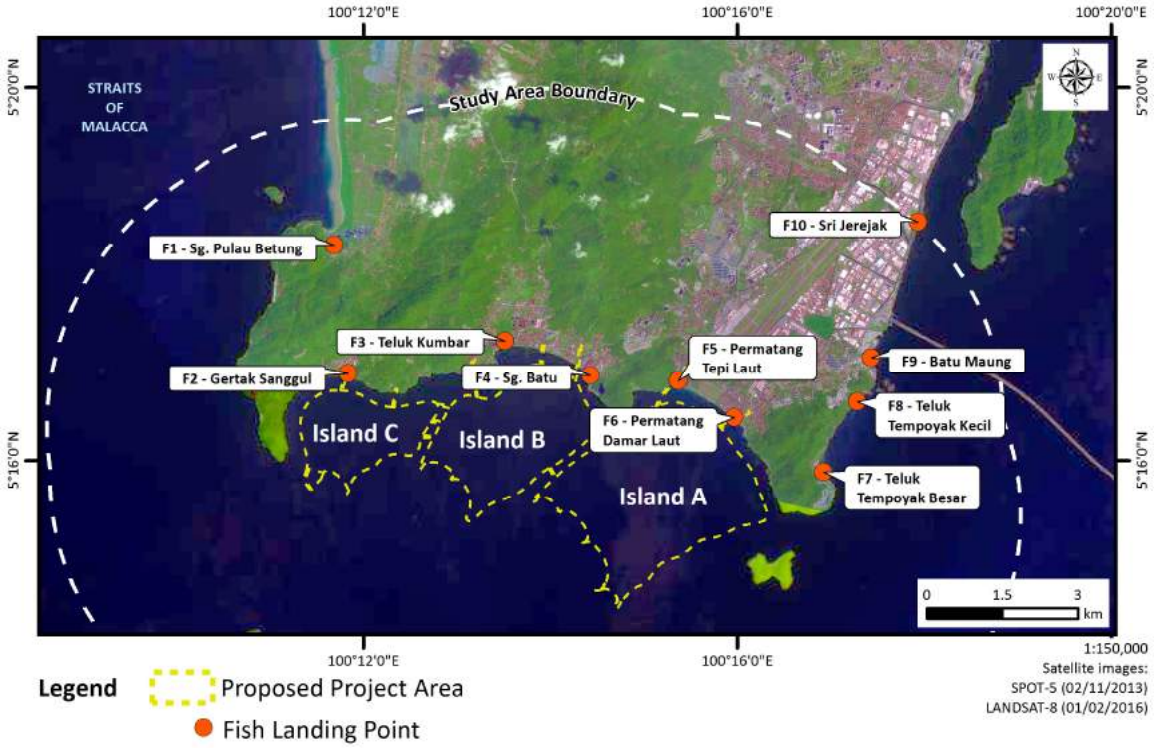
Source: Field data, 2016

Such an impact was further reflected in their opinion on how it will further impact them. To these respondents, the Second Penang Bridge had turned the former sandy beaches to muddy stretches which had encumbered them to go out fishing. But most importantly the polluted coasts or inshore waters would take a long time to rehabilitate, hence making it hard for marine resources especially fish and prawn to come back and breed naturally. Hence their notion that the proposed Project would further destroy the fish and prawn spawning area.

Last but not least, they were asked whether or not they had children working as fishermen. Slightly one-fifth had, with a majority (71.4%) had one member working and still others had two or three members working as fishermen, accounting for 23.8 and 4.8% respectively. When asked as to the reasons for the choice, the majority (78.6%) mentioned to help their family and it had been a tradition, an interest (14.3%) and the remaining 6.2% due to low education, being used to go out to sea and doing it part time. With such a background, fishing is seen to still being considered a traditional vocation for at least one-fifth of the next generation fishing communities. The following sections elaborate more on the fishing community and industry in detail.

6.4.2.2 Marine Capture Fisheries

This section is a detailed assessment of fisheries and the fishing community within the study area. The assessment was undertaken through discussions and interviews with sample fishing population at the study area. A questionnaire was prepared for this purpose (*Appendix D.3* in Volume 3: Appendices). The fishermen were interviewed from major fish landing points at the proposed Project area i.e. Sri Jerjak, Batu Maung, Teluk Tempoyak, Permatang Damar Laut, Sungai Batu, Teluk Kumbar, Gertak Sanggul and Pulau Betung (F6.123 and T6.75). The survey was undertaken from 14th to 19th January 2016, 2nd to 5th February 2016 and 10th to 12th March 2016.



F6.123 Fish landing points within the impact zone

T6.75 Location of the fish landing points within the impact zone

Fish Landing Point	Coordinates		Fishing Village
	Latitude (N)	Longitude (E)	
Sri Jerjak	5°18.608'	100°17.957'	Kampung Sungai Nibong, Kampung Sungai Kluang, Kampung Jawa and Kampung Sungai Tiram
Batu Maung	5°17.138'	100°17.466'	-
Teluk Tempoyak	5°16.625'	100°17.284'	Kampung Teluk Tempoyak
Permatang Damar Laut	5°15.877’	100°16.920’	Kampung Teluk Tempoyak
Sungai Batu	5°16.606’	100°15.792’	Kampung Permatang Damar Laut
Teluk Kumbar	5°16.863’	100°15.375’	Kampung Permatang Tepi Laut and Kampung Binjai
Gertak Sanggul	5°16.905'	100°14.429'	Kampung Sungai Batu
Pulau Betung	5°17.276'	100°13.516'	Kampung Nelayan

To cater for all fisheries-based stakeholders within the impact zone, the following FGDs were undertaken at several places (F6.124 to F6.127), which were:

a) 1st FGD: JKKK Hall, Kampung Sungai Batu for fishermen in 30th January 2016;
b) 2nd FGD: Fishermen Hall, Permatang Damar Laut for fishermen in 5th February 2016;
c) 3rd FGD: JKKK Hall, Teluk Kumbar for fishermen in 19th February 2016; and
d) 4th FGD: JKKK Hall, Gertak Sanggul for fishermen in 12th March 2016.

In addition, capture fisheries data was also requested from the Penang State Department of Fisheries, Fisheries Development Board (LKIM), *Persatuan Nelayan Kawasan* South of Penang Island.

F6.124
Interviews with fishermen.
A: Sri Jerjak, B: Batu Maung, C: Teluk Tempoyak, D: Permatang Damar Laut, E: Sungai Batu, F: Teluk Kumbar, G: Gertak Sanggul, H: Pulau Betung

F6.125 Focus Group Discussion (FGD) at Permatang Tepi Laut

F6.126 Focus Group Discussion (FGD) at Gertak Sanggul

F6.127 Focus Group Discussion (FGD) at Teluk Kumbar

6.4.2.2.1 Overview of Marine Capture Fisheries Industry

a) Fishing Infrastructure

■ Artisanal Fish Landing Points

The jetties at Sri Jerjak, Sungai Batu, Teluk Kumbar and Pulau Betung are of concrete. At Sri Jerjak and Sungai Batu (F6.128 to F6.130), the jetties are equipped with minimal facilities such as mooring site, treated water supply and beaching winch for loading purposes. The

jetties not only have minimal facilities, but are in a moderately satisfactory operating condition. Unfortunately, only a few fishermen use these facilities due to insufficient loading bays and lack of stairways. Most of the fisherman at these two jetties preferred to land on the beach.

F6.128
Fish landing points at Sri Jerjak

F6.129
Fish landing points at Sungai Batu

F6.130
Fish landing points at Pulau Betung

In addition, the existing concrete jetties at the same sites have been enhanced by fishermen themselves using wood based substitutes. These jetties are not rigid and are unstable for mooring the boats.

At Pulau Betung, the jetty was much more developed and equipped with the necessary fish-landing facilities such as loading bays, wharf, fish market and icemaker. The jetty appears fully utilised by the fishermen (F6.131). However, there is a lack of a beaching winch for loading purposes and there are limited vehicle parking facilities.

The concrete jetty at the fish-landing point at Teluk Kumbar (F6.132) is under-utilised. This is due to the location of the jetty, which is located far from the fish market. In addition, the jetty is also not equipped with landing facilities such as trolley, winches, mooring site and icemaker. Landings at this site commonly are made directly on the beach.

F6.131
Fish landing points at Teluk Kumbar

F6.132
Fish landing points at Batu Maung

Besides concrete jetties, wooden jetties were also observed at several fish landing points such as Batu Maung, Teluk Tempoyak Kechil, Teluk Tempoyak Besar, Permatang Tepi Laut and Gertak Sanggul (F6.133 to F6.136). At Batu Maung, Teluk Tempoyak Besar and Permatang Tepi Laut, the jetties did not have solid foundations and were equipped with minimal landing facilities. As for Teluk Tempoyak Kechil and Gertak Sanggul, the jetties were

of much poorer operational condition and on the verge of collapse. Fishermen in these areas landed their catch directly on the beach. At Permatang Damar Laut, there was no fishing jetties (F6.137). Landings at this site was made directly on the beach.

F6.133
Fish landing points at Teluk Tempoyak Besar

F6.134
Fish landing points at Permatang Tepi Laut

F6.135
Fish landing points at Teluk Tempoyak Kecil

F6.136
Fish landing points at Gertak Sanggul

F6.137
Fish landing points at Permatang Damar Laut

Overall, most of landing points were bereft of infrastructure for handling and storage of fish, treated water supply, sewerage and wastewater links, solid waste collection systems and limited parking facilities.

- Commercial Fish Landing Point

As mentioned earlier, the LKIM complex at Batu Maung incorporating the Malaysian International Tuna Port complex is the only major commercial fish landing point in the study area. The complex has a capacity to cater for long side mooring of large fishing vessels, including foreign tuna vessels fishing in the Indian Ocean as well as commercial fishing vessels, such as trawlers and purse seiners, operating within state waters. Substantial fisheries infrastructure have been provided in this complex including ice plants, cold room, fish auction and dedicated packing areas.

b) Fishing Population

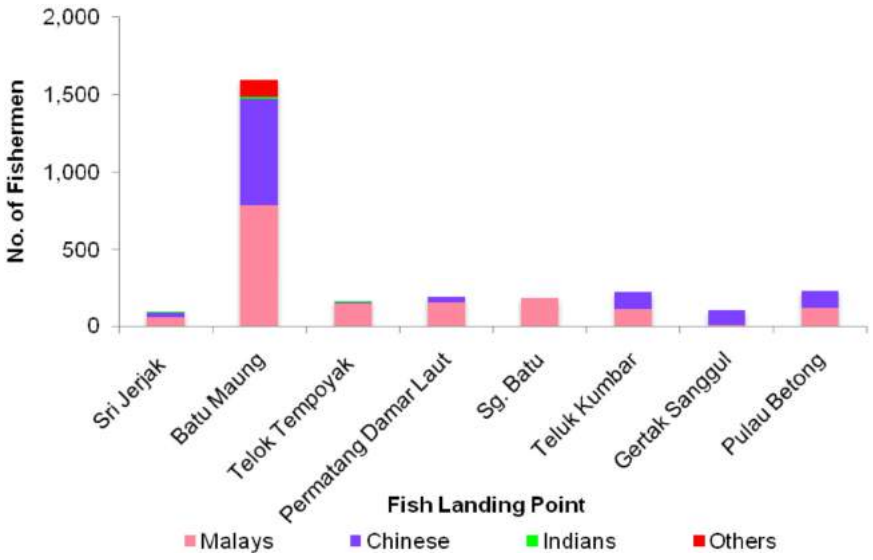
■ Physical and Ethnic Distribution

In 2015, a total of 2,757 licensed fishermen operated within the impact zone. The highest number of licensed fishermen was at LKIM Batu Maung with 1,591 fishermen, accounting for 57.7% of the total fishermen in the impact zone. This is followed by Pulau Betung (226 fishermen: 8.2%) and Teluk Kumbar (220 fishermen: 8.0%) (T6.76 and F6.138). The other fish landing points only had 92 to185 full-time fishermen.

T6.76 Number of fishermen working in licensed vessels by ethnic groups in impact zone, 2015

Fish Landing Point	No. of Fishermen				
	Malays	Chinese	Indians	Others	Total
Sri Jerjak	52	30	10	0	**92**
Batu Maung	785	682	11	113	**1,591**
Teluk Tempoyak	145	10	2	0	**157**
Permatang Damar Laut	150	35	0	0	**185**
Sungai Batu	180	0	0	0	**180**
Teluk Kumbar	108	112	0	0	**220**
Gertak Sanggul	10	96	0	0	**106**
Pulau Betung	120	106	0	0	**226**
Total	**1,550**	**1,071**	**23**	**113**	**2,757**

Note: Data for Teluk Tempoyak Besar and Teluk Tempoyak Kecil are registered under Teluk Tempoyak, Permatang Tepi Laut is registered under Permatang Damar Laut
Source: Department of Fisheries, Penang, 2016 - unpublished



Source: Department of Fisheries, Penang, 2016 - unpublished

F6.138
Fishing population within the impact zone

Most of fishermen were Malays, constituting 56.2% of the total fishing population, followed by Chinese (38.8%) and foreigners (mainly Indonesians) (4.1%). The highest number of Malay fishermen was recorded at LKIM Batu Maung (785 fishermen), while lowest was at Gertak Sanggul (10 fishermen). The majority fishermen at Gertak Sanggul were Chinese (DOF, 2016 - *unpublished*). Indian fishermen were only recorded at LKIM Batu Maung (11

fishermen), Sri Jerjak (10 fisherman) and Teluk Tempoyak (two fishermen) (DOF, Penang, 2016 - *unpublished*).

Most foreign fishermen registered at LKIM Batu Maung worked as fishing crew for tuna long-line boats. The highest number was Indonesians (63 fishermen), followed by Filipinos (22 fishermen), Chinese (11 fishermen) and Taiwanese (one fisherman). In addition, there were also 34 Thai fishermen who worked for trawler boats operating from the LKIM Batu Maung base (DOF, 2016 - *unpublished*).

The database for licensed fishermen differed from that registered as members of Fishermen's Association (FA). The absence of detailed data on the names of both the licensed and the FA members means that the actual number that overlaps both databases cannot be ascertained.

A total of 1,575 persons within the impact zone was also registered as member of the Fishermen's Association (*Persatuan Nelayan* South of Penang Island). In 2015, only 1,261 persons were paying members (there is a membership fee of RM3 a year). The balance of 314 persons had not made payment extending their membership beyond 2014.

Most of the registered members for 2015-2017 were Malays i.e. 846 persons, followed by Chinese with 413 persons, while only two Indians registered. Before 2015, the membership was also dominated by Malays with 212 persons, while Chinese and Indians recorded 99 persons and three persons respectively (South Penang Fishermen Association, 2016 - *unpublished*).

LKIM provided detailed data on the number of fishermen that received fuel subsidy and cost of living allowances (COLA/ESH) based in Permatang Damar Laut, Sungai Batu, Teluk Kumbar and Gertak Sanggul. In these four areas, a total of 276 fishermen claimed for the fuel subsidy, while 495 fishermen were registered for the COLA/ESH (LKIM, 2016 - *unpublished*). The differences in the figures provided by the Department of Fisheries (DOF), the *Persatuan Nelayan* and LKIM are accounted by the fact that there is no legal definition of "fisherman" in any of the three Acts that relate to the fisheries industry i.e. Fisheries Act, 1985 (Amended 1991), LKIM Act, 1972 and Akta Persatuan Nelayan, 1972.

The DOF licenses fishermen as a precondition of a boat licence. The "*Lesen Nelayan"* does not identify fishermen as being active; only that he has been fishing at the time the licence was issued. The *Persatuan Nelayan* is a voluntary organisation and fishermen are encouraged, but not compelled, to join it. The LKIM subsidy count is probably the most accurate indicator of active fishermen, since the subsidy is only dispensed when fishermen are licensed by the DOF, are members of the *Persatuan Nelayan* and have declared their catch.

- Age Profile of Fishermen

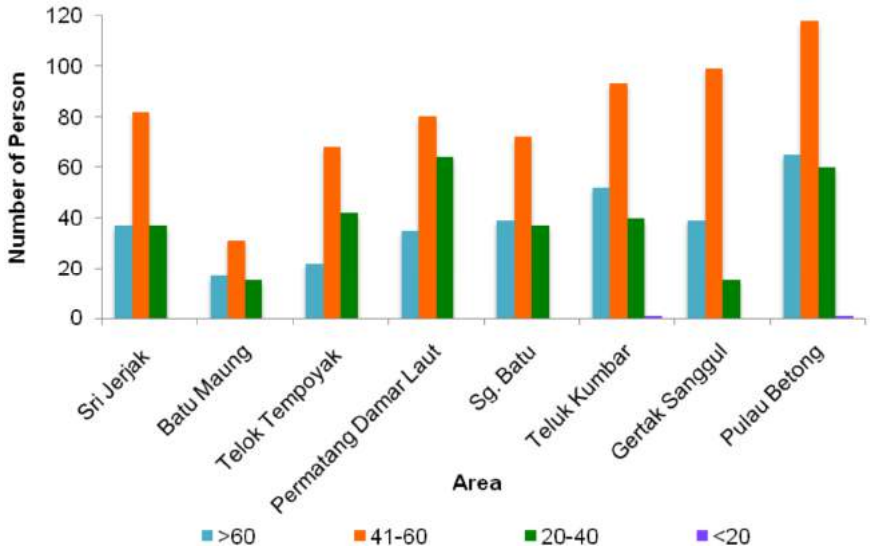
From the survey that was carried out, the age of fishermen varied between 20 to 90 years old. Most, however, were within 41 to 60 years old. The survey findings are supported by the membership records of the PNPPS, which indicated 51% to be within this age. For the members within 20 to 40 years old and above 60 years old, the numbers were recorded at 310 persons and 306 persons respectively (T6.77 and F6.139).

A high percentage (35.8%) of those aged below 40 was recorded from Permatang Damar Laut, Teluk Tempoyak (31.8%) and Sungai Batu (25%). Older members (above 60 years old) were prominent in Teluk Kumbar (28.0%), Batu Maung (27.0%) and Pulau Betung (26.6%). Only two persons were recorded below 20 years old; one at Teluk Kumbar and another one at Pulau Betung (South Penang Fishermen Association, 2016 - *unpublished*).

T6.77 Age profile of the members of Fishermen Association in South of Penang Island

Fish Landing Point	Registered for 2015-2017				Registered Before 2015 (2004-2014)				Total
	>60	41-60	20-40	<20	>60	41-60	20-40	<20	
Sri Jerjak	37	82	37	0	19	15	7	0	**197**
Batu Maung	17	31	15	0	28	18	10	0	**119**
Teluk Tempoyak	22	68	42	0	11	26	14	0	**183**
Permatang Damar Laut	35	80	64	0	2	18	8	0	**207**
Sungai Batu	39	72	37	0	11	17	7	0	**183**
Teluk Kumbar	52	93	40	1	11	26	10	0	**233**
Gertak Sanggul	39	99	15	0	3	18	8	0	**182**
Pulau Betung	65	118	60	1	5	16	6	0	**271**
Total	**306**	**643**	**310**	**2**	**90**	**154**	**70**	**0**	**1,575**

Source: Department of Fisheries, Penang, 2016 - unpublished



Source: Department of Fisheries, Penang, 2016 - unpublished

F6.139

Age profile of the members of Fishermen Association in South of Penang Island, 2015-2017

c) Fishing Fleet

In 2015, there was a total of 733 fishing boats licensed in the study area (F6.140). Most worked small boats powered by outboard engines (650 units or 94.0%). The highest number of outboard-powered boats was recorded from Teluk Kumbar (129 units) and Pulau Betung (109 units). The vessel count at other fish-landing points ranged from 50 to 91 units (DOF, Penang, 2016 - *unpublished*). Most of the boats were operated using 30 to 60 HP engines.

On the other hand, inboard powered boats were only recorded from LKIM Batu Maung (77 units), Gertak Sanggul (4 units) and 1 unit each at Permatang Damar Laut and Teluk Kumbar (T6.78). Out of 77 units of inboard powered boats registered in LKIM Batu Maung, six were 70 GRT and above and operated in offshore waters (DOF, Penang, 2016 - *unpublished*).

F6.140
Fishing fleets in south of Penang Island. A: Sri Jerjak, B: Teluk Tempoyak, C: Sungai Batu, D: Teluk Kumbar, E: Gertak Sanggul, F: Pulau Betung, G-H: LKIM Batu Maung

Fish Landing Point	No. of Fishing Boat		Total
	Outboard	Inboard	
Sri Jerjak	50	0	50
Batu Maung	40*	77	117*
Teluk Tempoyak	85	0	85
Permatang Damar Laut	91	1	92
Sungai Batu	90	0	90
Teluk Kumbar	129	1	130
Gertak Sanggul	56	4	60
Pulau Betung	109	0	109
Total	**650***	**83**	**733***

T6.78
Number of licensed fishing boat at the study area (2015)

Note: Data for Teluk Tempoyak Besar and Teluk Tempoyak Kecil are registered under Teluk Tempoyak, Permatang Tepi Laut is registered under Permatang Damar Laut
*Estimated
Source: DOF, Penang, 2016 - unpublished

d) Fishing Gear

In 2015, there were 1,389 licensed fishing gears in the study area (T6.79). Both commercial and artisanal gears were employed. Commercial gear included trawl nets and tuna longlines, while drift/gill nets, hook and lines and bag nets were common in the artisanal fisheries sub-sector. The trawl nets and tuna longlines were only registered at LKIM Batu Maung and were employed using inboard powered boats. The major artisanal gear registered at all fish landing points were drift/gill nets (1,319 units), which contributed 95% of the total gear count. Hook-and-line was only registered at Teluk Tempoyak (1 unit), while bag nets were licensed to operate at Batu Maung (5 units) and Pulau Betung (1 unit). Overall, the highest numbers of licensed fishing gears were recorded from Batu Maung (773 units), while the lowest from Sri Jerjak (50 units) (DOF, Penang, 2016 - *unpublished*).

T6.79 Number of licensed fishing gear at the study area (2015)

Fish Landing Point	Commercial Gear		Artisinal Gear			Total
	Trawl Net	Tuna Long-line	Drift Net	Hook and Lines	Bag Net	
Sri Jerjak	0	0	50	0	0	**50**
Batu Maung	57	6	705	0	5	**773**
Teluk Tempoyak	0	0	84	1	0	**85**
Permatang Damar Laut	0	0	92	0	0	**92**
Sungai Batu	0	0	90	0	0	**90**
Teluk Kumbar	0	0	130	0	0	**130**
Gertak Sanggul	0	0	60	0	0	**60**
Pulau Betung	0	0	108	0	1	**109**
Total	**57**	**6**	**1,319**	**1**	**6**	**1,389**

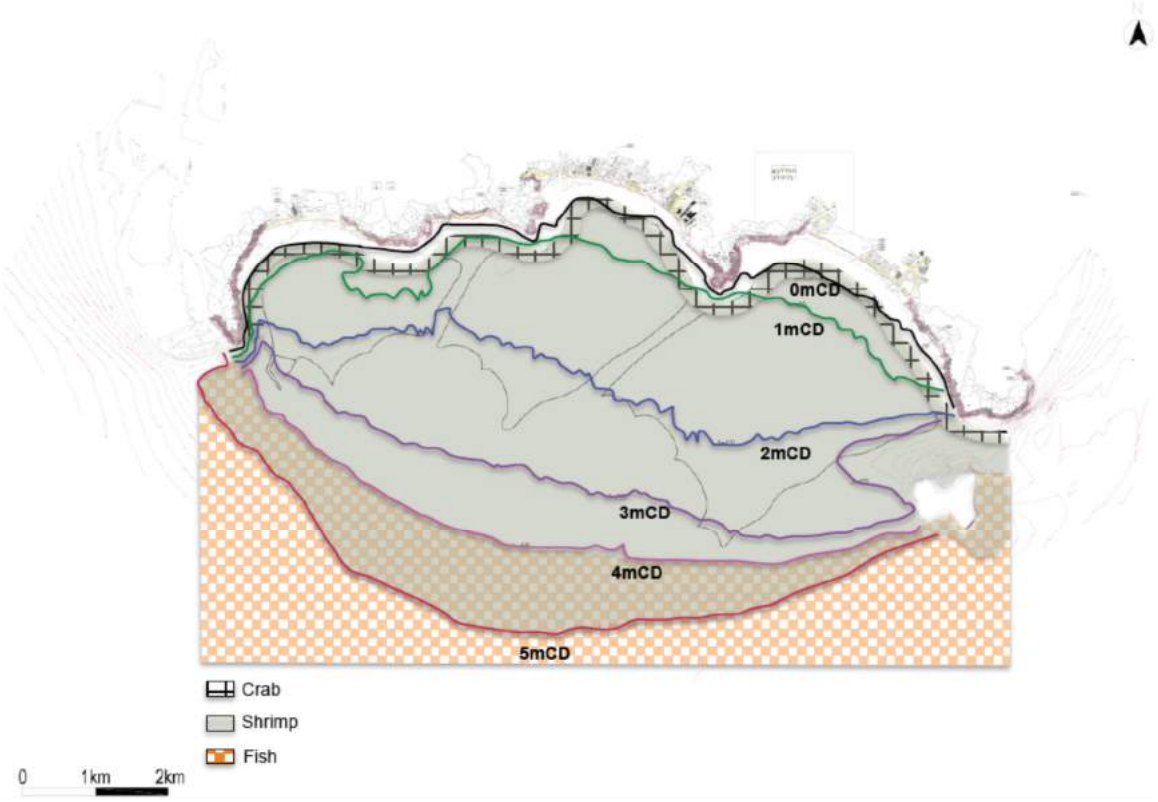
Note: Data for Teluk Tempoyak Besar and Teluk Tempoyak Kecil are registered under Teluk Tempoyak, Permatang Tepi Laut is registered under Permatang Damar Laut
Source: Department of Fisheries, Penang, 2016 - unpublished

Based on the survey undertaken in January until March 2016, among the major gears used for outboard vessels were bottom gill nets (e.g. *Pukat Udang, Pukat Kedera, Pukat Hantu, Pukat Jenahak, Pukat Kerapu* and *Pukat Ketam*), followed by surface drift nets (*Pukat Bawal, Pukat Senangin, Pukat Temenong*). Other gears employed were long-lines (*rawai umpan*), rod and lines and portable traps (F6.141). As for inboards, besides drift nets, trawl nets were commonly used, particularly from Batu Maung.

F6.141 Fishing gears employed in south of Penang Island. A: Trammel Net ("*Pukat Udang*"), B: Drift Net ("*Pukat Temenong*"), C: Long-lines ("*Rawai*")

e) Fishing Practice and Fishing Grounds

Fishing activities were undertaken extensively within the proposed reclamation area as well in within the surrounding sea. The fishing area within the impact zone is provided in F6.142. The survey indicated that a significant level of the landings was by artisanal fishermen within the impact zone. Fishing was carried out for 10 to 30 days/month, with more than 80% of the fishermen active for 20 to 25 days/month. The number of fishing can vary depending on the weather, season, type of fishing boat and engine capacity (HP), type of fishing gears and resource availability.



F6.142 Fishing grounds at the study area

The fishing grounds can be divided into three zones. The closer fishing zone i.e. 300 to 500 m from existing low water line is focus for crab fishing. Two main species of crabs are caught i.e. Ketam Bunga (Swimming Crab or *Portunus* spp.) and Ketam Mere (Crucifix Crab or *Charybdis* spp.). Single-layer drift nets with a 10 cm mesh are used to catch crabs. Commonly, the sizes of nets employed have a 200 m length and 1.5 m depth. The nets are commonly set at 4:00 pm to 5:00 pm and drawn the next morning. The peak season for crab fishing is in April to June, where the catch recorded around 500 to 600 crabs/shot as compared to 100 to 200 crabs/shot for the rest of the year.

The second zone is at depths between 1.5 to 6.0 m, where shrimps catch were actively carried out. The shrimp grounds can be found up to 2 to 3 nautical miles from the shore, especially during flood tide. There is no specific season for the shrimp fishery. Catch yield is all-year with declines in March to April. A 100 m net shot for 15 to 30 minutes can provide a catch of 1 kg.

In a meeting with the Department of Fisheries (DOF) on 15th March 2019, Fisheries Research Institute (FRI) informed that beam trawl surveys indicated that there were *udang baring/geragau* (*Acetes* sp.) in nearshore waters off the proposed Island A. While there was a *Acetes* fishery off Teluk Kumbar/Gertak Sanggul area in the 1970s (S. Selvanathan, former FRI officer pers. comm., 19th March 2019), it collapsed during the late 1980s, together with the shrimp paste (*belacan*) factories that it supported.

Though FRI did point out the presence of push nets in the area, our survey data obtained in 2016 indicates that there are no appreciable *Acetes* fishery at the study area. The *Acetes* shrimp are not consumed directly but used as the raw material for the fish processing industry such as *cencaluk*, dried shrimp or shrimp paste (*belacan*). Such industry also does not occur at the study area at the time of the baseline data survey in 2016.

f) Landings and Species

■ Catch Profile

About 58 species of fish, seven species of shrimp and three species of cephalopods and two species of crab were caught at the study area (T6.80). Pelagic fish such as Pelaling/ Temenong (*Rastrelliger* spp.), Bawal (*Pampus argentius*/*Pampus chinensis*/*Pampus* spp./ *Parapampus* spp.) and Senangin (*Polynemus* spp.) were the major fish species caught, particularly at Teluk Tempoyak Besar and Pulau Betung. As for demersal species, the major species caught were Gelama (*Johnius* spp./*Pennahia* spp./*Otolithes* spp.) and Duri (*Arius* spp.).

T6.80 List of fish landed from the study area (2015)

Local Name	Common Name	Scientific Name
Kebasi/Selangat	Chacunda shad	*Anodontostoma chacunda*
Beliak Mata	Elongated ilisna	*Ilisha elongata*
Lidah	Tonguefish	*Cynoglossus* spp.
Sebelah	Flatfish	*Psedorhombus* spp.
Biji Nangka	Goat fish	*Upenus* spp./*Parupeneus* spp.
Daun Baharu	Spotted batfish	*Drepane puntaca*
Dengkis/Debam	Rabbit fish	*Siganus* spp.
Duri/Pulutan/Utik	Marine catfish	*Arius* spp.
Gelama/Tengkerong	Croaker	*Johnius* spp./*Pennahia* spp./*Otolithes* spp.
Gerut-Gerut	Grunter	*Pomadasys* spp.
Jahan/Goh	Giant seacatfish	*Arius thalassinus*
Jebong	Trigger fish	*Abalister stellaris*
Jenahak	John's snapper	*Lutjanus johni*
Kaci	Sweetlips	*Plectorhinchus* spp.
Kapas Laut	Majorras	*Gerres* spp.
Kerapu	Grouper	*Epinephelus* spp.
Kerisi	Threadfin bream	*Nemipterus* spp.
Kikek	Ponyfish	*Leiognathus* spp./*Secutor* spp.
Malong	Conger eel	*Muraenesox* spp.
Merah	Red snapper	*Lutjanus malabaricus*
Mengkerong/Conor	Lizard fish	*Saurida* spp.
Puntong Damar/Bulus	Sillago-whitings	*Sillago* spp.
Semilang	Eel catfish	*Plotosus* spp.
Tanda	Russel's snapper	*Lutjanus russelli*
Temenggong/Lara Bara	Red bigeye	*Priachantus macrachantus*
Ikan Buntal	Puffer fish	*Lagocephalus* spp./*Tetraodon* spp./ *Chelonodon* spp./*Xenopterus* spp.
Alu-Alu/Kacang-Kacang	Barracuda	*Sphyraena* spp.
Aruan Tasik	Cobia	*Rachycentron canadum*
Bawal Hitam	Black pomfret	*Parastromateus* spp.
Bawal Putih	Silver pomfret	*Pampus argentius*
Bawal Tambak	Chinese silver pomfret	*Pampus chinensis*
Bawal Selatan	Small pomfret	*Pampus* spp.

T6.80 List of fish landed from the study area (2015) (cont'd)

Local Name	Common Name	Scientific Name
Belanak/Kendera	Mullets	*Liza* sp.
Cermin/Sagai/Cupak	Trevally	*Alectis indicus*
Cincaru	Hardtail scad	*Megalaspis cordyla*
Senangin	Threadfin	*Polynemus* spp.
Senangin Buis	Threadfin	*Polydactylus sextarius*
Kerepoh	Bigeye trevally	*Caranx sexfasciatus*
Lolong	Ox-eye scad	*Selar boops*
Selar	Yellowtail scad	*Alepes* spp.
Pelata	Yellowtail scad	*Atule mate*
Selar Kuning	Rainbow runner	*Elagatis bipinnulatus*
Selayang/Curut	Round scad	*Decapterus* spp.
Talang	Queen fish	*Scomberoides* spp.
Tamban Sisek	Fringescale sardine	*Sardinella frimbriata*
Tamban Buluh Bulat	Rainbow sardine	*Dussumieris* spp.
Bilis/Bunga Air	Anchovy	*Stolephorusas* spp.
Parang-Parang	Wolf herring	*Chirocentrus dorab*
Aya/Tongkol/Aya Hitam	Longtail tuna	*Thunnus tonggol*
Aya/Tongkol/Aya Kurik	Eastern little tuna	*Euthynnus affinis*
Tenggiri	Spanish mackerel	*Scomberomorus* spp.
Kembong	Indian mackerel	*Rastrelliger kanagurta*
Pelaling/Temenong	Mackerel	*Rastrelliger* spp.
Timah/Layor/Selayor	Ribbon fish	*Lepturacanthus* spp.
Yu	Shark	*Carcharhinus* spp./*Sphyrna* spp.
Pari/Ketuka	Rays	*Dasyatis zugei*
Pari	Rays	*Himantura* spp./*Gymnura* spp./*Myliobatis* spp./*Aetobabus* spp./*Dasyatis* spp.
Ikan Baja	Trash fish	-
Ikan Campur	Mixed fishes	-
Ketam Laut	Swimming crab	*Potunus* spp.
Ketam Renjong	Swimming crab	*Potunus pelagicus*
Udang Harimau	Tiger prawn	*Panaeus monodon*
Udang Putih	Banana prawn	*Penaeus merguiensis*/*P. indicus*/ *Metapenaeus lysianassa*
Udang Kaki Merah/Sua Lor	Red prawn	*Solenecera subnuda*
Udang Kulit Keras	Rainbow prawn	*Parapenaeopsis sculptilis*
Udang Cendana Rotan	Sharp rostrum prawn	*Parapenaeopsis hungerfordi*
Udang Pasir	Sand prawn	*Metapeneopsis stridulans*/*M. berbeensis*/ *Trachypenaeus fulvus*
Udang Lipan	Mantis shrimp	*Squilla* spp.
Sotong Biasa/Cumit	Common squid	*Loligo* spp.
Sotong Katak	Cuttle fish	*Sepia* spp.
Sotong Kereta	Octopus	*Octopus* spp.

Source: Department of Fisheries, Penang, 2016 - unpublished

Besides finfish, shrimps and crabs also constitute another important component of marine resources exploited from South Penang's waters. Udang Putih (*Penaeus merguiensis)* was the dominant the shrimp species caught in the area, while the main crab species was Ketam Bunga (*Portunus* spp.) and Ketam Mere (*Charybdis* spp.). In a meeting with the Department of Fisheries on 15th March 2019, it was indicated that the area is a crucial transit ground for the east west migration of the greasyback shrimp (*Metapenaeus ensis*). However, the *M. ensis* is generally found in deeper waters and usually the target of trawlers. It was not reported as being within the catch profile of the coastal fishermen operating in the study area. It is conceivable that the mudflat does serve as transit for the east-west migration of the shrimp larvae but there is no published data to that effect. Discussions with other expertise (Dr. A. Sasekumar, retired professor, marine ecology; 17th March 2019, University of Malaya and Dr. Harinder Singh, lecturer, marine ecology UiTM, 20th March, 2019) suggest that the data is currently inadequate to identify the precise role of the mudflats that are to be reclaimed, play in the *M. ensis* migration.

According to the fishermen interviewed during the course of this study, about two to three persons at Teluk Tempoyak and Permatang Damar Laut were involved in the collection of shellfish. Among the major species of shellfish collected were Siput Sudu/Kupang (*Perna viridis)*, Kemudi (*Pinna bicolor*), Kepah (*Meretrix meretrix*) and Siput Belitong (*Terebralia sulcata*). Normally, shellfish collection was undertaken for around two to four hours. It was estimated around 5 to 20 kg/hour of shellfish could be collected at any one time, depending on the species. Besides the collection of shellfish, Pulau Betung is also active in catching horseshoe crabs (*Trachypleus* spp.). The horseshoe crabs caught were used for self-consumption or sold at RM1 to RM2 each.

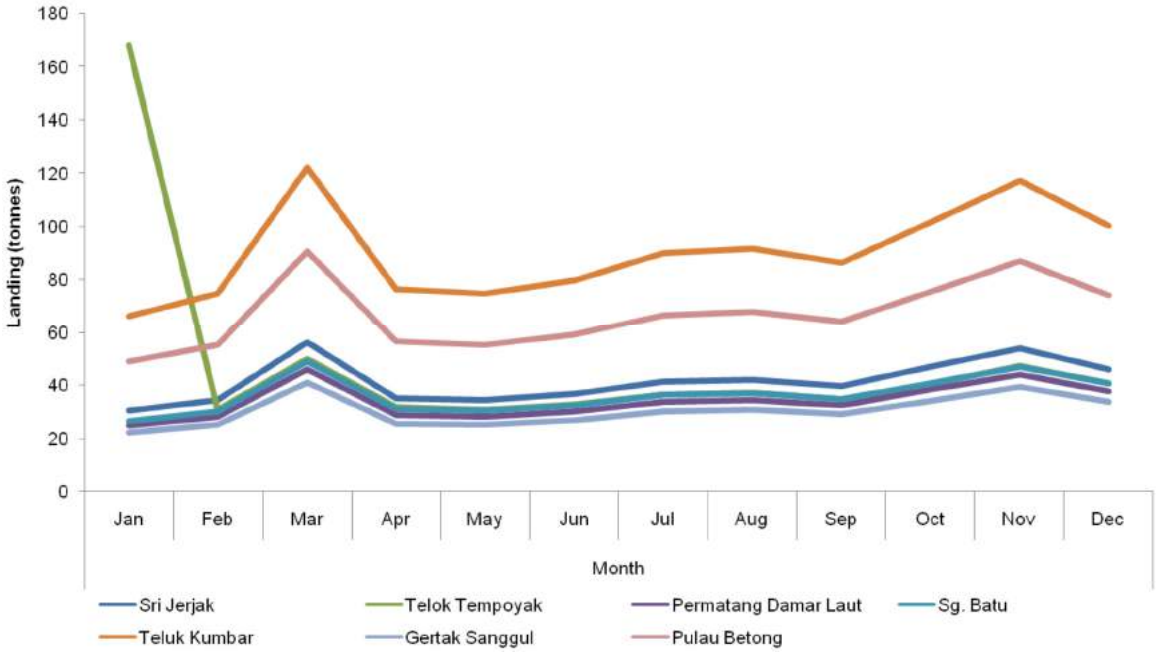
T6.81 Fish landing (tonnes) by month at the impact zone, 2015

Landing Points	Month							Total
	Sri Jerjak	Teluk Tempoyak	Permatang Damar Laut	Sungai Batu	Teluk Kumbar	Gertak Sanggul	Pulau Betung	
January	30.42	168.25	24.96	26.58	66.27	22.23	49.14	**387.85**
February	34.32	30.76	28.16	30.30	74.9	25.08	55.44	**278.96**
March	56.16	49.92	46.08	48.92	122.28	41.04	90.72	**455.12**
April	35.10	31.69	28.8	31.10	76.65	25.65	56.70	**285.69**
May	34.32	30.67	28.16	30.37	74.93	25.08	55.44	**278.97**
June	36.66	32.54	30.08	32.35	80.00	26.79	59.22	**297.64**
July	41.34	36.33	33.92	36.38	90.17	30.21	66.78	**335.13**
August	42.12	37.07	34.56	36.97	91.83	30.78	68.04	**341.37**
September	39.78	34.65	32.64	34.64	86.61	29.07	64.26	**321.65**
October	46.8	40.14	38.40	40.72	101.88	34.20	75.60	**377.74**
November	53.82	47.28	44.16	47.01	117.24	39.33	86.94	**435.78**
December	46.02	40.67	37.76	40.62	100.43	33.63	74.34	**802.62**
Total	**496.86**	**579.97**	**407.68**	**435.96**	**1,083.19**	**363.09**	**802.62**	**4,169.37**

Source: Department of Fisheries, Penang, 2016 - unpublished

- Catch Volume

In 2015, fish landings in the study area amounted to 4,169.37 tonnes, excluding the landing from LKIM Batu Maung as they do not come from nearby waters, but from distant and offshore waters. The highest fish landing was recorded at Teluk Kumbar with 1,083.19 tonnes, and contributed 26% of the total fish landing, followed by Pulau Betung (802.62 tonnes: 19.3%) and Teluk Tempoyak (579.97 tonnes; 13.9%). Fish landing at other landing points ranged from 363.09 to 496.86 tonnes. In terms of months, the highest fish landing was recorded during March 2015 with 455.12 tonnes, followed by November 2015 (435.78 tonnes) and January 2015 (387.85 tonnes) (T6.81).



F6.143 Trend of fish landing (tonnes) by month at the impact zone, 2015

The landings at most of the fish-landing points recorded increased from January to March 2015, decreased during May 2015 and increased again in August 2015. However, in September 2015, the landing slightly decreased, but increased in November 2015 before decreasing again in December 2015 (F6.143) (DOF, Penang, 2016 - *unpublished*).

Fish landings in the study area in 2015 were slightly lower than in 2014, when it amounted to 4,212.07 tonnes. The highest landing that year was recorded in July (405.38 tonnes), followed by April (392.06 tonnes) and September (385.64 tonnes). As in 2015, Teluk Kumbar and Pulau Betung recorded the highest landings (1,132.17 tonnes and 841.98 tonnes) as compared to other fishing bases (379.62 to 519.48 tonnes) (DOF, Penang, 2016 - *unpublished*).

From the survey, the highest landing recorded per boat was 500 kg and the lowest was 1 to 2 kg. As for shrimps and crabs, the catch was normally around 5 to 10 kg and 5 to 7 kg per boat respectively. On average, the gross income per day per fisherman is around RM100 to RM150, depending on the fishing effort, weather, location (fishing ground) and type of fishing gears used.

- Value

In 2015, the wholesale value of fish landed at the study area was estimated at RM42.09 million, which amounted to 12.4% of the total wholesale value of fish landings (RM339.21 million) from Penang Island (Barat Daya and Timur Laut) (DOF, Penang, 2016 - *unpublished*). The value was contributed by several commercial species such as Bawal (*Pampus argentius* / *Pampus chinensis* / *Pampus* spp. / *Parapampus* spp.), Senangin (*Polynemus* spp.), Kerapu (*Epinephelus* spp.), Jenahak (*Johnius* spp.) and Udang Putih *Besar* (*Penaeus merguensis*) (F6.144). Based on interviews undertaken at the study area, the wholesale price of Bawal, Senangin, Kerapu, Jenahak and Udang Putih ranged from RM30 to RM65/kg, RM15 to RM22/kg, RM40 to RM42/kg, RM30 to RM32/kg and RM38 to RM60/kg, respectively with the highest price recorded during Chinese New Year.

F6.144
Fish landings in south of Penang Island. A – B: Udang Putih (*Penaeus merguiensis*), C: Gelama (*Johnius* spp. / *Pennahia* spp. / *Otolithes* spp.), D: Ketam Bunga (*Portunus* spp.) and Bawal (*Pampus argentius* / *Pampus chinensis* / *Pampus* spp. / *Parapampus* spp.)

6.4.2.2.2 Survey Findings

A total of 250 respondents were interviewed during the survey. The outcome of the survey is as follows.

a) Fishing Population

- Physical and Ethnic Distribution

The ethnic distribution of the respondents followed the ethnic breakdown of the general population of the various fish landing points. The majority of the respondents consisted of Malays (71.6%) with Chinese fishermen accounting for 28.4%. Chinese fishermen were more predominant in fish landing points like Batu Maung and Gertak Sanggul. Of the 250 respondents that were successfully interviewed, 91.2% of the fishermen were fishing full-time, while the remaining 8.8% were part time fishermen (T6.82).

T6.82 The distribution of fishermen surveyed according to their occupational status and ethnicity

Fish Landing Point	Fishermen Surveyed (Frequency)	Occupational Status (%)		Ethnic (%)	
		Full-time	Part-time	Malay	Chinese
Sri Jerjak	32	11.6	1.2	10	2.8
Batu Maung	37	14.8	-	6.4	8.4
Teluk Tempoyak Kechil	21	7.2	1.2	7.6	0.8
Teluk Tempoyak Besar	9	3.6	-	3.6	-
Permatang Damar Laut	9	3.6	-	3.6	-
Permatang Tepi Laut	29	11.6	-	11.6	-
Sungai Batu	21	6.4	2	8.4	-
Teluk Kumbar	30	8.8	3.2	9.2	2.8
Gertak Sanggul	30	10.8	1.2	3.6	8.4
Pulau Betung	32	12.8	-	7.6	5.2
Total (%)		**91.2**	**8.8**	**71.6**	**28.4**

Note: Population surveyed = 250 respondents

Part-time fishermen were only found at five fish landing points as listed in T6.83. Part-time fishermen were either boat owners or boat crew ("*Awak-Awak*"). The majority of the part-timers (70%) were boat crew, whilst the remaining 27.3% owned a boat. Boat owners usually rented out their boats or had fishermen working for them.

T6.83 The distribution status of part-time fishermen surveyed according to occupation

Fish Landing Point	Status	
	Boat Owner (%)	Assistant (%)
Teluk Tempoyak Kechil	4.5	9.1
Sungai Batu	-	22.7
Teluk Kumbar	9.1	27.3
Gertak Sanggul	13.6	-
Sri Jerjak	-	13.6
Total (%)	**27.3**	**72.7**

Note: Total part time fishermen = 22 persons

■ Age Profile of Fishermen

Only 14.8% of the respondents were over 60 years old, 18% between 31 to 40 years and 7.6% between 20 to 30 years, respectively (T6.84). The majority of the fishermen surveyed were between 41 to 50 (34%) and 51 to 60 (25.6%) years old. This age pattern was quite similar among all fish-landing points.

T6.84 Distribution of age categories of surveyed fishermen by age cohort and fish landing point

Fish Landing Point	Age Categories (%)				
	20 – 30	31 – 40	41 – 50	51 – 60	> 60
Sri Jerjak	1.2	1.2	5.6	2.4	2.4
Batu Maung	0.4	2.4	4.4	5.2	2.4
Teluk Tempoyak Kechil	0.4	0.8	4.4	2.0	0.8
Teluk Tempoyak Besar	0.8	-	2.0	0.8	-
Permatang Damar Laut	-	-	2.8	0.8	-
Permatang Tepi Laut	1.6	3.6	3.2	1.2	2.0
Sungai Batu	0.8	2.0	2.4	1.6	1.6
Teluk Kumbar	1.2	4.0	2.4	2.8	1.6
Gertak Sanggul	-	2.0	3.2	6.0	0.8
Pulau Betung	1.2	2.0	3.6	2.8	3.2
Total (%)	**7.6**	**18**	**34**	**25.6**	**14.8**

Note: Based on total fishermen survey = 250 respondents

b) Fleet Character

A wide range of boats and engine sizes were owned by the fishermen. The sizes of the fishing boats ranged from 4.3 to >9.4 m long. About 76% were between 6.1 to 7.6 m, while 12.2% were less than 6 m. Only a few fishermen (1.5%) had boats longer than 9.4 m (T6.85).

T6.85 Lengths of fishing boat used by surveyed fishermen by length cohort and fish landing point

Fish Landing Point	Boat Length (m)			
	4.3 – 6.0 (%)	6.1 – 7.6 (%)	7.7 – 9.4 (%)	> 9.4 (%)
Sri Jerjak	-	10.2	-	-
Batu Maung	2.0	14.2	1.5	0.5
Teluk Tempoyak Kechil	0.5	7.6	1.0	-
Teluk Tempoyak Besar	-	3.6	-	-
Permatang Damar Laut	-	4.1	0.5	-
Permatang Tepi Laut	4.1	5.1	1.5	-
Sungai Batu	0.5	6.1	-	-
Teluk Kumbar	2.5	6.6	2.0	-
Gertak Sanggul	1.0	10.7	2.0	0.5
Pulau Betung	1.5	8.1	1.5	0.5
Total (%)	**12.2**	**76.1**	**10.2**	**1.5**

Note: Boat owner surveyed = 193 persons

About 15.5% had second-hand boats, while the majority (84.5%) owned new boats (T6.86). Similar proportions also applied to engine ownership, with 88.6% fishermen owning a new engine, while the remaining 11.4% had bought a reconditioned engine (T6.86).

T6.86 Boat ownership (new or second hand)

Fish Landing Point	Boat		Engine	
	New (%)	Second Hand (%)	New (%)	Second Hand (%)
Batu Maung	14.0	4.7	15.0	3.6
Teluk Tempoyak	8.8	1.0	9.8	0.0
Permatang Damar Laut	4.7	0.0	4.7	0.0
Permatang Tepi Laut	8.3	2.6	10.4	0.5
Sungai Batu	6.2	0.0	6.2	0.0
Teluk Kumbar	8.8	1.0	8.3	1.6
Gertak Sanggul	13.5	1.0	13.0	1.6
Pulau Betung	9.3	2.1	10.4	1.0
Pulau Jerjak	7.3	3.1	7.8	2.6
Teluk Tempoyak Besar	3.6	0.0	3.1	0.5
Total (%)	**84.5**	**15.5**	**88.6**	**11.4**

Note: Boat owner surveyed = 193 persons

Most (81%) fishermen employed engine capacities between 40 HP to up to 99 HP. The highest percentage was for engine capacities ranging from 60 to 99 HP (47%) and 40 to 49 HP (34%). About 7% used engine capacities between >100 HP, while 3% used low-capacity engines between 10 to 19 HP (T6.87). The ownership of productive assets by fishermen is supported by a low-interest loan facility provided by LKIM. The loan facility requires that the fisherman be a member of the Fishermen Association (*Persatuan Nelayan* - PN). With the endorsement of the PN, which acts as a guarantor on their behalf, the fishermen are entitled to take a loan of up to RM25,000 from LKIM. By agreeing to the terms determined by PN, the fishermen are bounded to sell their catch to PN. Loan repayments are then deducted directly from the sales proceeds of the monthly catches.

T6.87 Engine capacity of fishing boat used by surveyed fishermen by engine size and fish landing point

Fish Landing Point	Engine Capacity (Horsepower, HP)				
	10 - 19 (%)	20 - 39 (%)	40 - 59 (%)	60 - 99 (%)	>100 (%)
Sri Jerjak	-	0.5	3.6	4.7	1.0
Batu Maung	0.5	4.7	5.2	7.2	1.0
Teluk Tempoyak Kechil	-	0.5	3.6	4.6	0.5
Teluk Tempoyak Besar	-	-	0.5	3.1	-
Permatang Damar Laut	-	0.0	1.6	3.1	-
Permatang Tepi Laut	-	1.6	6.7	2.0	0.5
Sungai Batu	-	1.0	2.6	3.1	-
Teluk Kumbar	-	1.0	4.1	4.6	-
Gertak Sanggul	0.5	-	5.2	7.3	2.1
Pulau Betung	1.5	1.0	1.0	6.8	2.1
Total (%)	**2.5**	**10.4**	**34.3**	**46.7**	**7.2**

Note: Boat owner surveyed = 193 persons

Normally, boat prices vary even among those of similar sizes, depending on the boat yard and hull quality. Purchases of fishing equipment are normally on cash terms. Thus, fishermen purchasing high capacity boat engines need to invest huge amounts of their savings, especially where larger engines are concerned. Another necessary fishing equipment used by fishermen is net hauler (F6.145). Net haulers are powered hydraulically and are known as “Robert” (a mispronunciation of “robot”). On average, the cost of this machine is around RM6,000. T6.88 provides a list and the price of common equipment used in fishing boats. However, sonar detector and walkie-talkie are not commonly used on boats with engine capacities below 115 HP.

F6.145 Net hauler or “Robert” (robot)

T6.88 List of equipment (and price) used aboard fishing vessel. Average price incurred by fishermen.

Fishing Equipment		Price/Unit (RM)
Boat profile (size, m)	4.3	6,300
	5.5	7,800
	6.4	9,800
	6.7	11,000
	7.0	13,000
	8.2	18,000
	9.1	21,000
Engine (horsepower, HP)	15	4,600
	30	8,000
	40	15,000
	60	23,000
	115	30,500
Trawl towing machine		6,000
Sonar machine		2,500
Walkie-talkie		1,600
Life jacket		180
Plastic barrel (capacity of 25L)		150

Source: All estimation is given by respondent base on average fishermen estimation and also according to the market price observation

c) Fishing Gear

The fishing gear used at the study area include drift/gill net, bottom gill net, hooks and line and portable traps (T6.89). For instance, trammel nets are used to catch shrimp, while the *Pukat Bawal* (pomfret net) is used to catch pomfret. The nets are differentiated by their lengths and mesh size. Among the fishing gears, the bottom gill nets was the most widely used gear, followed by drift/gill nets, hooks and line and portable traps.

The most widely used drift/gill nets were *Pukat Bawal* (pomfret net) and *Pukat Senangin* (threadfin net), which were worked by 59.4 and 55.9% of the respondents, respectively. Only 21.3% used the *Pukat Temenong* (mackerel net). These nets are usually employed in open waters as they could reach a total length of 1 km.

On the other hand, where bottom gill nets are concerned, about 88.2% of the fishermen interviewed used trammel nets, which largely targeted shrimp. Another net that is used by the fishermen is the *Pukat Ketam* (crab net), used by 17.1% of the respondents. Both of these nets are commonly employed in shallow waters; the trammel net at depths less than 10 m and *Pukat Ketam* (crab net) in less than 3 m. Other nets that are also used included the *Pukat Kedera* (mullet net) (3.5%), *Pukat Jenahak* (snapper net) (0.5%), *Pukat Kerapu* (grouper net) (0.5%) and *Pukat Hantu* (2.5%).

Less common gears used include hooks and line and portable traps, with about 6.3% of the surveyed fishermen used longlines, followed by rod and line with 6.2%. Only 3.1% of the fishermen used *bubu*. While the longlines and rod and lines are usually employed at the open waters, much like the drift/gill net, the *bubu* is usually set near to the coastline where the water is calmer and shallower.

T6.89 Gear group according to engine horsepower

Gear Group		Engine – Powered (Horsepower, HP) (%)					Total (%)
		10 - 19	20 - 39	40 - 59	60 - 99	>100	
Drift/Gill Net	*Pukat Temenong* (Mackerel Net)	0.5	1.6	4.1	11.4	3.7	**21.3**
	Pukat Senangin (Threadfin Net)	0.5	6.2	19.7	25.3	4.2	**55.9**
	Pukat Bawal (Pomfret Net)	1.0	5.7	21.7	26.4	4.6	**59.4**
Bottom Gill Net	*Pukat Tiga Lapis* (Trammel Net)	1.6	8.3	30.0	42.6	5.7	**88.2**
	Pukat Ketam (Crab Net)	-	1.6	4.7	9.8	1.0	**17.1**
	Pukat Kedera (Mullet Net)	1.0	1.0	-	1.5	-	**3.5**
	Pukat Jenahak (Snapper Net)	-	-	-	0.5	-	**0.5**
	Pukat Kerapu (Grouper Net)	-	-	-	0.5	-	**0.5**
	Pukat Hantu	-	-	-	1.0	1.5	**2.5**
Hooks and Line	Rod and line	-	-	1.6	4.1	0.5	**6.2**
	Long-lines	-	-	1.6	4.2	0.5	**6.3**
Portable Traps	*Bubu*	-	-	3.1	-	-	**3.1**

Note: Boat owner surveyed = 193 persons

d) Fishing Practice and Fishing Ground

Ten specific sites were identified in the survey as fishing grounds. A larger, more generalised fishing ground, was from 3 to 10 nautical miles from the shoreline was also targeted by fishermen (T6.90).

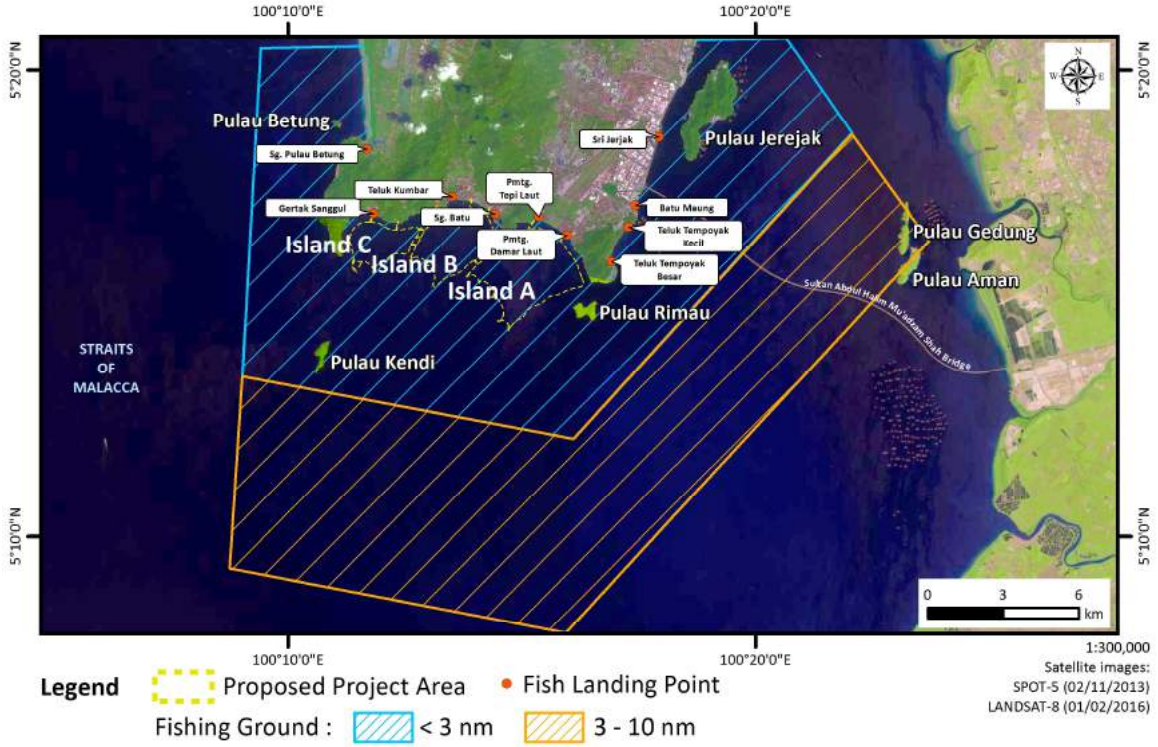
F6.90 Major fishing ground by fishermen from different fish landing point

Landing Points	Month										
	Sri Jerjak	Batu Maung	Teluk Tempoyak Kechil	Teluk Tempoyak Besar	Permatang Damar Laut	Permatang Tepi Laut	Sungai Batu	Teluk Kumbar	Gertak Sanggul	Pulau Batung	Total (%)
< 3 n.m.	3.2	6.8	6.8	2.4	3.6	7.6	6.8	11.6	10.0	7.6	**66.4**
< 10 n.m.	-	0.4	0.4	0.4	0.4	2.0	-	-	0.4	2.4	**6.4**
Balik Pulau Coast	24	1.2	1.2	0.4	0.4	1.2	-	-	-	-	**6.8**
Pulau Betung	-	-	-	-	-	-	-	0.8	-	0.4	**1.2**
East Penang	-	-	1.2	0.4	0.4	0.8	0.8	-	-	0.8	**4.4**
Pulau Rimau	9.2	12.0	6.0	2.8	3.2	6.8	4.4	10.0	5.2	4.0	**63.6**
Pulau Kendi	7.2	9.6	6.8	3.2	2.0	6.8	5.6	10.4	8.8	7.2	**67.6**
Pulau Aman	0.8	3.6	2.0	0.4	1.2	0.4	2.0	0.8	0.4	-	**11.6**
Penang Second Bridge	2.0	7.2	0.8	0.8	-	0.4	0.8	2.0	0.4	0.8	**15.2**
Tanjung Bungah	0.8	-	-	-	-	-	-	-	-	-	**0.8**
Padang Kota	0.8	-	-	-	-	-	-	-	0.8	-	**1.6**

Note: Based on total fishermen survey = 250 respondents

However, based on the interviews and discussions with fishermen, the most important fishing ground was within 3 nautical miles from the coast, with 66% of the fishermen attesting that they fished there regularly. Other major areas of fishing effort were Pulau Kendi and Pulau Rimau. Both these islands supported coral reefs, which accounted for the large aggregations of fish around them. While a minority of fishermen (1.6%) went eastwards to Padang Kota and west as far as Tanjung Bungah, the bulk of the fishermen (92.6%) fished within the boundaries indicated in F6.146.

In general, the main factor determining the willingness of the fishermen to reach a certain fishing ground was engine size and fuel cost. Not many fishermen were able to reach Tanjong Bungah and Padang Kota, which are at a considerable distance from their home villages. Another related factor is the fact that the southern coast fringes major fisheries habitats, especially around Pulau Kendi and Pulau Rimau.



F6.146 Major fishing grounds of coastal fishermen off the study area

e) Landings and Species

T6.91 provides the list of main species caught by coastal fishermen in the study area namely Udang Putih (Banana Shrimp or *Penaeus merguensis* / *P. indicus*), Temenong (Mackerel or *Restrelliger* spp.), Senangin (Threadfin or *Polynemus* spp.), Bawal (Pomfret or *Pampus* spp.), Kedera (Mullet or *Liza* spp.), Jenahak (Snapper or *Lutjanus* spp.) and Kerapu (Grouper or *Epinephelus* spp.). Shrimp is at the top of the catch list, with some 88% of respondents identifying them as target species. Fishermen at Batu Maung, Sungai Batu, Teluk Kumbar and Gertak Sanggul particularly targeted the commodity.

Among the finfish, Senangin (*Polynemus* spp.) and Bawal (*Pampus* spp.) were major target species, with 54.8 and 89.6% of the respondents targeting these species. Species such as Kedera (*Liza* spp.), Jenahak (*Lutjanus* spp.) and Kerapu (*Epinephelus* spp.) are caught mainly by bigger boats and not the favoured target fish of smaller boats, hence accounting for the low percentage of fishermen that target these species. Temenong (*Restrelliger* spp.) is caught seasonally by all fishermen, but some smaller boats are unable to accommodate larger volumes of catch. Most Temenong fishing is carried out on the west coast of the island, around Balik Pulau.

On average, fishermen in the study area indicated that about 35% of their catch by volume consisted of Udang Putih (*Penaeus merguensis*/*P. indicus*), 22% of Senangin (*Polynemus* spp.) and 23% of Bawal (*Pampus* spp./*Parastromateus* spp.). Despite the anectodal importance of the Temenong (*Restrelliger* spp.), the fish accounted for only 8%, probably because of its seasonality.

T6.91 Species caught by fishermen

Fish Landing Points	Species Categories (%)							
	Udang Putih (*Penaeus merguensis/ P. indicus*)	**Temenong** (*Restrelliger* spp.)	**Senangin** (*Polynemus* spp.)	**Bawal** (*Pampus* spp.)	**Kedara** (*Liza* spp.)	**Jenahak** (*Lutjanus* spp.)	**Kerapu** (*Epinephelus* spp.)	**Ketam** (*Portunus* spp./ *Charybdis* spp.)
Sri Jerjak	6.8	0.4	10.8	9.6	0.0	1.6	-	0.4
Batu Maung	12.8	5.6	11.6	10.8	0.4	-	-	2.0
Teluk Tempoyak Kechil	8.8	3.2	4.0	7.6	1.2	0.4	-	1.2
Teluk Tempoyak Besar	4.0	0.4	2.8	0.8	0.4	0.4	-	2.0
Permatang Damar Laut	3.6	0.4	2.0	2.8	-	1.6	-	0.4
Permatang Tepi Laut	8.4	2.0	5.6	6.4	-	0.8	-	5.6
Sungai Batu	12.8	0.4	3.6	4.4	0.8	0.8	-	1.2
Teluk Kumbar	11.2	1.2	6.0	6.8	-	1.2	-	2.0
Gertak Sanggul	11.6	6.0	5.6	4.4	-	-	-	3.6
Pulau Betung	9.6	1.6	2.8	6.0	0.4	0.4	0.4	0.4
Total (%)	**89.6**	**21.2**	**54.8**	**59.6**	**3.2**	**7.2**	**0.4**	**18.8**

Note: Percentage of respondents (N = 250) who targeted the species

f) Output Values and Socio-economics

■ Overview

The estimated gross incomes of fishermen are based on values reported by the fishermen during the survey. The mean gross income per fishermen was RM1,989.50 per month, ranging from RM500 to RM9,000 per month. About 93% reported their incomes came entirely from fishing, with only 7% supplementing their income from other sources. These other sources included operating restaurants and boat rentals. The lowest dependence on fishing incomes was 20%, while the highest was 100%. Hence, while the latter group is entirely dependent on fishing, there are those who obtain up to 80% from non-fishing sources.

The mean incomes from fishing averaged RM1,837.00 per month, ranging from RM350 to RM9,000 per month. The mean incomes from non-fishing sources averaged RM145.30 per month, ranging from zero to as high as RM3,600 monthly.

Out of the 250 respondents, 192 or 76.8% were boat owners, one person (0.4%) used a rented boat, while the rest (57 persons or 22.8%) were boat crew (*awak-awak*). A fishing team generally comprised of the boat owner and one or two crew members, though, especially for smaller boats, the owner may operate the boat singly. Where a fishing team is involved, income distribution from fishing is distributed into two: one part for the boat owner and the other for the boat crew. If the boat owner hired a "*tekong"* (lead fishermen), then the split is three ways. For most part, however, the boat owner acted as the lead fishermen. The breakdown of the overall sources of incomes according to the types of fishermen is provided in T6.92.

T6.92 Overall income (percentage distribution of respondents by income cohort and types of fishermen)

Income Range (RM)	Boat Owner/T*ekong*		Boat Rental		Boat Crews	
	No.	%	No.	%	No.	%
< 1,000	13	6.8	-	-	7	12.3
1,001-1,500	45	23.4	-	-	21	36.8
1,501-2,000	72	37.5	1	100.0	16	28.1
2,001-2,500	19	9.9	-	-	6	10.5
2,501-3,000	13	6.8	-	-	6	10.5
3,001-3,500	9	4.7	-	-	1	1.8
3,501-5,000	13	6.8	-	-	0	-
5,001-8,000	7	3.6	-	-	0	-
>8,000	1	0.5	-	-	0	-
Total	**192**	**100**	**1**	**100**	**57**	**100**

Note: Total no. of respondent = 250 persons

Boat owners, who were are the *tekong*s, earned a wider range of incomes, with the lowest range <RM1,000 per month to an excess of RM8,000 per month. The lower end range pertained to boat owners/*tekong*s who either owned smaller boats, engines or fished less frequently.

There were more boat owners/*tekongs* earning from the overall monthly income categories of RM1,001 to 1,500 (23.4%), RM1,501 to RM2,000 (37.5%), RM2,001 to RM2,500 (9.9%), RM2,501 to RM3,000 (6.8%), RM3,001 to RM3,500 (4.7%) and RM3,501 to RM5,000 (6.8%). A smaller proportion (3.6%) of the boat owners/*tekong*s did earn RM5,001 to RM8,000. Only one (0.5%) boat owners/*tekong*s claimed to have earned in excess of RM8,000 per month. The fishermen who rented a boat (1 respondent) earned RM1,501 to RM2,000 a month.

The boat crew/*awak-awak* tend to have lower incomes, unlike the *tekong* who also earns a portion of the haul if he is the boat owner. The incomes of boat crews/*awak-awak* ranged from <RM1,000 to RM3,001 to RM3,500. Most were within the RM1,001 to RM1,500 (36.8% of boat crew respondents) and RM1,501 to RM2,000 (28.1%) worth. Some 10.5% of the boat crews/*awak-awak* were within the RM2,001 to RM2,500 and RM2,501 to RM3,000 income cohort.

- Fishing Incomes

As mentioned earlier, the fishermen of southern Penang Island depended very much on fishing, deriving 93.5% of their overall incomes from the activity. T6.93 provides the distribution of incomes earned directly from fishing. The majority of boat owners*/tekongs* had fishing incomes in range RM1,501 to RM2,000, with 18.8% within RM1,001 to RM1,500 cohort and 7.2% within RM2,001 to RM2,500 cohort. None of them earned in excess of RM8,000 per month.

The incomes of boat crews/*awak-awak* exhibited a different pattern. Most (9.2%) were within the RM1,001 to RM1,500 income category. There were no boat crews/*awak-awak* having fishing incomes in the RM3,001 to RM3,500 category and beyond. This suggests that the boat crews/*awak-awak* must rely on other non-fishing income as well. Being younger, and the fact that they earn only a share of the fishing haul, they are more likely to seek additional employment opportunities elsewhere.

T6.93 Fishing income (percentage distribution of respondents by income cohort and types of fishermen)

Income Range (RM)	Percentage (%) of Respondents			
	Fisherman/ Boat Owner	Fishermen/ Boat Rental	Boat Crew	Total
< 1,000	7.6	0	6.8	**14.4**
1,001 – 1,500	18.8	0	9.2	**28.0**
1,501 – 2,000	26.8	0.4	4.8	**32.0**
2,001 – 2,500	7.2	0	1.6	**8.8**
2,501 – 3,000	5.2	0	0.4	**5.6**
3,001 – 3,500	4.4	0	0	**4.4**
3,501 - 5,000	0.4	0	0	**0.4**
5,001 – 8,000	6.4	0	0	**6.4**
>8,000	0	0	0	**0**
Total (%)	**76.8**	**0.4**	**22.8**	**100**

Note: No. of respondents: 192 persons for fishermen/boat owner, 1 person for fishermen/boat rental and 57 persons for boat crew

Fishermen from Batu Maung, Teluk Tempoyak, Permatang Tepi Laut, Teluk Kumbar, Gertak Sanggul, Pulau Betung and Sri Jerjak are reported to have higher incomes from fishing than those from Teluk Tempoyak Besar, Permatang Damar Laut and Sungai Batu [T6.94 (in numbers) and T6.95 (in percentage)]. A few fishermen from Batu Maung, Teluk Tempoyak, Teluk Kumbar, Gertak Sanggul and Pulau Betung (0.4 to 1.6%) reported that they could earn more than RM5,001 per month. Fishermen in Permatang Damar Laut asserted that they could at least obtain beyond RM1,000 monthly.

T6.94 Fishing income (number of respondents by income cohort)

Fish Landing Point	Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	4	16	6	2	2	1	1	0	**32**
Batu Maung	3	5	15	3	1	3	6	1	**37**
Teluk Tempoyak Kechil	3	8	4	3	2	0	0	1	**21**
Teluk Tempoyak Besar	2	0	7	0	0	0	0	0	**9**
Permatang Damar Laut	0	2	3	4	0	0	0	0	**9**
Permatang Tepi Laut	4	8	10	0	3	3	1	0	**29**
Sungai Batu	6	8	6	1	0	0	0	0	**21**
Teluk Kumbar	7	10	11	0	0	0	1	1	**30**
Gertak Sanggul	1	7	10	6	3	2	0	1	**30**
Pulau Betung	6	6	8	3	3	0	2	4	**32**
Total No. of Respondent	**36**	**70**	**80**	**22**	**14**	**9**	11	**8**	**250**

T6.95 Percentage of fishing incomes

Fish Landing Point	Percentage (%) of Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	1.6	6.4	2.4	0.8	0.8	0.4	0.4	0	**12.8**
Batu Maung	1.2	2	6	1.2	0.4	1.2	2.4	0.4	**14.8**
Teluk Tempoyak Kechil	1.2	3.2	1.6	1.2	0.8	0	0	0.4	**8.4**
Teluk Tempoyak Besar	0.8	0	2.8	0	0	0	0	0	**3.6**
Permatang Damar Laut	0	0.8	1.2	1.6	0	0	0	0	**3.6**
Permatang Tepi Laut	1.6	3.2	4	0	1.2	1.2	0.4	0	**11.6**
Sungai Batu	2.4	3.2	2.4	0.4	0	0	0	0	**8.4**
Teluk Kumbar	2.8	4	4.4	0	0	0	0.4	0.4	**12**
Gertak Sanggul	0.4	2.8	4	2.4	1.2	0.8	0	0.4	**12**
Pulau Betung	2.4	2.4	3.2	1.2	1.2	0	0.8	1.6	**12.8**
Total No. of Respondent	**14.4**	**28**	**32**	**8.8**	**5.6**	**3.6**	**4.4**	**3.2**	**100**

Within each fish landing point, the spread of fishermen among income cohorts varied quite significantly. Most of respondents from Sri Jerjak (50%), Teluk Tempoyak Kechil and Sungai Batu (both at 38.1%) were within the RM1,001 to RM1,500 income cohort (T6.96).

T6.96 Percentage of fishing incomes by fish landing point

Fish Landing Point	Percentage (%) of Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	12.5	50.0	18.8	6.3	6.3	3.1	3.1	0	**100**
Batu Maung	8.1	13.5	40.5	8.1	2.7	8.1	16.2	2.7	**100**
Teluk Tempoyak Kechil	14.3	38.1	19.1	14.3	9.5	0	0	4.8	**100**
Teluk Tempoyak Besar	22.23	0	77.8	0	0	0	0	0	**100**
Permatang Damar Laut	0	22.2	33.3	44.4	0	0	0	0	**100**
Permatang Tepi Laut	13.8	27.6	34.5	0	10.3	10.3	3.5	0	**100**
Sungai Batu	28.6	38.1	28.6	4.8	0	0	0	0	**100**
Teluk Kumbar	23.3	33.3	36.7	0	0	0	3.3	3.3	**100**
Gertak Sanggul	3.3	23.3	33.3	20.0	10.0	6.7	0	3.3	**100**
Pulau Betung	18.8	18.8	25.0	9.4	9.4	0	6.3	12.5	**100**

Respondents at Batu Maung, Teluk Tempoyak Besar, Permatang Tepi Laut, Teluk Kumbar, Gertak Sanggul and Pulau Betung were largely (25 to 78%) within RM1,501 to RM2,000 income cohort, while most (44%) in Permatang Damar Laut reported income within RM2,001 to RM2,500 income cohort.

The > RM5,001 income cohort was reported by only eight sampled fishermen or 3.2% of all respondents, mostly of whom from Pulau Betung (T6.97). Most (32%) respondents reported being within the RM1,501 to RM2,000 and were represented in all the fish landing points, especially Batu Maung (18.75%), Teluk Kumbar (13.75%), Permatang Tepi Laut (12.5%) and Gertak Sanggul (12.5%).

T6.97 Percentage of fishing incomes by income cohort

Fish Landing Point	Percentage (%) of Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	11.1	22.9	7.5	9.1	14.3	11.1	9.1	0	**12.8**
Batu Maung	8.3	7.1	18.8	13.6	7.1	33.3	54.6	12.5	**14.8**
Teluk Tempoyak Kechil	8.3	11.4	5.0	13.6	14.3	0	0	12.5	**8.4**
Teluk Tempoyak Besar	5.6	0	8.8	0	0	0	0	0	**3.6**
Permatang Damar Laut	0	2.9	3.8	18.2	0	0	0	0	**3.6**
Permatang Tepi Laut	11.1	11.4	12.5	0	21.4	33.3	9.1	0	**11.6**
Sungai Batu	16.7	11.4	7.5	4.5	0	0	0	0	**8.4**
Teluk Kumbar	19.4	14.3	13.8	0	0	0	9.1	12.5	**12.0**
Gertak Sanggul	2.8	10.0	12.5	27.3	21.4	22.2	0	12.5	**12.0**
Pulau Betung	16.7	8.6	10.0	13.6	21.4	0.0	18.2	50.0	**12.8**
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total No. of Respondent	**36**	**70**	**80**	**22**	**14**	**9**	**11**	**8**	**250**

- Non-fishing Incomes

As mentioned earlier, only 41 respondents reported alternative income sources. These addition income streams are generally much lower than that of fishing (T6.98). Among the boat owners/*tekongs*, the highest percentage range was within RM3,501 to RM5,000 per month, while it was RM2,001 to RM2,500 per month for the boat crews/*awak-awak*.

T6.98 Non-fishing income (percentage distribution of respondents by income cohort and types of fishermen)

Income Range (RM)	Percentage (%) of Respondents			
	Fisherman/ Boat Owner	Fishermen/ Boat Rental	Boat Crew	Total
< 1,000	29.3	0	36.6	65.9
1,001 - 1,500	9.8	0	12.2	22.0
1,501 - 2,000	2.4	0	2.4	4.9
2,001 - 2,500	2.4	0	2.4	4.9
2,501 - 3,000	0	0	0	0
3,001 - 3,500	0	0	0	0
3,501 - 5,000	2.4	0	0	2.4
5,001 - 8,000	0	0	0	0
>8,000	0	0	0	0
Total (%)	**46.4**	**0.0**	**53.7**	**100**

The distribution of non-fishing incomes by fish-landing point is given in T6.99 (in numbers) and T6.100 (in percentage). Fishermen from Batu Maung, Teluk Tempoyak Kechil, Teluk Tempoyak Besar, Permatang Tepi Laut, Sungai Batu, Teluk Kumbar, Gertak Sanggul, Pulau Betung and Sri Jerjak had reported non-fishing incomes. One fisherman from Teluk Kumbar and two fishermen from Sri Jerjak (4.9%) claimed that they could earn high incomes from other sources, ranging from RM5,001 to RM8,000 and RM2,501 to RM3,000 per month respectively.

T6.99 Number of respondents for non-fishing income

Fish Landing Point	Percentage (%) of Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	0	3	2	1	0	0	0	0	**6**
Batu Maung	0	1	0	0	0	0	0	0	**1**
Teluk Tempoyak Kechil	0	0	2	0	0	0	0	0	**2**
Teluk Tempoyak Besar	0	0	0	0	0	0	0	0	**0**
Permatang Damar Laut	0	2	0	0	0	0	0	0	**2**
Permatang Tepi Laut	0	6	1	0	0	0	0	0	**7**
Sungai Batu	0	8	2	0	0	0	0	1	**11**
Teluk Kumbar	0	2	1	0	0	0	0	0	**3**
Gertak Sanggul	0	3	0	0	0	0	0	0	**3**
Pulau Betung	0	2	1	1	2	0	0	0	**6**
Total No. of Respondent	**0**	**27**	**9**	**2**	**2**	**0**	**0**	**1**	**41**

T6.100 Percentage of non-fishing incomes

Fish Landing Point	Percentage (%) of Income Levels (RM)								
	<1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-3,000	3,001-3,500	3,501-5,000	>5,001	Total
Sri Jerjak	0	7.3	4.9	2.4	0.0	0.0	0.0	0.0	**14.6**
Batu Maung	0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	**2.4**
Teluk Tempoyak Kechil	0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	**4.9**
Teluk Tempoyak Besar	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Permatang Damar Laut	0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	**4.9**
Permatang Tepi Laut	0	14.6	2.4	0.0	0.0	0.0	0.0	0.0	**17.1**
Sungai Batu	0	19.5	4.9	0.0	0.0	0.0	0.0	2.4	**26.8**
Teluk Kumbar	0	4.9	2.4	0.0	0.0	0.0	0.0	0.0	**7.3**
Gertak Sanggul	0	7.3	0.0	0.0	0.0	0.0	0.0	0.0	**7.3**
Pulau Betung	0	4.9	2.4	2.4	4.9	0.0	0.0	0.0	**14.6**
Total No. of Respondent	**0**	**65.9**	**22.0**	**4.9**	**4.9**	**0.0**	**0.0**	**2.4**	**100.0**

6.4.2.3 Aquaculture Industry at the Study Area

Discussions and interviews with aquaculture farmers particularly cage culture operators off Batu Maung (01° 18.962' N; 103° 26.614' E) and hatchery operators at Permatang Damar Laut, Teluk Kumbar, Gertak Sanggul and Pulau Betung were undertaken (F6.147 to F6.149). A questionnaire was prepared for this purpose (*Appendix D.3* in Volume 3: Appendices). FGD was also undertaken for Persatuan Akuakultur Pulau Pinang (PENKUA) at Orkid Room, Safira Club, Butterworth on 8th April 2016. In addition, aquaculture data was also requested from the Penang State Department of Fisheries.

Three aquaculture systems are employed in the study area i.e. marine cage culture, brackish water pond culture and oyster culture. In 2015, aquaculture production in the study area amounted to 2,297.48 tonnes, of which 69.4% was contributed by marine cage culture (1,594.90 tonnes), 30.1% by brackish water pond culture (692.31 tonnes) and 0.4% by oyster culture (10.26 tonnes). In addition, shrimp/marine fish fry production (hatchery) is also actively undertaken at the study area.

F6.147 Interview with the cage operators at Batu Maung

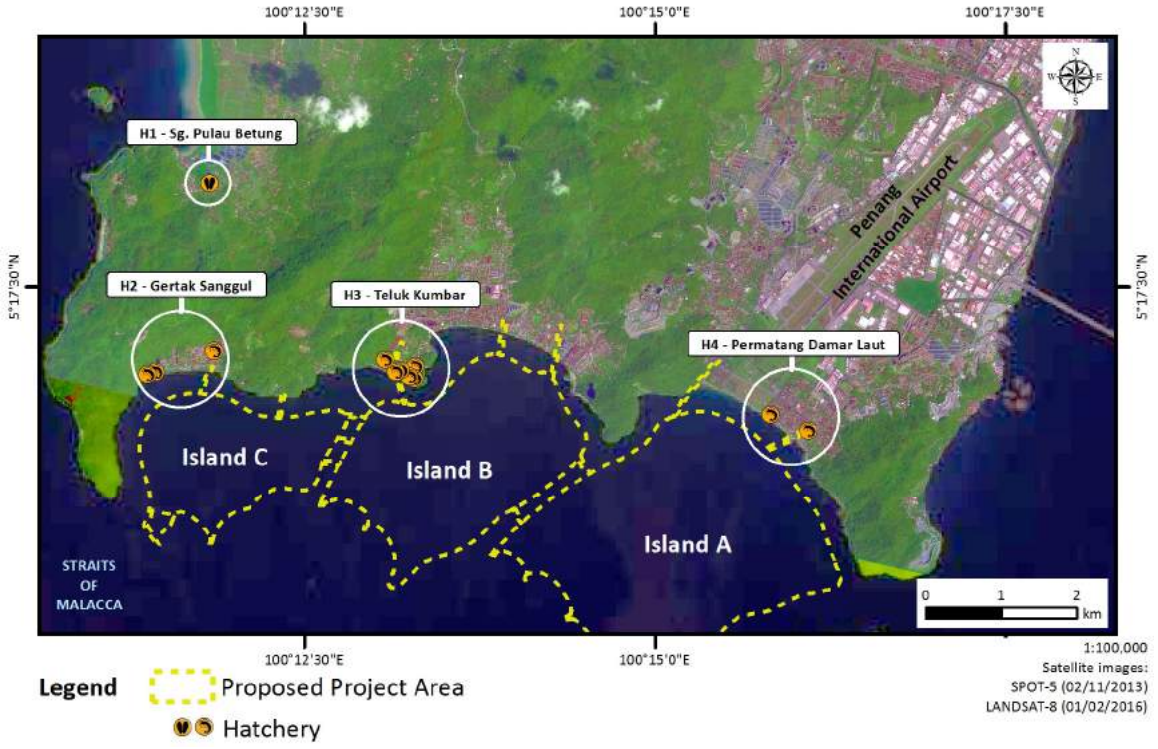
F6.148 Interview with the hatchery operators. A: BE Biomarine, B: Gertak Sanggol Hatchery Sdn. Bhd., C: Seaharvest Aquamarine (M) Sdn. Bhd.

F6.149 Focus Group Discussion (FGD) with PENKUA

The detailed descriptions for each system are as follows:

a) Hatcheries and Seed Production

In 2015, there were seven private hatcheries involved in the shrimp fry production, two in prawn fry production and one in oyster production in the study area (F6.150 and T6.101).



F6.150 Aquaculture activities (hatcheries) operating at the study area

T6.101 Details of hatcheries operating at the study area, (2015)

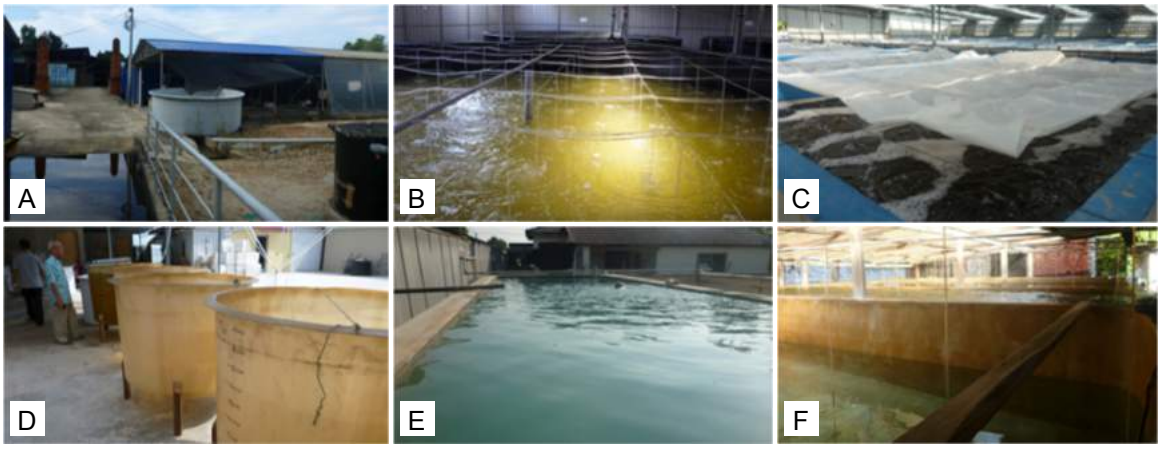
Location	Gertak Sanggul	Teluk Kumbar	Permatang Damar Laut	Pulau Betung	Total
No. of culturist	3	4	2	1	**10**
No. of hatchery	3	6	2	1	**12**
Production					
■ Udang Putih (*P. vannamei*)					
- Naupli	40 million	755.8 million	-	-	**795.8 million**
- Post Larvae (PL9-15)	-	396.2 million	105.0 million	-	**314.7 million**
- Broodstock	-	1,200	-	-	**1,200**
■ Udang Harimau (*P. monodon*)					
- Naupli	-	4.20 million	-	-	**4.20 million**
- Post Larvae (PL9-15)	-	4.27 million	4.5 million	-	**8.77 million**
■ Udang Galah (*M. rosenbergii*)	-	6 million	12 million	-	**18 million**
■ Tiram (*C. iredelei*, *Crassosstrea* hybrids)	-	-	-	6 million	**6 million**
Wholesale Value (RM)					
■ Udang Putih (*P. vannamei*)					
- Naupli	28,000	40,600	-	-	**58,600**
- Post Larvae (PL9-15)	-	4,462,000	1,195,000	-	**5,657,000**
- Broodstock	-	144,000	-	-	**144,000**
■ Udang Harimau (*P. monodon*)					
- Naupli	-	29,400	-		**29,400**
- Post Larvae (PL9-15)	-	128,100	135,000	-	**263,100**
■ Udang Galah (*M. rosenbergii*)	-	420,000	720,000	-	**1,140,000**
■ Tiram (*C. iredelei*, *Crassosstrea* hybrids)	-	-	-	1,500,000	**1,500,000**
Total	**28,000**	**5,224,100**	**2,050,000**	**1,500,000**	**8,802,100**

Source: Field data, 2016

■ Shrimps

i) Size and Locations

Shrimp hatcheries are operated at Teluk Kumbar (Gertak Sanggol Hatchery Sdn. Bhd., BE Biomarine Sdn. Bhd., Ocean Sea Culture Hatchery), Gertak Sanggul (Soon Jaya Hatchery, Global Agro Life Sdn. Bhd., Yu Full Aquaculture Trading) and Permatang Damar Laut (Ocean Star Aquaculture, Permatang Aquaculture) (F6.151). These hatcheries produce post-larvae of the Udang Putih (Pacific White Shrimp or *Litopenaeus vannamei*) and Udang Harimau (Tiger prawn or *Penaeus Monodon*).



F6.151 Shrimp hatcheries in south of Penang Island. A-B: Teluk Kumbar (Gertak Sanggol Hatchery Sdn. Bhd.), C-D: Gertak Sanggul (Global Agro Life Sdn. Bhd.), E-F: Permatang Damar Laut (Ocean Star Aquaculture)

ii) Productive Assets

Shrimp hatcheries consist of facilities for quarantine, maturation, spawning, hatching, larval rearing, indoor or outdoor algal culture and artemia preparation area. Supporting infrastructure was also provided for water management (facilities for abstraction, filtration, storage, disinfection, aeration, temperature adjustment and distribution), larval laboratories, feed laboratories (for analysis and preparation) and storage facilities, maintenance areas, packing areas for nauplii and PL, offices, store rooms and staff living quarters and other related facilities.

Water used in the hatcheries is filtered and treated to prevent entry of predatory invertebrates, pathogens and sediments present in the source water so as to ensure consistent quality for larval rearing. Water was abstracted from the shoreline. Most of the intake pipelines were located within 100 m from the low water line. Only one hatchery at Gertak Sanggul had the intake pipeline located approximately 400 m from the coastline. Filtration involves sub-surface well points at the intakes and sand filters (gravity or pressure), and/or mesh bag filters, before being piped to the reservoir tanks. Following settlement of residual sediments, water is disinfected by chlorination. Some of the hatcheries do additional filtration again with a cartridge/bag filter and a final disinfection using ultraviolet light (UV) and/or ozone. The use of activated carbon filters, the addition of ethylene diamine tetra acetic acid (EDTA) and temperature and salinity regulation are other features of the water supply system.

Specific tanks are assigned for quarantine, spawning, hatching, larval rearing, live feed culture (algal and artemia), water storage and packing purpose. The number of tanks vary for each hatchery. For example, the number of larvae-rearing tanks ranged from <10 to 50 units. Their sizes also vary from 1 to 10 tonnes. Tanks are of fibreglass, prefabricated concrete or cement.

iii) Husbandry

Shrimp farms essentially require reliable post larval stocks. Hatcheries play an essential role in supplying seed stock on a year-round basis in substantial quantities for the shrimp grow-out farms.

The production of each hatchery in the study area depends on larval survival and nutrition, disease as well as the quality of the source water. In this respect, different husbandry approaches were taken by each hatchery.

iv) Production and Value

In 2015, shrimp fry production at the study area amounted to 1,309.97 million fry (800 million nauplii and 433.47 million PL9-PL15), valued at RM6.018 million. Most of the production (99%) came from Udang Putih (*Litopenaeus vannamei*), while only 1% was from Udang Harimau (*Penaeus monodon*). According to farmers, cultured Udang Harimau was more challenging as compared to Udang Putih, with low survival rates.

The highest production was recorded from Gertak Sanggol Hatchery Sdn. Bhd., which contributed 76.3% of the total production, followed by Ocean Sea Culture Hatchery (9.2%) and Ocean Sea Culture (6.5%). Production of BE Biomarine Sdn. Bhd., Yu Full Aquaculture Trading and Permatang Aquaculture was less than 50 million a year.

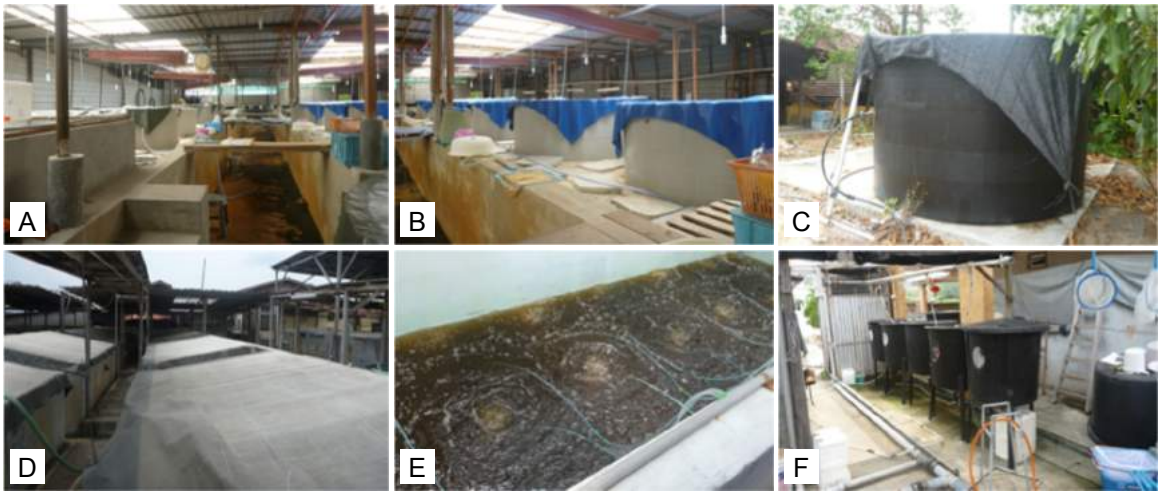
It is important to note that there was no production in 2015 from Soon Jaya Hatchery and Global Agro Life Sdn. Bhd., both of which operated at Gertak Sanggul. Soon Jaya Hatchery is a collaboration with Gertak Sanggol Hatchery Sdn. Bhd. and was only used for storing the stocks and equipment, while Global Agro Life Sdn. Bhd. just recently began operation with first harvest recorded in February 2016.

The PL9-PL15 was sold at RM0.010 to RM0.013/ind. for Udang Putih and RM0.03 to RM0.045/ind. for Udang Harimau, while RM600 to RM800/million ind. for nauplii.

■ Prawn

i) Size and Locations

There are two hatcheries producing Udang Galah, freshwater giant prawn (*Macrobrachium rosenbergii*) at study area, i.e. at Teluk Kumbar (Exauhall (M) Sdn. Bhd.) and Pematang Damar Laut (Permatang Aquaculture) (F6.152).



F6.152 Prawn hatcheries in south of Penang Island. A-C: Teluk Kumbar [Exauhall (M) Sdn. Bhd.], D-F: Permatang Damar Laut (Permatang Aquaculture)

ii) Productive Assets

Same information as mentioned for shrimp culture.

iii) Husbandry

Prawn farms also require reliable post-larval stocks either from the wild or from shrimp/prawn hatcheries. However, the supply from the wild is extremely unpredictable and thus hatcheries play an important role in supplying seed stock on year-round basis in substantial quantities for grow-out farms.

The production of each hatchery in the study area depends on larval survival and nutrition, control of disease as well as the quality of the source water. In this respect, different husbandry approaches were undertaken by each hatchery.

iv) Production and Value

Based on the data collected in 2016, the production freshwater prawn fry amounted to 18 million juveniles, valued at RM1.140 million in 2015. The main producer was Permatang Aquaculture (12 million), which accounted for 66.7% of the total production, while Axauhall (M) Sdn Bhd. supplied the remaining 33.3% (6 million). The prawn fry was sold at RM0.06 to 0.07/ind.

■ Oysters

i) Size and Locations

The country's only commercial hatchery producing Tiram (Oyster or *Crassostrea iredelei, Crassostrea* sp.) is located at Pulau Betung, and operated by Sea Harvest Aqua Marine Sdn. Bhd. (F6.153).

F6.153
Oyster hatchery (Sea Harvest Aqua Marine Sdn. Bhd.) at Pulau Betung

ii) Productive Assets

An oyster hatchery also consists of facilities for quarantine, maturation, spawning, hatching, larval rearing and algal culture. The superstructure in the hatchery involves 20 units of larval tanks with a capacity of 3 tonnes/tank, 16 units of water storage tanks, 4 units of nursery tanks, 12 units of holding tanks and 1 earthen pond.

Supporting infrastructure was also available for the water management (facilities for abstraction, filtration, storage, disinfection, aeration, temperature adjustment and distribution), feed laboratories and storage facilities, maintenance areas, packing areas, offices, storerooms and staff living quarters and facilities.

iii) Production and Value

Though production of oyster spat amounted to 321.75 million in 2014, the figure had dropped to 6 million in 2015 (DOF, 2016 - *unpublished*). This was due to the degradation of water quality off Pulau Betung. The wholesale value in 2015 was recorded at RM1.5 million, the oyster seed being sold at RM0.20 to 0.30/ind.

b) Grow Out

■ Marine Cage Culture

Cage culture has a long history in Penang. The first attempt of cage culture in the country was carried out in Teluk Kumbar and Jelutong in the 1970s (Chua and Teng, 1977). The culture did not take off initially as the biology of many marine fish was relatively unknown. Seed supply was a problem and its availability was uncertain. It was only in the 1980s, when farmers were more familiar with the culture system and seed, especially sea bass fry, and becoming available from Thailand that the marine cage culture industry took off. The industry also relies on the steady supply of trash fish landing in the state as feed.

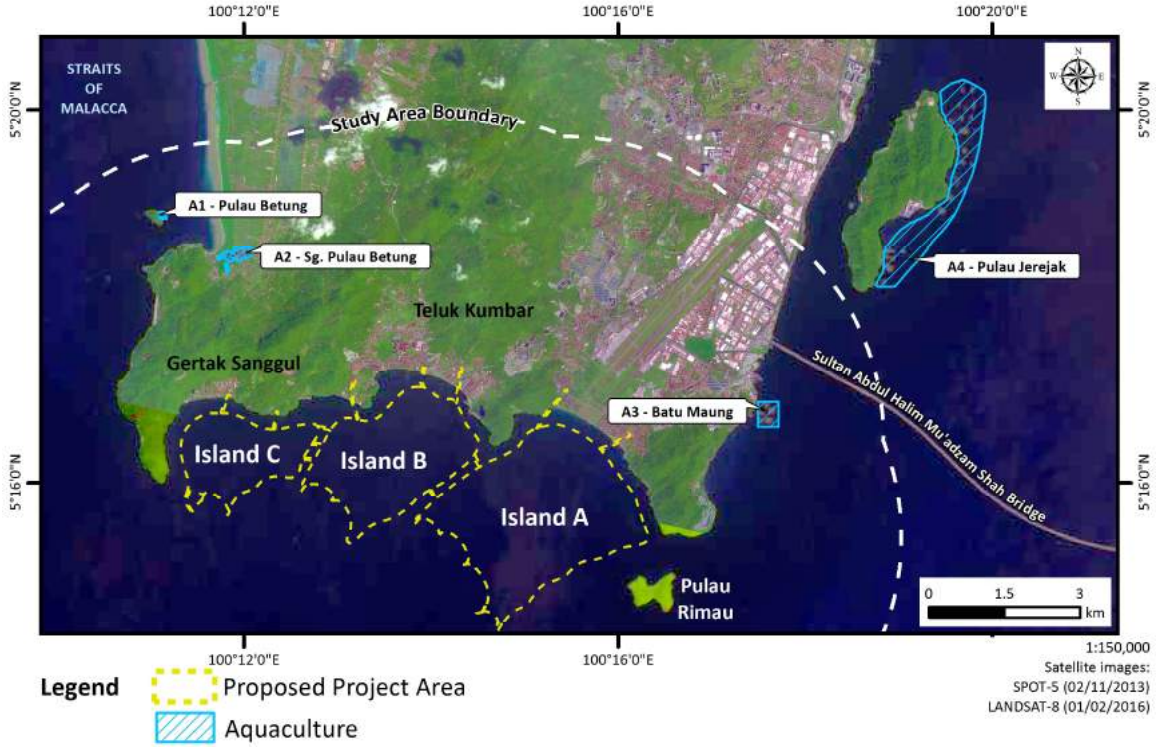
i) Size and Locations

There are 40 farmers involved in marine cage culture in study area. The locations are related to the sheltered nature of the site and the proximity to feed sources. Most cages are located around Pulau Jerejak and off Batu Maung on the leeward side of islands to protect against strong winds and wave action (T6.102). Their locations relative to the proposed reclamation Project is provided in F6.154 and F6.155.

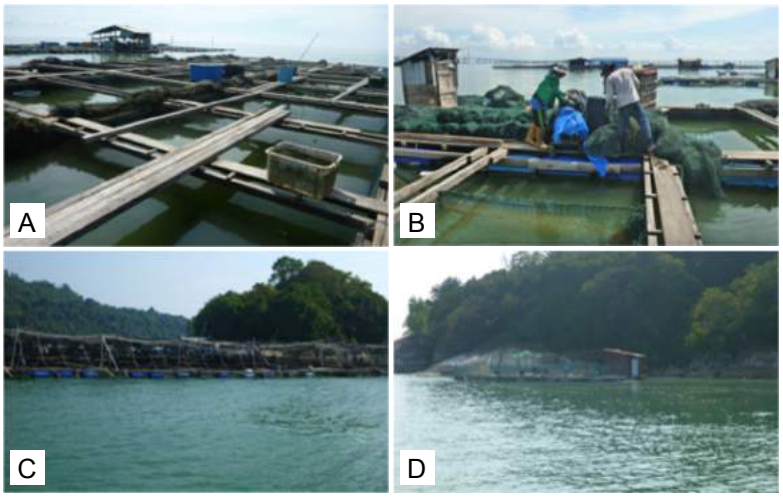
T6.102 Cage culture information at the study area

Location	Pulau Jerejak	Off Batu Maung	Pulau Betung
No. of culturist	30	8	2
No. of cage	6,885	2,240	400
Area (m^2)	139,000	49,365	4,500
Fish reared	Kerapu (*Epinephelus* sp.), Merah (*Lutjanus* spp.), Siakap (*L. calcarifer*), Bawal Mas (*Trachinotus blochii*), Nyok-nyok (*Caranx sexfasciatus*)	Kerapu (*Epinephelus* sp.), Merah (*Lutjanus* spp.), Siakap (*L. calcarifer*), Bawal Mas (*Trachinotus blochii*), Nyok-nyok (*Caranx sexfasciatus*)	*Kerapu (*Epinephelus* sp.), Merah (*Lutjanus* spp.)
Production (tonnes)	1,594.90	*829	*15
Wholesale value (RM)	**38,483,162.70**	***20,002,847.75**	***290,000.00**

Source: Department of Fisheries, Penang, 2016 - unpublished, *Survey undertaken in 2016



F6.154 Aquaculture activities (grow out) undertaken at the study area



F6.155 Cage culture. A-B: Batu Maung, C-D: Pulau Betung

ii) Productive Assets

The major asset of a cage farm is the floating superstructure, which consists of the sets of interlinked rafts. These, in turn, support net cages that are used to hold the farmed fish. In 2015, the number of cages that are operated within the impact zone amounted to 6,885 units at Pulau Jerjak, 2,240 units off Batu Maung and 400 units off Pulau Betung with a total productive area of 192,865 m^2. Besides the cages, the superstructure housed shelters for workers, stores for the safe keeping of feed, extra netting with different mesh size for different size of fish, small generators and pumps for general washing purpose.

Each farm was equipped with motorised boats for transportation of workers and materials to and from their base on land to the culture site. The boats are also used for the transportation of fish fry, and harvested fish to be marketed.

iii) Husbandry

The superstructure of the cage farms is made of hardwood, with plastic drums used as floats. Cages are usually 5 m x 9 m x 5 m in size, though some could be slightly smaller or bigger. The net cages are made of braided polyethylene and hung from hardwood rafts. The cages are anchored to prevent them from being swept away by currents.

iv) Production and Value

In 2015, the estimated production from marine cage culture at the study area amounted to 2,438.9 tonnes, with an estimated wholesale value of RM58.776 million or an average of RM24.10/kg (DOF, 2016 - *unpublished*). The relatively high price is partly because grouper, a high value fish, is increasingly being cultured in relation to other species. The average price for grouper of less than one kilogram each was RM38/kg, while those weighing more than one kilogram were priced at RM40/kg and could reach a maximum of RM46/kg.

■ Brackishwater Pond Culture (Shrimp Farming)

Traditional shrimp farming began in Malaysia in the 1930s with the utilisation of the trapping pond culture system, which depends on incoming tides for the supply of wild fry. Successful larvi-culture of shrimp in the late 1960s led to large-scale seed production and the establishment of government and private sector shrimp hatcheries in the late 1970s and early 1980s (Mazuki and Subramaniam, 2005).

i) Size and Locations

Two companies were involved in shrimp farming in study area, i.e. Great Fishore Sdn. Bhd. and Iyin Cooperation Sdn. Bhd. both of which operated at Sungai Pulau Betung. Great Fishore Sdn. Bhd. operated a total of nine ponds while Iyin Cooperation Sdn. Bhd. has 10 ponds (T6.103 and F6.156). Both shrimp farms were located close to the coast within a mangrove forest area. Their locations relative to the proposed reclamation Project are provided in F6.154 (A2: Sungai Pulau Betung).

T6.103
Shrimp farming information at the study area

Location	Sungai Pulau Betung
No. of culturist	2
No. of pond	19
Area (ha)	13
Commodity cultured	Udang Harimau (*Penaeus monodon*), Udang Putih (*L. vannamei*)
Production (tonnes)	692.32
Wholesale value (RM)	**19,601,239.00**

Source: Department of Fisheries, Penang, 2016 - unpublished

F6.156
Brackishwater pond culture at Sungai Pulau Betung. A-D: Great Fishore Sdn. Bhd., E-F: Iyin Cooperation Sdn. Bhd.

ii) Productive Assets

The culture of shrimps is mostly carried out in ponds built in coastal low-lying areas. In 2015, there were 19 excavated ponds with sizes of between 0.5 to 0.7 hectares. Three-phase electricity outlets were located around the pond walls to enable aerators (paddle wheels) to be connected by cable. At least three paddle wheels were installed in each pond.

All ponds are installed with small jetties to provide access for monitoring of feed trays and water quality. There are also stores located within the farm area to keep formulated feed and other equipment. The administration building and workers' quarters are also located within the farm. Transportation of seed, farm materials as well as harvested shrimp is undertaken by lorries and pick-up trucks.

iii) Husbandry

The man shrimp species cultured were Udang Harimau (*P. monodon*) and Udang Putih (*L. vannamei*). The stocking density was 175,000 fry/pond or 35 fry/m^2 for Udang Harimau (*P. monodon*) and 700,000 fry/pond or 100 fry/m^2 for Udang Putih (*L. vannamei*). Commonly fry were stocked early morning around 7:00 am to 9:00 am. The fry were bought from a hatchery at Sitiawan for Udang Harimau (*P. monodon*) and Gertak Sanggul Hatchery Sdn. Bhd. for Udang Putih (*L. vannamei*). The price of fry (PL) were RM0.04/fry and RM0.014/fry for *P. monodon* and *P. vannamei* respectively.

Frequent change of pond water was carried out at both farms to maintain water quality. Approximately 40% water exchange was undertaken daily and carried out during high tide. The process helped to introduce new food organisms into the pond and to stimulate moulting of shrimp. In stagnant water, decomposition of accumulated organic wastes or depletion of trace metals would affect shrimp growth.

Shrimps were fed with formulated feed pellets. The pellets cost around RM4.60 to RM4.80/ kg. Each pond required at least 200 kg/day. The formulated feed pellets were placed in the feeding trays that were installed strategically at different parts of the pond. The feeding frequency was 2 to 3 times a day. In addition, multivitamin mixes were also added at a rate of 5 gm for every 1 kg of pellet to enhance the immunity, growth and biological performance of shrimps.

The shrimp was harvested upon reaching the marketable size. The local market preferred small shrimp, commonly within 14 to 16 g/ind. or 60 to 70 ind./kg, while the Korean market preferred bigger size shrimp of 20 to 25 g/ind. or 40 to 50 ind./kg. Culture periods were around 4 months and shrimp were harvested twice a year.

iv) Production and Value

In 2015, shrimp production from both of the farms amounted to 692.32 tonnes, valued at RM19.601 million (DOF, Penang, 2016 - *unpublished*). The price of shrimp depended on the size, ranging from RM25/kg for 16 g/ind. (70 shrimp/kg), RM26.50/kg for 14 g/ind. (60 shrimp/kg) and RM29.50/kg for 25 g/ind. (40 shrimp/kg) and RM28/kg for 20 g/ind. (50 shrimp/kg).

■ Oyster Farming

Oyster culture in Peninsular Malaysia is still in the initial stages of development. At present, total oyster production is very low and estimated at only about 10 tonnes/year. Out of five locations where oyster farming is carried in the country, one is located within the study area i.e. at Pulau Betung (F6.155) (A1: Pulau Betung). The species cultured were *Crassosstrea belcheri, C. iredalei* and *Ostrea folium*.

i) Size and Locations

The oyster farming carried out at Pulau Betung was undertaken by only one farmer i.e. Mr. Alan Wong Chin Poh (T6.104 and F6.157).

T6.104
Oyster farming information at the study area

Location	Pulau Betung
No. of culturist	1
No. of raft	150
Area (m^2)	3,000
Commodity cultured	Tiram (*Crassosstrea iredalei*)
Production (tonnes)	10.26
Wholesale value (RM)	409,000.00

Source: Department of Fisheries, Penang, 2016 - unpublished

F6.157
Oyster farm at Pulau Betung

ii) Productive Assets

The farming of the oyster was by using plastic trays suspended from rafts. The plastic trays were hung from the raft frame in tiers. Besides the plastic trays, the raft housed a shelter for workers, a store for the safe keeping of extra culture materials and other equipment.

There were also motorised boats for transportation of workers and materials to and from their base on land to the culture site. The boat was also be used for the transportation of oyster seed, and harvested oyster to market.

iii) Husbandry

The sizes of the rafts were approximately 7 m x 7 m and could support about 100 to 120 plastic trays. The size of the plastic trays was 50.8 cm x 40.6 cm. To increase their carrying capacity of the raft, the plastic trays were hung from the raft frame in tiers. Stocking density of the oysters per tray depended on the size of seed. Commonly not more than 100 seeds were placed in each tray. The size of seed was between 7 to 10 cm. If there was any mortality, or growth is not satisfactory, the oysters were thinned out by transferring a portion to the new trays.

To ensure a high survival rate, the husbandry involved cleaning, thinning, sorting, grading, pest control and predator protection of the oyster. Silt and other debris was removed by washing the oysters, either with a pump or swishing the trays up and down in the water. Monthly washing was carried out if the siltation was heavy. However, during the dry season, siltation was not much of a problem.

Thinning activities were carried out monthly to avoid overcrowding. If the oysters were overcrowded, growth would be very slow and mortality increased rapidly. In addition, sorting was also frequently carried out. The sorting process was continued until oysters were marketed. In addition, removal of pests such as sponges, ascidians and barnacles, unwanted bivalves species, as well as predators such as crabs, oysters drill and blister worms were also frequently carried out.

iv) Production and Value

Cultured oysters reach marketable size around eight months after stocking. The marketable size of oyster was commonly within 11 to 15 cm. In 2015, the oyster production amounted to 10.26 tonnes, valued at RM0.409 million. The oyster was sold at RM3.50/ind.

6.4.2.4 Recreational Fisheries Activity at the Study Area

Discussion and interviews with anglers were undertaken at the study area (F6.158). A questionnaire was prepared for this purpose (*Appendix D.3*).

Recreational fishing is the sport of catching fish. Also known as angling, it includes the catching of freshwater and saltwater fish, typically with rod, line, and hook. Recreational fishing, often called sport fishing to distinguish it from artisanal commercial fishing, is a popular participant sport. Unlike artisanal and commercial fishing, which are commodity based, recreational fishing is more of a service-based industry.

F6.158 Interviews with the anglers. A: Tanjung Karang, B: Sungai Batu, C; Teluk Tempoyak, D: Gertak Sanggul

Malaysia has had a long-standing tradition of fishing, either commercially or for recreation. In the past, hobby fishing was undertaken from nearby ponds, rivers, disused mining pools, swamps and rice fields in inland areas or from tidal lagoons or estuaries along the shoreline. Angling has thus strong traditional linkages and is part of the cultural landscape of most Malaysians. Despite this, there is little or no data on the activity.

The rapid urbanisation and development of the country has meant that more people now live in built-up areas with little time or access to nature-based recreational facilities on a day-to-day basis. This has created a demand for outdoor leisure-based activities, of which angling is among the most popular.

Another major factor that supports the continued growth of the angling and the recreational fisheries industry is its egalitarian appeal and easy entry requirements. Entry is open ended and the activity can be undertaken in any water body that lends itself to the purpose. The equipment requirements are also flexible, ranging from a basic rod and line that costs very little to sophisticated deep sea trolling ensembles that can cost RM20,000 or more.

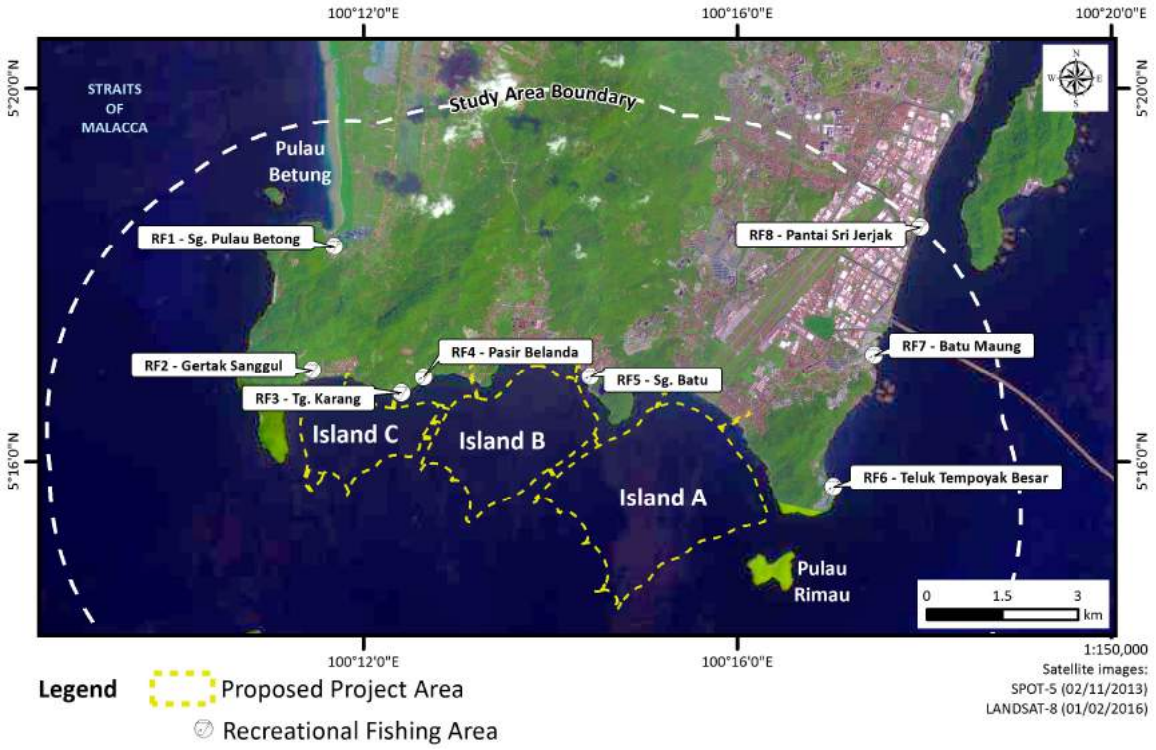
a) Location of Recreational Fishing Activity

In the study area, recreational fishing activities were carried out at Pantai Sri Jerjak, Batu Maung, Teluk Tempoyak Besar, Sungai Batu, Pasir Belanda, Tanjung Karang, Gertak Sanggul and Pulau Betung. Recreational fishing activity was recorded as being more intense during weekends as compared to weekdays. The coastal area is also famous for its other beach-based recreational activities, the assessments of which are not part of the scope of this study.

Angling hotspots within the study area were dominated by two main activities which are shore-based angling and boat-based angling (T6.105 and F6.159). Basically, the classification is made from a fishing skills point of view. The shore-based anglers use line casting and bottom fishing, while boat-based anglers use trolling and line casting. However, in both cases, it is the value of the experience, rather than of fish caught, that is the primary economic determinant.

T6.105 Staging locations for shore-based and boat-based angling at the study area

	Location	Coordinates	
		Latitude	Longitude
Shore-based Angling	Gertak Sanggul	5°16.974'N	100°11.453'E
	Tanjung Karang	5°16.729'N	100°12.407'E
	Sungai Batu	5°16.905'N	100°14.429'E
	Teluk Tempoyak Besar	5°15.732'N	100°17.029'E
Boat-based Angling	Pantai Sri Jerjak	5°18.608'N	100°17.957'E
	Batu Maung	5°17.138'N	100°17.466'E
	Pasir Belanda	5°16.898'N	100°12.648'E
	Pulau Betung	5°18.302'N	100°11.688'E



F6.159 Recreational fishing staging locations within the study area

b) Fishing Effort and Catch Type

Fishing effort was estimated using a model developed by Nagaraj *et al.* (2013). The model is not commodity-based, but takes time input into account and is more reminiscent of contingent valuation models used in nature-based tourism (Hakim, 2011) rather than traditional fish stock models.

The modelling indicated that total fishing effort amounted to 27,690 person-days per year, where 64.5% was shore-based angling, while the remaining 35.5% from boat-based angling. From the investigation, the total economic value for recreational fisheries at study area amounted to RM5.229 million (T6.106).

T6.106 Recreational fishing effort and total economic value for recreational fishing activity at study area

Type of Angling Activities/Location		Recreational Fishing Effort (Total Person Days)	Total Economic Value (RM)
Shore-based Angling	Gertak Sanggul	7,377	737,700
	Tanjung Karang (Gemuruh Cape)	5,789	578,900
	Sungai Batu	2,342	234,200
	Teluk Tempoyak Besar	2,342	234,200
Subtotal		**17,850**	**1,785,000**
Boat-based Angling	Pulau Betung	864	302,400
	Pasir Belanda	7,038	2,463,300
	Batu Maung	264	92,400
	Pantai Sri Jerjak	1,674	585,900
Subtotal		**9,840**	**3,444,000**
Total		**27,690**	**5,229,000**

Detailed elaboration on each angling location according to their type of angling activities is discussed below.

- Shore-based Angling

Shore-based angling was undertaken primarily at Gertak Sanggul, Tanjung Karang, Sungai Batu and Teluk Tempoyak Besar (F6.160). Shore-based angling at Gertak Sanggul was mainly carried out at the recreational fee-based pond in the village i.e. Gertak Sanggul Fishing Stage, while at Tanjung Karang, Sungai Batu and Teluk Tempoyak Besar angling is mostly undertaken at jetties or along the rocky shore. Angling activity is commonly undertaken during weekends.

An average of 5 to 15 persons was recorded undertaking angling activities during weekdays at Gertak Sanggul Fishing Stage, increasing from 5 to 25 persons during weekends and public holidays. At Tanjung Karang, a low number of anglers was observed during weekdays, only 2 to 5 persons during the day, while no anglers were recorded at night. However, during weekends and public holidays, the area supported a large number of anglers, from 20 to >50 anglers during the day and 1 to 2 anglers at night.

The same situation was also recorded at Sungai Batu and Teluk Tempoyak Besar. The number of anglers was low during weekdays (1 to 2 anglers: day time) and increased during weekends and public holidays (5 to 20 anglers: day-time; 5 to 10 anglers: night-time).

The most common baits used were live shrimp, small fish, shrimp, fishmeal, polychaete worms (*pumpun*), hermit crabs and squids. Normally the live-baits (shrimps, small fish) were purchased at aquarium shops at around RM0.6 to RM1/individual, while fish, shrimp and squid were purchased at wet markets for around RM2 to RM3. The standard fishing gears used by anglers were the rod-and-line. According to the anglers, the cost of their gear ranged from RM50 to RM300. The best catch was obtained during incoming tides, particularly springs, with catch averaging from 0.5 to 1.5 kg/person. Among the common species caught include the Semilang (*Plotosus* sp.), Duri (*Arius* spp.), Bedukang (*Arius sagor*), Gelama (*Johnius* sp.), Jenahak (*Lutjanus* sp.), Kerapu (*Epinephelus* sp.), Siakap (*Lates calcarifer*), Merah (*Lutjanus malabaricus*), Senangin (*Polynemus* spp.), Belanak (*Mugil* spp./*Liza* spp./*Valamugil* spp.) and Pari (*Himantura* spp./*Gymnura* spp./*Dasyatis* spp.).

The investigation indicated that the total fishing effort amounted to 17,850 person-days a year. The highest numbers were recorded at Gertak Sanggul, which accounted for 41.3% of the total fishing effort, followed by Tanjung Karang with 32.4% (5,789 person-days a year), while balance 13.1% each was in Sungai Batu and Teluk Tempoyak Besar (2,342 person-days a year) (T6.107). Commonly, anglers spent around 4 to 6 hours during the day and sometimes over the night too.

F6.160 Shore-based angling. A- B: Tanjung Karang, C-D: Gertak Sanggul, E: Teluk Tempoyak Besar, F: Sungai Batu

T6.107 Recreational fishing effort for shore-based angling

Location	Time Segment	Weekdays	Person (hrs/yr)	Weekends	Person (hrs/yr)	Total Person (hrs)	Total Person (days)
Gertak Sanggul	0900 - 1300 hrs	5	5,220	7.5 (5-10)	3,120	8,340	1,043
	1300 - 1900 hrs	7.5 (5-10)	11,745	17.5 (5-20)	10,920	22,665	2,833
	1900 - 2400 hrs	12.5 (10-15)	16,313	22.5 (20-25)	11,700	28,013	3,502
						Sub-total	**7,377**
Tanjung Karang	0900 - 1300 hrs	3.5 (2-5)	3,654	50	20,800	24,454	3,057
	1300 - 1900 hrs	3.5 (2-5)	5,481	25 (20-30)	15,600	21,081	2,635
	1900 - 2400 hrs	0	0	1.5 (1-2)	780	780	98
						Sub-total	**5,789**
Sungai Batu	0900 - 1300 hrs	1.5 (1-2)	1,566	15 (10-20)	6,240	7,806	976
	1300 - 1900 hrs	1.5 (1-2)	2,349	7.5 (5-10)	4,680	7,029	879
	1900 - 2400 hrs	0	0	7.5 (5-10)	3,900	3,900	488
						Sub-total	**2,343**
Teluk Tempoyak Besar	0900 - 1300 hrs	1.5 (1-2)	1,566	15 (10-20)	6,240	7,806	976
	1300 - 1900 hrs	1.5 (1-2)	2,349	7.5 (5-10)	4,680	7,029	879
	1900 - 2400 hrs	0	0	7.5 (5-10)	3,900	3,900	488
						Sub-total	**2,342**
						Total	**17,850**

- Boat-based Angling

Four boat-based angling locations were recorded at the study area which are Pantai Sri Jerjak, Batu Maung, Pasir Belanda and Pulau Betung (F6.161). Detailed discussions of boat-based angling are as follows.

F6.161
Boat-based angling - Boats for rental for angling activity. A-B: Inboard powered boat (Pasir Belanda), C: Outboard powered boat (Pasir Belanda), D: Outboard powered boat (Pantai Sri Jerjak)

Pasir Belanda was the most productive location for boat-based angling. Two outboard and three inboard powered boats were generally available for rental. Most of these boats were licensed by the Marine Department, Peninsular Malaysia. The outboard-powered boats were chartered for angling at Pulau Kendi and the surrounding areas while inboard-powered boats went offshore (Kapal Karam and Karang). The rental rates for outboard were RM400/trip (4 to 9 hours/trip), while it was RM2,800/trip (2 days and 1 night) for an inboard-powered boat. Each outboard boat could accommodate 6 anglers/boat, while inboard and could carry 10 passengers.

The second most important location for boat-based angling was Pantai Sri Jerjak, where there were five outboard powered boats available for boat rental. Three boats could be chartered for angling at Pulau Kendi and the surrounding area, while two larger boats were for offshore areas ("*Kapal Karam"* and "*Karang*"). The smaller boats had engine sizes of 40, 60 and 90 HP, while larger boats used 115 HP engines (2 units). Most of the boats are licensed by the Marine Department, Peninsular Malaysia.

Rental rates for angling at Pulau Kendi ranged from RM800 to RM1,000/trip (12 hours) during daytime and an additional RM100 for angling during night-time. As for angling at more distant locations, the rental rate was RM1,500/trip (24 hours) for angling at "*Kapal Karam*" and RM2,500/trip (24 hours) for angling at "*Karang*". The rate included cost of food and bait. Each boat could accommodate around 3 to 4 anglers/trip for angling at Pulau Kendi and 4 to 5 anglers/trip for angling at offshore area. An average of 2 trips/month/boat for angling at Pulau Kendi and 4 trips/month/boat for angling at "*Kapal Karam*" and "*Karang*" was recorded.

The third most important location for boat-based angling was at Pulau Betung, where there was one (1) outboard-powered boat available for rental. The boat was licensed by the Marine Department, Peninsular Malaysia, and had an engine size of 150 HP (2 units). Rental rates depended on the fishing area, with rates as high as RM1,500/trip for angling at "*Kapal 40"* and "*Kapal Taiping"*, RM 1,000/trip at "*Kapal Russia*" and RM800/trip at "*Kapal Jepun*". Besides charter for angling in offshore areas, boats were also available for angling at Pulau

Kendi, with rental rate recorded at RM600/trip. The rates for all areas were for a 12-hour period. A typical boat could accommodate around 6 anglers/trip. Trips were mostly undertaken during daytime (7:00 am to 7:00 pm). There were an estimated 8 trips/month.

In addition, boat rental was also available at Batu Maung. Two outboard-powered boats owned by fishermen were available for boat rental. The angling locations were at Penang Bridge, Pulau Rimau and Pulau Kendi. The rental rates were RM200 to RM300 for angling at Penang Bridge and Pulau Rimau, and RM450 for Pulau Kendi. The rental excluded bait and food. Each boat could accommodate 5 to 6 anglers. Trips were mostly undertaken during daytime (9:00 am to 5:00 pm). There were an estimated 2 trips/month by each of those boats. Summaries of the profile of boat services and service charge (rental rate/trip) are provided in T6.108 and T6.109 respectively.

T6.108 Profile of boat services for angling activity at the study area

Staging Point	No. of Boats Available for Rental	Boat Capacity	Engine Capacity
Pulau Betung	1 outboard	6 anglers/boat	150 HP (2 units)
Pasir Belanda	5 units (2 outboard and 3 inboard)	6 anglers/boat (outboard) and 10 anglers/boat (inboard)	60 HP (outboard), *data on inboard not available*
Batu Maung	2 outboard	5 to 6 anglers/boat	Not available
Pantai Sri Jerjak	5 outboards	3 to 4 anglers/boat (Pulau Kendi) and 4 to 5 anglers/ boat (offshore)	Angling at Pulau Kendi - 40, 60 and 90 HP and offshore angling - 115 HP (2 units)

T6.109 Recreational service fee (RM/boat/trip) for angling activity at the study area

Staging Point	Angling Location	Fee Rate (RM/boat/trip)	Average Fishing Period
Pulau Betung	Pulau Kendi	RM600/boat/trip	12 hours (0700 – 1900 hrs)
	Kapal Jepun	RM800/boat/trip	12 hours (0700 – 1900 hrs)
	Kapal Russia	RM1,000/boat/trip	12 hours (0700 – 1900 hrs)
	Kapal 40	RM1,500/boat/trip	12 hours (0700 – 1900 hrs)
	Kapal Taiping	RM1,500/boat/trip	12 hours (0700 – 1900 hrs)
Pasir Belanda	Pulau Kendi and surrounding area	RM400/boat/trip	8 hours (0800 – 1600 hrs) or 4 hours (1800 – 2000 hrs)
	Kapal Karam	RM2,800/boat/trip	36 hours (2 days and 1 night)
	Karang	RM2,800/boat/trip	36 hours (2 days and 1 night)
Batu Maung	Penang Bridge	RM200-300/boat/trip	8 hours (0900 – 1700 hrs)
	Pulau Rimau	RM200-300/boat/trip	8 hours (0900 – 1700 hrs)
	Pulau Kendi	RM400/boat/trip	8 hours (0900 – 1700 hrs)
Pantai Sri Jerjak	Pulau Kendi and surrounding area	RM800-RM1,000/boat/trip and additional RM100 for night angling	12 hours (0700 – 1900 hrs)
	Kapal Karam	RM1,500/boat/trip	24 hours (0700 – 1900 hrs)
	Karang	RM2,500/boat/trip	24 hours (0700 – 1900 hrs)

According to the boat operators, more than 80% of anglers were from Penang itself, while others from Kuala Lumpur, Perak, Selangor, Pahang, Kelantan and also foreigners. The majority of the anglers were about 30 to 35 years old. Most of the anglers were Malays, who formed more than 50% of the total anglers, followed by Chinese (<40%), Indians (>10%) and foreigners (1%).

The main fishing gear was rod-and-line with 2 to 4 rods per person. Anglers commonly use live shrimp, juvenile Belanak (*Mugil* spp.) and small-sized octopus as baits. Live shrimp costs about RM1/ind., juvenile Belanak (*Mugil* spp.), RM0.60 to RM0.80/ind. and small octopus, RM1.50/ind. Commonly, the fish caught include Jenahak (*Lutjanus johnii*), Tanda (*Lutjanus russelli*) Kerapu (*Epinephelus* spp.), Merah (*L. malabaricus*), Senangin (*Polynemus* spp.), Tenggiri *(Scomberomorus* sp), Alu-alu (*Sphyraena* spp.), Golden Trevally (*Charanx ignobilis*), Talang (*Scomberoides* spp.), Bawal (*Pampus* spp.), Kerisi (*Nemipterus* spp.) and Mengkerong (*Saurida* spp.). The average number of fish caught was about 10 to 20 kg/boat. However, sometimes the catch could exceed 50 kg/boat, especially at distant waters.

The study indicated that the fishing effort for boat-based angling amounted to 9,840 person days a year. Pasir Belanda recorded the highest fishing effort with 7,038 person days a year, followed by Pantai Sri Jerjak (1,674 person days a year). As for Pulau Betung and Batu Maung, the recreational fisheries efforts were recorded at 864 person days a year and 264 person days a year respectively (T6.110).

T6.110 Recreational fishing effort for boat-based angling

Location	Time Segment	No. of Anglers	Person (hrs/yr)	Total Person (days)
Pantai Sri Jerjak	0700 - 1900 or 1900 - 0700	10.5 (3-4 anglers x 3 boats)	3,024	378
	1900 - 0700	9 (4.5 anglers x 2 boats)	10,368	1,296
			Sub-total	**1,674**
Batu Maung	0900 - 1700	11 (5-6 anglers x 2 boats)	2,112	264
			Sub-total	**264**
Pasir Belanda	2 days 1 night (36 hours)	30 (10 anglers x 3 boats)	51,840	6,480
	0800 - 1700	12 (6 anglers x 2 boats)	3,888	486
	1800 - 2000	12 (6 anglers x 2 boats)	576	72
			Sub-total	**7,038**
Pulau Betung	0700 - 1900 or 1900 - 0700	6 (6 anglers x 1 boats)	6,912	864
			Sub-total	**894**
			Total	**9,840**

c) Output Values and Socio-economics

The data from all locations involving recreational fisheries activity along the Penang waters indicate that the total fishing effort amounted to 27,690 person-days per year. The economic value of recreational fisheries is difficult to estimate. Some of the fishers are from outside the immediate area while others are local residents. MIER (2000) adopted a value of RM50 per person-day.

These figures are clearly outdated. For instance, the boats at Pulau Betung rent out RM1,500 for six anglers, which averages out at RM250 per 12-hour period or RM500 per person man-day. Data from T6.111 suggests rental rates vary from RM200 to RM500/person -day. The cost of shore-based fishing is not as high, but RM50 would probably be insufficient to cover the cost of bait, food and other relevant expenses. Assuming:

i) An average payout of RM350/person-day for boat-based anglers; and
ii) An average payout of RM100/person-day for shore-based anglers.

T6.111 Estimation of the total economic value at the study area

Fishing Type	Total Person (days)	Unit Economic Value (RM)	Total Economic Value (RM)
Shore-based fishing	17,850	100	1,785,000
Boat-based fishing	9,840	350	3,444,000
Total	**27,690**	-	**5,229,000**

It is estimated the direct economic value from the recreational fisheries amounts to RM 5.229 million per year.

6.4.3 Feedback from the Focus Group Discussion (FGDs) with the Public and Fishing Community

The FGDs were conducted by initially informing the participants of its objectives and then followed by a briefing about the proposed 3-island reclamation fronting the southern coastal area from Kampung Permatang Damar Laut in the east to Kampung Gertak Sanggul in the west. Some details were also given as pertained to its construction sequence, methods of reclamation, island size, the width of the separation channel, general topside development and the conservation of the coastal area through beach nourishment and revetment where applicable and also of the upgrading of local fish landing jetties before construction is carried out.

The discussion commences at this juncture when the participants were asked how they foresee such a kind of project would be affecting them. This was done in lieu of exploring residents'/people's views and perceptions of the proposed Project based on their current level of knowledge of the Project. Hence it complements the results gathered from the questionnaire survey. The discussion was left to progress and flow by itself with occasional remarks or chipping in by the facilitators when it was felt that it had gone out of context and brought it back to focus/mainstream. Further prompting of other lead issues or questions will follow to lead for further discussion. In this way, what are uppermost in the people's mind, what are their concerns, fears, expectations and aspirations could be assessed.

There were various feedbacks received from, or issues raised, during the discussions carried out at the FGD sessions with the fishermen. The main concerns voiced out by them include among others:

a) The sea fronting their villages or the proposed reclaimed area is an important fish and prawn (spawning) area which when reclaimed would destroy it, thus affecting local fishermen's livelihood;
b) Demand compensation if reclamation is implemented based on the loss and destruction of the prawn catching site which they have to bear to sustain them and the second generation or at least for the duration until the completion of the Project;
c) Concern over the possibility of a repeat of mud being washed to the shore by the reclamation project as previously experienced from the delayed effects of mud/ sediments from the Second Penang Bridge project affecting the water quality and the coasts;
d) Demand for improvement of infrastructural facilities which are especially related to fishing activities such as storage, jetty and generating new economic venture such as seafood eateries or promotion for tourist attraction;

e) Voiced the need to build special settlement of affordable housing for fishermen since there are still fishermen who are lodgers. Fishermen need modern settlements, plans for making existing fishermen involved in more advanced practice, with modern facilities and settlement. They hoped that part of the reclaimed island will be allocated for fishermen; and
f) Last but not least, fear of marginalisation with the influx of foreign workers into the area had also gripped them.

Details of the feedbacks and issues raised by the fishermen during the FGD sessions conducted is given in *Appendix B.1* in Volume 3: Appendices whereby there are issues common to all being raised as well as matters peculiar to specific localities where the FGD were conducted.

The FGD sessions with the public revealed different concerns, for although they were concerned with the well-being of their fishermen co-inhabitants when the latter's fishing ground will be covered and turned into islands, they also fear of their own physical-being and sustainability from being relocated or displaced due to land being sold in lure of future economic gains from sale of land. To them not only their physical being is being threatened, their cultural sustainability is also at stake as future spill-over development from the reclamation may see to the demise of the *kampung* atmosphere and social as well as cultural values. They even see the need to preserve the village historical and cultural heritage as well as traditions. The issues raised or the feedbacks received from the discussions carried out during the two FGD sessions with the public are given in *Appendix B.2* in Volume 3: Appendices.

T6.112 lists the feedbacks received from, or issues that rose, during the various discussions carried out at the FGD sessions with the fishermen while T6.113 lists the issues raised or the feedbacks received from the various discussions carried out during the two FGD sessions with the public:

T6.112 Feedbacks and issues raised in the Focus Group Discussion with the fishermen

Arbitrary Zone	Place	Feedback/Issues
Zone A	Kampung Permatang Tepi Laut	■ Concern over the site for Island A as an important fish and prawn area which when reclaimed would destroy it and local fishermen's livelihood since most of them are inshore fishermen. ■ Concern over the length of the underwater/seabed pipeline for sand transport to the construction site and its potential to cause damage to fishing gears. ■ Fear of relocation due to land being acquired by the private company owning the land where their settlement sits, when and if the latter decides to develop the land in conjunction with the development of the reclaimed island. ■ Concern over fishing as a vocation of generational tradition and that it should be improved upon and upgraded.
Zone B	Kampung Teluk Kumbar	■ Concern over delayed effects of mud/sediments from the 2nd bridge project affecting the water quality and the possibility of a repeat of mud being washed to the shore by the reclamation Project, ■ Fear of loss of livelihood and the obstruction of the reclamation for fishing boats to pass through. ■ Compensation is necessary, but there needs long term planning for fishermen to carry on fishing legacy. Fishermen need modern settlements, planning to make existing fishermen move towards a more advanced practice, facilities and settlement. Hopefully, part of the island will be allocated for fishermen's use.

T6.112 Feedbacks and issues raised in the Focus Group Discussion with the fishermen (cont'd)

Arbitrary Zone	Place	Feedback/Issues
Zone B (cont'd)	Kampung Sungai Batu	■ Majority disagreed with the proposed Project as they claimed that the area is the most important prawn and prawn spawning area in Penang and that 99 % of the fishermen in Sungai Batu and Teluk Kumbar are involved in prawn landing. Reclamation will destroy the spawning area and livelihood of the local fishermen. Those who agreed, especially among Chinese fishermen, only if the reclamation does not affect their livelihood during construction. ■ Worry over the construction method and the surety that disposed materials containing mud would not be washed back to the coasts from its designated disposal area located 30 km away which would potentially threaten and destroy the prawn catching and spawning area. ■ Demand compensation of RM1.5 million each if reclamation is implemented based on the loss and destruction of the prawn catching site which they have to bear to sustain them and the second generation. ■ They also demand for improvement of infrastructural facilities which are especially related to fishing activities such as storage, jetty and generating new economic venture such as seafood eateries or promotion for tourist attraction. ■ Questioned the logic of building low cost or affordable housing on a multi-billion cost island, what more when they are sold to a third party. ■ Voiced concern over the need to also see into the welfare of the other members of society such as women, youth and children when it was obvious that the focus was zoomed towards the impact on fishermen. ■ Fear of marginalisation with the influx of foreign workers into the area. ■ Upset with the state government to rationalise the proposed reclamation Project, despite the fact that local fishermen have been grappling to preserve their marine areas from the threat of illegal trawling and Rimau net and that the site is an
Zone C	Kampung Gertak Sanggul	■ Concern over the site for Island C as an important fish and prawn area which when reclaimed would destroy it and local fishermen's livelihood as prawns do not thrive in deep water i.e. beyond the reclaimed land. ■ Should reclamation be implemented, the fishing community demanded that they be compensated by giving monthly stipend of RM5,000 to fishermen (owner-operator) and RM3,000 to boat crew or *awak-awak* for the duration until the completion of the Project. ■ They also demand for higher subsidy for petrol and bigger boat should they have to go further for deep sea fishing. ■ The need to build special settlement of affordable housing for fishermen since there are still fishermen who are lodgers. ■ Suggestion to put artificial reefs in the area to attract and stimulate fish and prawn spawning was not well received as it was said to defeat the purpose when they would be damaged by the trawl nets from "illegal" trawling carried out in the area.

T6.113 Feedbacks and issues raised in the Focus Group Discussion with the public

Arbitrary Zone	Place	Feedback/Issues
Zone A	Kampung Permatang Tepi Laut	■ Perceived concern on the possibility that there will be land acquisition for road widening as access road for transportation of construction materials. ■ Fear of relocation due to land being acquired by the private company owning the land when and if the latter decides to develop the land in conjunction with the development of the reclaimed island. ■ That they be relocated at one resettlement or a new fishing settlement in order to retain and preserve local tradition and culture. ■ Seeking assurance that they be given priority when applying for affordable housing on the island.
Zone C	Kampung Gertak Sanggul	■ Concern over the impact of the reclamation of the three islands on the habitat of fish and other marine life in the area. ■ Concern over the impact of the reclamation over the physical sustainability or future existence of Kampung Gertak Sanggul when the impact of increased land value may end up in the locals and private land owners selling off their land. ■ Demand to know more about the Project to the very detail of the topside development and the number of job opportunities created and to be briefed during weekends not on weekdays as many were away working. ■ Concern over cultural sustainability as future spill-over development from the reclamation may see to the demise of the kampung atmosphere and social as well as cultural values. ■ Concern over the preservation of the village historical and cultural heritage as well as traditions. ■ Concern over the impact on fishermen who have to go further to fish, hence having to bear higher petrol cost and the fact that the area is an important prawn breeding area. ■ Concern on survival of future generations through economic and housing benefits for them and the need to conserve the environment. ■ Majority of the locals disagreed with the proposed Project due to its long term negative impacts and wanted the environment to be preserved for future generations.

6.4.4 Feedback from the Informal Conversation with the Public and Fishing Community

The informal conversations were conducted using some lead questions pertaining to the proposed Project in terms of its possible impacts on the local communities, its acceptability as well as the local needs and aspirations (*Appendix B.3* in Volume 3: Appendices). The study team (normally comprising at least two persons) started off by approaching and inviting themselves to join in the small gathering and slowly gearing the conversation towards the PSR Project and asking what they (the group) think of the impending Project.

The various feedbacks gathered from the informal conversations conducted clearly portray dual responses - one was that of the fishermen and the other the public. What can be deduced from the various feedbacks was that the fishermen, as the directly impacted stakeholders, were less supportive whilst the public, being indirectly impacted were more keen as seen from the support given to the likely benefits that the impending Project would generate. However, they had also cautioned about the likelihood that the benefits may miss the locals' grasps if care was not taken to see to their just distribution. Details of the feedbacks are given in *Appendix C.9* in Volume 3: Appendices.

Taking the cue from the highest score (in terms of percentage) of opinion or opinions given during the informal conversation based on the lead questions revealed that:

a) *On the opinion regarding the PSR Project* – they opined that although it is good for the development of the area, it will give major impacts on fishermen and marine resources;
b) *On its advantages* – they were of the opinion that it will benefit specific group(s) only and not the local population;
c) *On its disadvantages* – to them fishermen and fish landing will be badly affected;
d) *On recommendation for improvement* – it would be better to seek fishermen's opinion since they are the ones to be directly impacted;
e) *On reducing the disadvantages* – to form a just task force in conducting a study to find out whether or not it is for the better or worse and to relocate it elsewhere;
f) *On expectation of the implementation of the Project to own-self* – good if benefit the locals but disagree if for advantage of specific groups;
g) *On expectation of the implementation of the Project to family members* – do not disturb the livelihood of the fishermen and give priority to locals and not foreign labour;
h) *On expectation of the implementation of the Project to local community* – all will reap benefit in terms of comfort and harmony;
i) *On expectation of the implementation of the Project to South Penang* – to give employment to the locals and to built affordable housing; and
j) *On aspiration for the progress of South Penang* - upgrade each village and turn each of them as tourist centre and improve the local fishermen as modern fishermen like the west.

Feedbacks received from the various lead questions brought up for the informal conversation are given in *Appendix B.4* in Volume 3: Appendices.

6.4.5 Feedback from the Public Dialogue

The feedbacks from the public dialogue would refer mainly to those residing in the study area, more specifically within the 5 km perimeter of the Project site. As it is, they did not only participate in the social survey but for some others who were not randomly selected during the social survey were also expected to be involved in the public dialogue organised to better understand their problems and to provide the platform for them to air their grievances, views and opinions.

As mentioned earlier, the public dialogue attracted some 853 people (comprising 485 Malay, 342 Chinese and 26 Indians), not only from among the locals especially fishermen, but also from as far out as Seberang Prai and some 26 reporters and journalists from various electronic and print media came to cover the occasion (*Appendix C.2* in Volume 3: Appendices). The dialogue started at 9:00 am with a brief introduction on the Project and its components by the Chief Minister of Penang, followed by the presentation of the DEIA studies and findings. Hence, the feedback described in this section mainly refers to the opinions given by those gathered during the public dialogue. They were mixed opinions of for and against the proposed development, the latter concerning issues akin to their fishing activities that they were concerned with.

However, during the Q&A session, the crowd gathered was seen to be slowly leaving the hall as early as 11:30 am and gathered momentum by 12:47 pm apparently for a greater agenda of demonstrating against the project taking the cue from the protest mooted by one of the local peripheral fishermen. The (peaceful) demonstration (as depicted in F6.116) was led by the Fishermen Association of Penang.

In the Q&A session, 44 questions and issues were raised by 18 interested participants comprising fishermen/head of Fishermen Units both local and non-local, a cage-culture operator from Pulau Jerjak, a local pig breeder, a chemist, a retiree and even a blogger. While some expressed support for the proposed Project, others mooted concerns, the details of which could be gleaned from *Appendix C.9* (as mentioned earlier) and summarised into four major issues raised especially by the general public and the fishermen, the latter would be the directly impacted group:

a) The concern over reclamation affecting fishing activities and livelihood and the associated demand for compensation;
b) The concern over eligibility and ability of purchasing affordable houses;
c) The concern over the Project's impacts on the environment and the associated aspects covered in the DEIA; and
d) Other local and state issues of concerns such as pig farming and several aspects of the Transport Master Plan.

Issues raised by the representatives of the fishing communities were seen not to be so different from those expressed by the respondents in the social survey, particularly with regards to the concerns of the impacted fishing communities.

Besides verbal questions, the Dialogue also allowed written questions or comments to be forwarded by the participants to enable those who did not have the opportunity to ask questions or shied away from asking questions directly, to write down their concerns. According to the record, 165 forms of written comments were received from the participants who returned the 'Question slips' handed out during the dialogue. Out of 165 forms returned, half (83 forms) were from Malay and the other half (82 forms) were from Chinese attendees. On scrutiny it was found that 21 or 12.7% of them were devoid of comments except for giving the vital information sought. This means that 144 or 87.3% were returned filled forms. Most were written comments from fishermen who comprised 42% of them, followed by 17% housewives, 10% private sector employees, 3% business people and the rest were of mixed occupation or retirees.

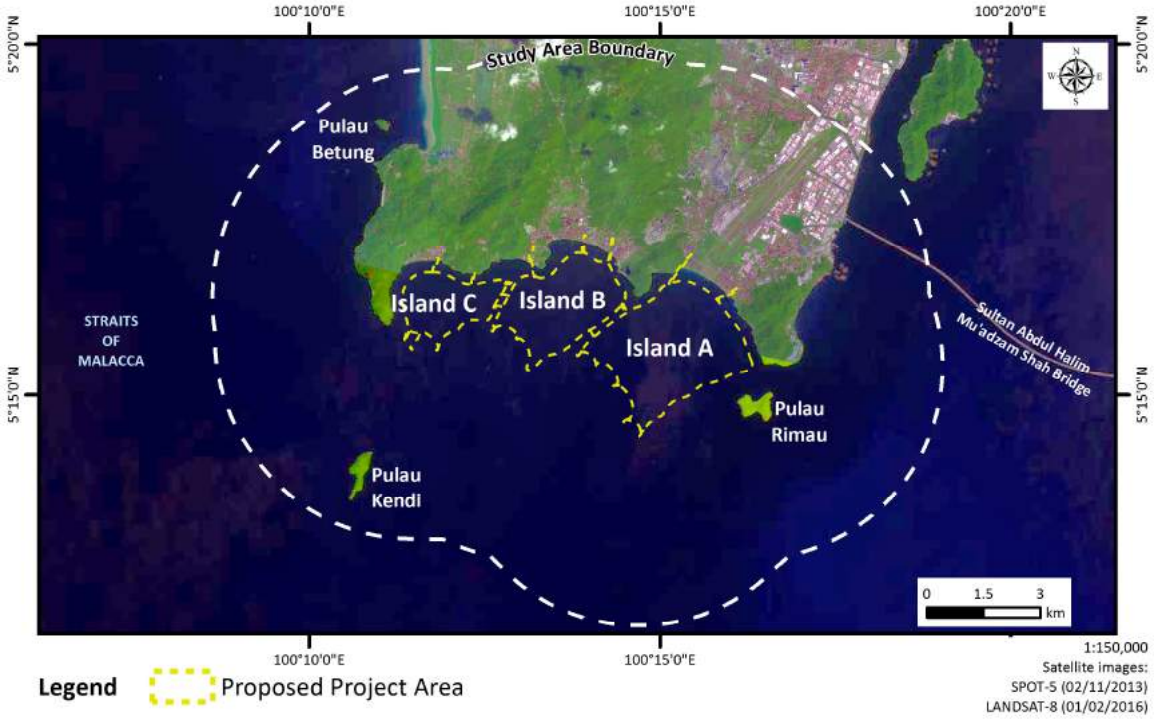
Out of the 144 filled forms, 63.2% expressed their support, 13.9% expressed their disagreement and the remaining 22.9% were non-committal. Also more than half (57.6%) of the filled forms were written with mere statements of support or against the project and only 61 forms or 42.4% were comments made or given. Mostly were wary of their fishing activities, but a few did caution on matters that relate to the environment, marine ecology in the affected area as well as that the locals be given due consideration and priority for the employment opportunities created from the Project. *Appendix C.6* (mentioned earlier) lists out the comments and the reciprocated remarks as well as the copies of the original handwritten comments.

6.5 Environmentally Sensitive Areas

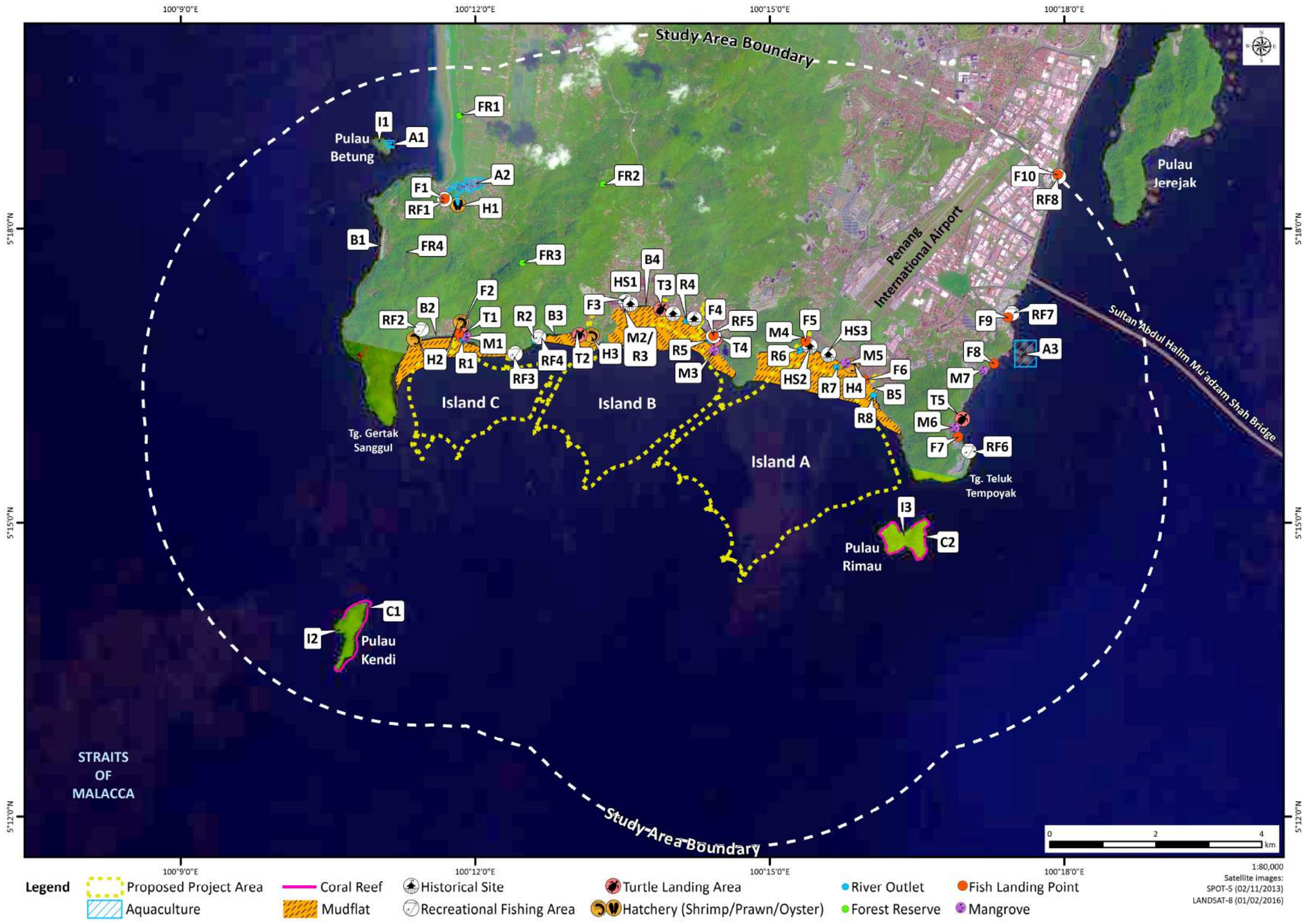
The Department of Environment (DOE) Malaysia defines an Environmentally Sensitive Area (ESA) as an area where specific attention or proper consideration is duly given prior to any development being authorised within or in the vicinity of the area. The coverage of the existing environment to indicate the ESAs is within a 5-km radius from the Project area (F6.162 and F6.163). This is to ensure that their well-being is taken into account in the development.

The ESAs are explained in detail according to the following (T6.114):

a) Physical ESAs;
b) Biological ESAs; and
c) Socio-economic ESAs.



F6.162 5-km radius study area from the Project location



F6.163 ESAs within the study area

T6.114 Summary of ESAs within the study area

Type of ESA		Point	Location	Distance (km)
Physical	Recreational Beaches	B1	Pantai Pasir Panjang	2.0
		B2	Pantai Gertak Sanggul	0.3
		B3	Pantai Tanjung Asam	0.5
		B4	Pantai Nelayan	0.5
		B5	Pantai Bakar Kapor	0.1
	Island		Pulau Betung	3.9
			Pulau Kendi	2.9
			Pulau Rimau	0.6
	Rivers	R1	Sungai Gertak Sanggul	<0.1
		R2	Sungai Gemuruh	0.4
		R3	Sungai Teluk Kumbar	0.5
		R4	Sungai Mati	0.2
		R5	Sungai Batu	0.2
		R6	Sungai Bayan Lepas	<0.1
		R7	Bayan Lepas Main Drain	0.2
		R8	Sungai Ikan Mati	0.2
	Mudflat	–	Along the coastline: Permatang Damar Laut, Teluk Kumbar and Gertak Sanggul	<0.1
	Historical Structures (WW2 Pillbox)	HS1	Teluk Kumbar	0.1
		HS2	Permatang Damar Laut	0.1
		HS3	Bayan Lepas Main Drain	0.3
Biological	Coral Reef	C1	Pulau Kendi	2.6
		C2	Pulau Rimau	0.6
	Turtle Landing Area	T1	Gertak Sanggul	<0.1
		T2	Pasir Belanda	0.1
		T3	Teluk Kumbar	<0.1
		T4	Sungai Batu	0.3
		T5	Teluk Tempoyak	1.4
	Forest Reserve	FR1	Hutan Simpan Balik Pulau	2.4
		FR2	Hutan Simpan Bukit Genting	2.1
		FR3	Hutan Simpan Bukit Gemuruh	0.8
	Mangrove	M1	Sungai Gertak Sanggul	0.1
		M2	Sungai Teluk Kumbar	0.5
		M3	Sungai Teluk Kumbar	0.2
		M4	Sungai Bayan Lepas	<0.1
		M5	Bayan Lepas Main Drain	0.3
		M6	Teluk Tempoyak Besar	1.2
		M7	Teluk Tempoyak Kecil	1.7
Socio-economic	Hatchery	H1	Near Sungai Pulau Betung (1 location)	2.4
		H2	Gertak Sanggul (3 locations)	0.2
		H3	Teluk Kumbar (6 locations)	<0.1
		H4	Permatang Damar Laut (2 locations)	<0.1
	Cage Culture	A1	Pulau Betung	3.3
		A2	Sungai Pulau Betung	2.2
		A3	Batu Maung	2.3

T6.114 Summary of ESAs within the study area (cont'd)

Type of ESA		Point	Location	Distance (km)
Socio-economic	Fish Landing Point	F1	Sungai Pulau Betung	2.3
		F2	Gertak Sanggul	<0.1
		F3	Teluk Kumbar	0.6
		F4	Sungai Batu	0.2
		F5	Permatang Tepi Laut	<0.1
		F6	Permatang Damar Laut	<0.1
		F7	Teluk Tempoyak Besar	1.2
		F8	Teluk Tempoyak Kecil	1.9
		F9	Batu Maung	2.4
		F10	Sri Jerejak	4.5
	Recreational Fishing Staging Area	RF1	Sungai Pulau Betung	2.3
		RF2	Gertak Sanggul	0.5
		RF3	Tanjung Karang	<0.1
		RF4	Pasir Belanda	0.5
		RF5	Sungai Batu	0.2
		RF6	Teluk Tempoyak Besar	1.3
		RF7	Batu Maung	2.5
		RF8	Pantai Sri Jerjak	4.5

6.5.1 Physical ESAs

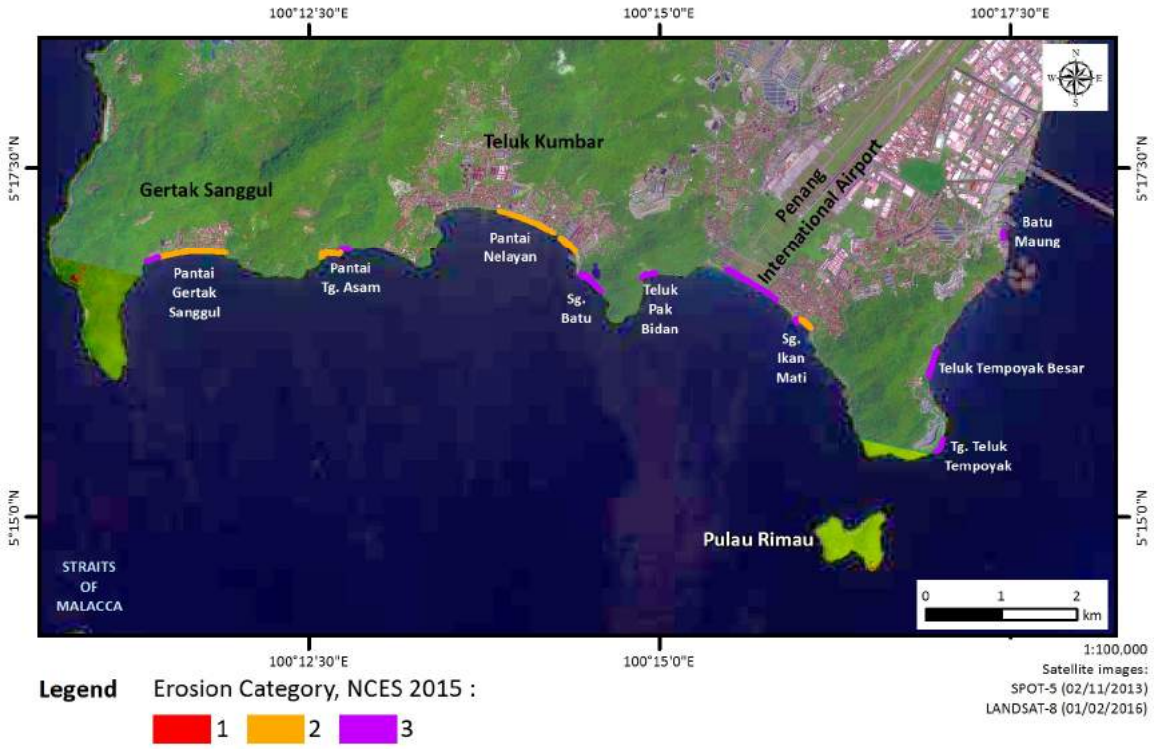
6.5.1.1 Beaches

The proposed Project area is approximately 250 m from the southern coastline of Penang Island, extending from Tanjung Teluk Tempoyak to Tanjung Gertak Sanggul. The coastline faces the Straits of Malacca and experiences direct impact from currents and waves. The coastline erosion conditions at certain areas are mostly categorised as Category 2 ("Significant") and Category 3 ("Acceptable") (NCES, 2015). The erosion category of Penang Island southern coastline is visualised in F6.164.

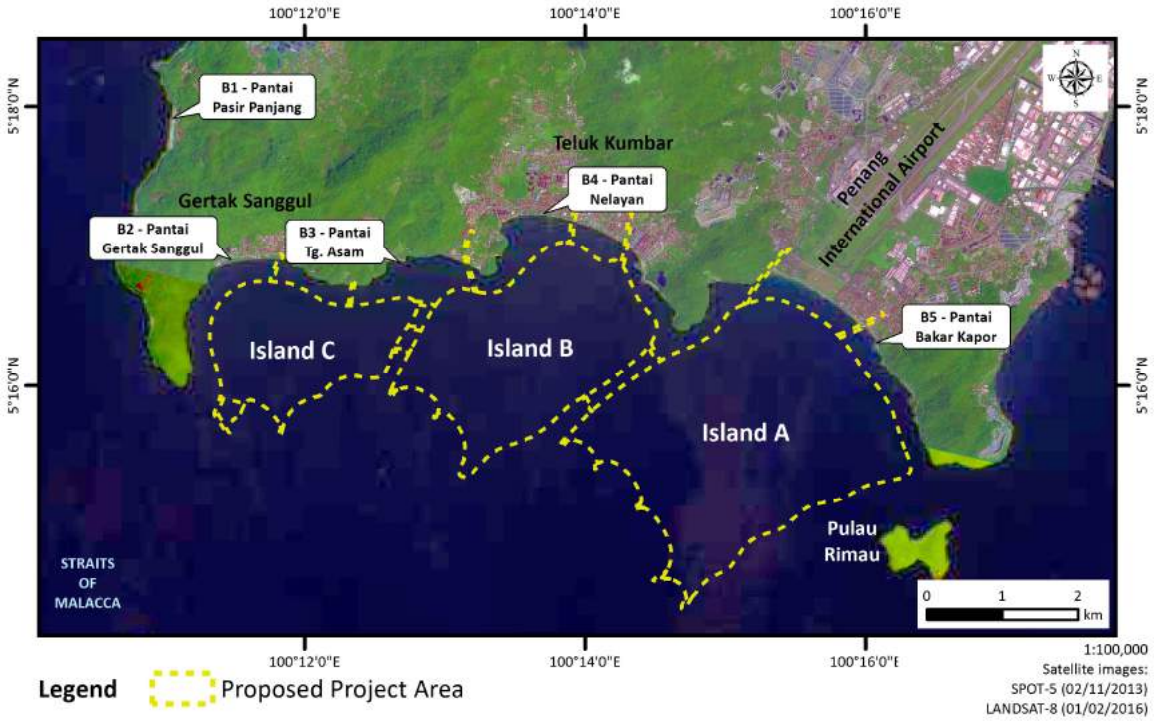
From a field observation on March 2015 at Teluk Kumbar, the coastal erosion area had been stabilised by the constructed coastal protections which still require regular maintenance to ensure sustainability. Several beaches have been identified namely Pantai Pasir Panjang, Pantai Gertak Sanggul, Pantai Tanjung Asam, Pantai Nelayan and Pantai Bakar Kapor (F6.165).The beaches along the coastline are considered as ESAs as they could be directly impacted from the hydrodynamic changes happening once the proposed Project is in place.

6.5.1.2 Islands

The nearest islands within a 5-km radius from the Project area are Pulau Rimau, Pulau Kendi and Pulau Betung (F6.165). These small islands are not marine park islands, but their existence contributes towards economic purposes such as fisheries and tourism, which therefore makes them environmentally sensitive.



F6.164 Erosion category of south coast of Penang Island



F6.165 Recreational beaches within the study area

a) Pulau Rimau

Pulau Rimau is a small island on the southeast corner of Penang Island, off the coast of Permatang Damar Laut. It is located approximately 800 m away from the tip of Tanjung Teluk Tempoyak. Pulau Rimau is the site of a lighthouse which helps ships navigate into the South Channel of Penang. Apart from the lighthouse itself, Pulau Rimau is uninhabited. The Pulau Rimau formation is of microcline granite, which is medium to coarse-grained biotite granite (Ahmad *et al*., 2006).

b) Pulau Kendi

Towards the southwest tip of Penang Island (off Gertak Sanggul), sits the petite island of Pulau Kendi. Due to its distance from the Penang Island, it has managed to stay relatively pristine. It is located about 3.5 km away from the tip of Tanjung Gertak Sanggul. It is a popular spot for recreational fishing. The formation of Pulau Kendi is Mahang formation, which is mainly ferruginous spotted slate (Ahmad *et al*., 2006).

c) Pulau Betung

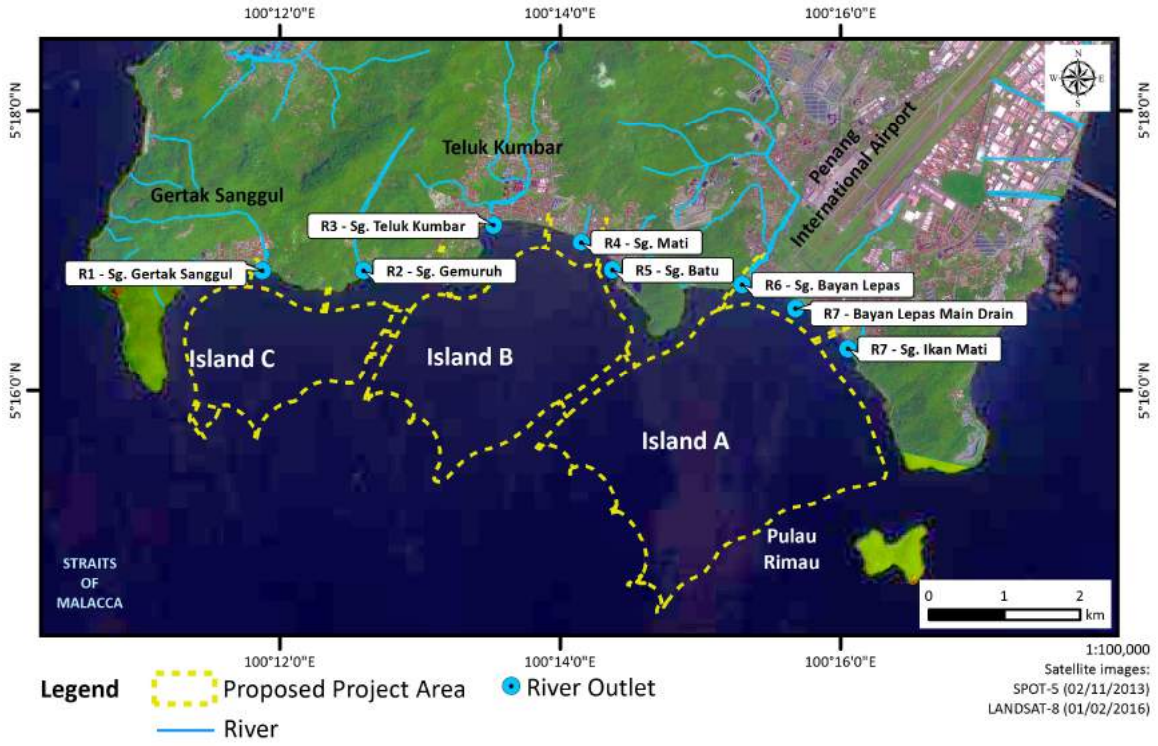
Pulau Betung is a small island on the west of Penang Island, about 1 km from Sungai the Pulau Betung river mouth. Pulau Betung is uninhabited and safe for some fish-breeding activities. Pulau Betung is not a tourist site but is often visited by fishermen and anglers. Pulau Betung as well as villages on the Penang Island nearby were affected by the 2004 Indian Ocean tsunami.

6.5.1.3 River Outlets

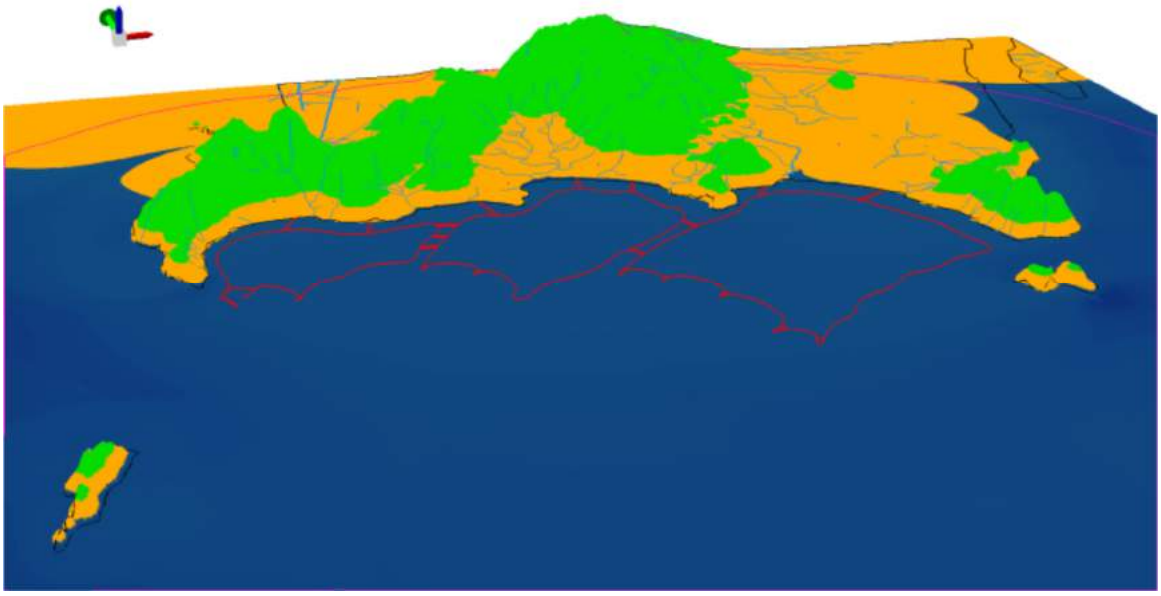
Rivers are considered as environmentally sensitive because a slight change of water level at the outlet can cause flooding. Flooding of major rivers can threaten lives and cause tremendous damage to the settlements and towns at the south coast of Penang Island.There are eight river outlets found along the Penang Island south coast namely (F6.166):

a) Sungai Ikan Mati;
b) Bayan Lepas Main Drain;
c) Sungai Bayan Lepas;
d) Sungai Batu;
e) Sungai Mati;
f) Sungai Teluk Kumbar;
g) Sungai Gemuruh; and
h) Sungai Gertak Sanggul.

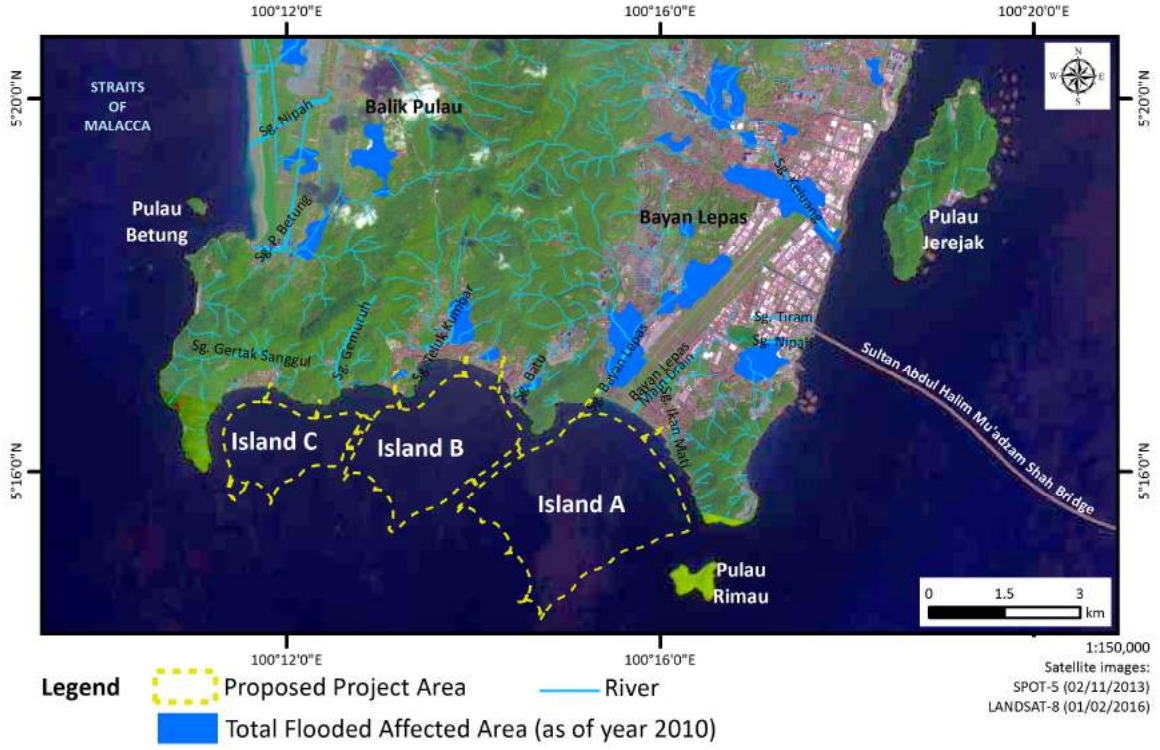
The rivers discharging along the south coast of Penang Island are small but there are many, with the existing topography showing that the upstream of these rivers are mostly of hilly areas (F6.167). A map showing flood extent recorded from year 2001 to 2009 is shown in F6.168. The flood extent shows that Sungai Teluk Kumbar and Sungai Bayan Lepas are most prone to flooding.



F6.166 River outlets at the south coast of Penang Island



F6.167 Topography of south Penang Island with the rivers in 3D



F6.168 Recorded flood extent at the south of Penang Island

Based on the Water Quality Index (WQI) classification (EQR, 2006) (T6.115), the existing river water quality for can generally be categorised as polluted as detailed out in T6.116. Only five rivers from eight were selected as these rivers carry the main contributors to pollutants downstream.

T6.115 Water Quality Index (WQI) classification

Parameter	Unit	Class				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	<0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	>2.7
BOD	mg/l	<1	1 – 3	3 – 6	6 – 12	>12
COD	mg/l	<10	10 – 25	25 – 50	50 – 100	>100
DO	mg/l	>7	5 – 7	3 – 5	1 – 3	<1
pH	-	>7.0	6.0 – 7.0	5.0 – 6.0	<5.0	>5.0
TSS	mg/l	<25	25 – 50	50 – 150	150 – 300	>300
WQI		**>92.7**	**76.5 – 92.7**	**51.9 – 76.5**	**31.0 – 51.9**	**<31.0**

WQI Index Range	
Clean	**81 – 100**
Slightly Polluted	**60 – 80**
Polluted	**0 – 59**

Source: Environmental Quality Report (DOE, 2006)

T6.116 Existing river water quality based on Water Quality Index (WQI)

Name of River	WQI Classification	WQI Range
Bayan Lepas Main Drain	Class III	56.1 - Polluted
Sungai Bayan Lepas	Class III	75.0 - Slightly polluted
Sungai Batu	Class III	61.0 - Slightly polluted
Sungai Teluk Kumbar	Class IV	36.8 - Polluted
Sungai Gertak Sanggul	Class IV	49.4 - Polluted

6.5.1.4 Mudflats

A mudflat is muddy land that is covered by water during high tide. They form when sediment carried by the sea encounters low-energy environment and settles to the bottom. Mudflats normally form at bays that are sheltered from waves. Hence, they are found along the south coast of Penang Island due to its sheltered conditions with rocky headlands (F6.169).

F6.169 Mudflats, mangrove and coral reefs found at the south coast of Penang Island

Mudflats may seem insignificant and unimportant from their physical appearance. However, a unique ecosystem of lifeform thrives in the anoxic conditions common below the surface of these mudflats. Since mudflats also have high organic content, bacteria is extremely prevalent. These bacteria perform vital services in decomposing plant matter, making it more digestible as food for other organisms.

6.5.2 Biological ESAs

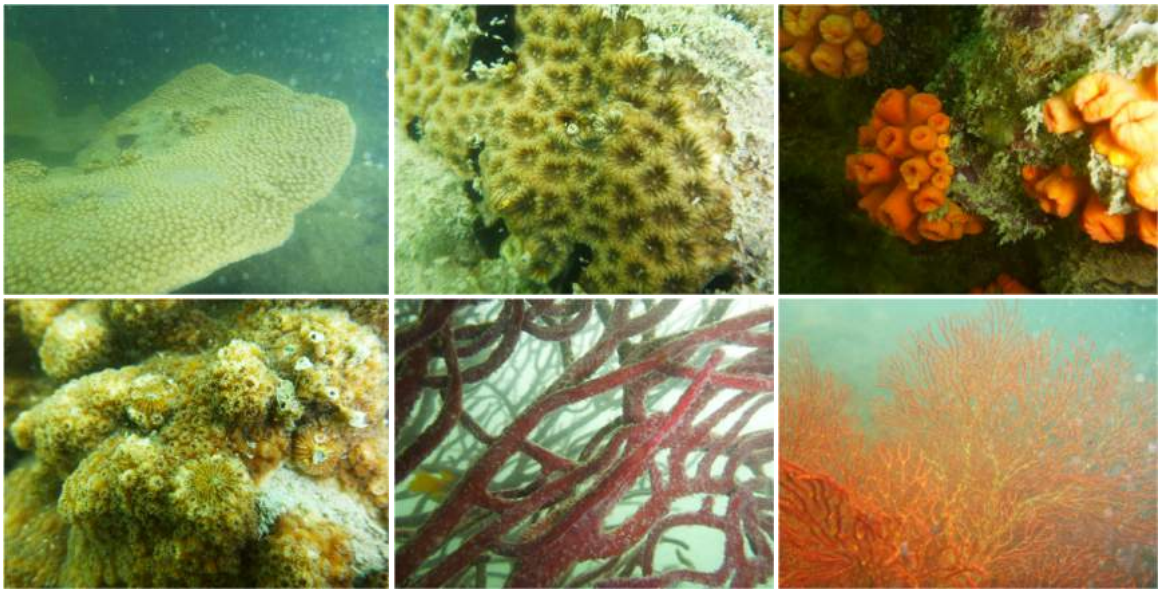
6.5.2.1 Coral Reefs

Pulau Kendi and Pulau Rimau at the south of Penang Island (F6.170) are two of many islands in the country that are inhabited by corals. Both soft and hard corals were found at both Pulau Rimau and Pulau Kendi. From the study, the coral cover in Pulau Kendi was less than 30% of the total coral area which indicates “fair” coral health, while the coral cover in Pulau Rimau was less than 5% which indicates “poor” coral health. The range of coral health is divided into four categories based on the percentage of coral cover as shown in T6.117.

T6.117 Range of coral health status

Coral Health Status	Coral Cover (%)
Excellent	>75
Good	50 to 75%
Fair	25 to 50%
Poor	>25

Photos of corals were taken during the survey as shown in F6.170. Nevertheless, coral bleaching was spotted at Pulau Kendi (at approximately 5°13'49.06" N, 100°10'46.71" E) (F6.171). Bleaching indicates stress response of corals to disturbances such as sedimentation which was observed in the water column during the survey.



F6.170 Corals found at Pulau Rimau and Pulau Kendi

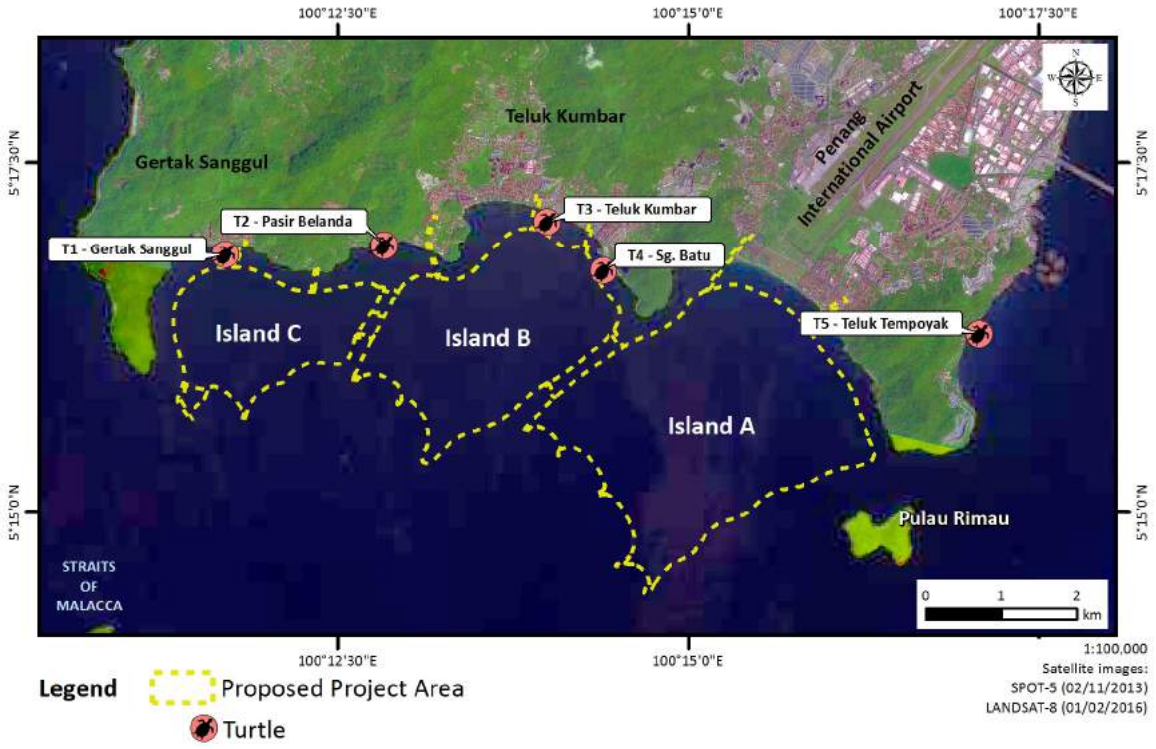
F6.171 Coral bleaching observed during the study survey

6.5.2.2 Turtle Landing Areas

Turtles are among the world's longest-lived creatures and are unique marine animals, categorised as reptiles. Female turtles start to breed between 30 and 50 years of age and usually only produce eggs once every four or five years. They do not lay their eggs on just any beach, but migrate back to their beach of birth. According to the World Wide Fund for Nature (WWF), nearly all species of turtles are classified as endangered species because of human activities.

Five landing sites were identified at the south coast of Penang Island namely Teluk Kumbar, Pantai Medan, Gertak Sanggul, Teluk Tempoyak and Pantai Belanda (F6.172). These turtle landing occurrences were recorded from year 2001 to 2014 (DHI Environment, 2014).

The landings on Teluk Kumbar beach have become a rare occurrence because of rapid development along the beach. In recent years, an Olive Ridley female turtle was spotted emerging from the sea to Teluk Kumbar beach to lay eggs (The Star, 2015). According to a study conducted by DHI Environment (2014), the possibility of the turtles finding an alternative nesting site is present if the original site had been disturbed by human activities.

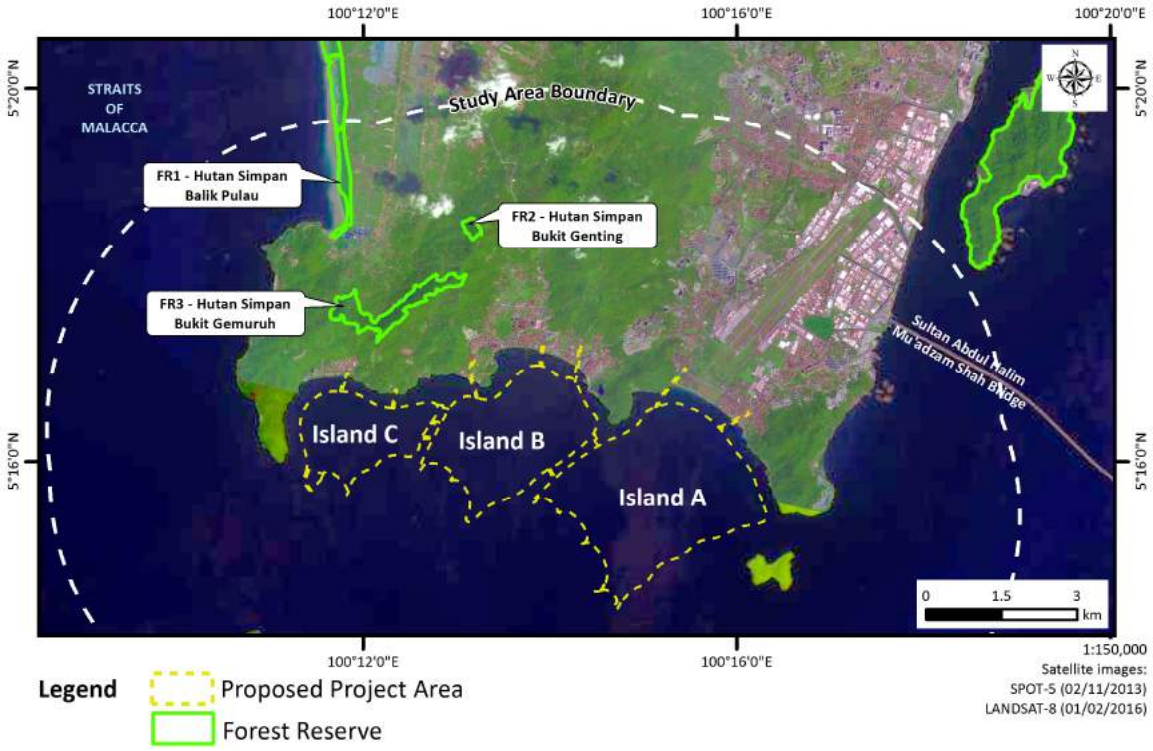


Source: DHI Environment, 2014

F6.172 Turtle landing sites at the south coast of Penang Island

6.5.2.3 Permanent Reserved Forests (PRFs)

Forests in Penang are classified into five categories, i.e. Reserved Forest, National Park, State Park, Mangrove Forest and Permanent Reserved Forest (PRF). In the southern part of Penang Island, most of the forest hill lands are gazetted as PRF. According to RSNPP, Forestry Department Peninsular Malaysia (FDPM) reported that a total of 4,746.77 hectares had been constituted as PRF throughout Pulau Pinang. About 93.52 hectares of PRFs are located at southern Penang Island as shown in F6.173. The PRFs are Hutan Simpan Bukit Genting, Hutan Simpan Bukit Gemuruh and Hutan Simpan Pasir Panjang. The details of each PRFs are tabulated in T6.118.



F6.173 Permanent Reserved Forests (PRFs) within the study area

T6.118 Permanent Reserved Forests (PRFs) at the south of Penang Island

Local Name	Location Coordinates	Area (hectare)	Estimated Terrain Elevation Above Sea Level (m)
Hutan Simpan Bukit Genting	5° 18' 39.6" N, 100° 13' 08.4" E	9.09	162.0
Hutan Simpan Bukit Gemuruh	5° 17' 38.8" N, 100° 12' 28.8" E	51.66	214.0
Hutan Simpan Pasir Panjang	5° 17' 30.5" N, 100° 11' 19.0" E	32.77	350.0
Total Area (hectare)		**93.52**	

6.5.2.4 Mangroves

In Penang, the total of mangrove forests makes up about 1,695.6 hectares. Mangroves in Penang mainly consisted of genera such as *Avicennia, Rhizophora* and *Sonneratia* (Hamdan *et al.*, 2012). Like mudflats, mangroves play a significant role in marine ecosystems. They provide habitat for aquatic plants and organisms as well as shelter that act as nursery and feeding grounds for fishes, crustaceans and mollusks. In addition, they also help reduce shoreline erosion and provide protection from wave impacts to inland areas. A study by Blasco *et al.* (1996) stated that mangroves can be used as an indicator of coastal changes and sea level rise.

There are no significant mangrove forests found surrounding the Project area. However, small patches of mangroves were discovered mostly in the rivers at Teluk Tempoyak Kecil, Teluk Tempoyak Besar, Permatang Tepi Laut, Kampung Binjai, Bayan Lepas Main Drain, Sungai Batu, Teluk Kumbar and Sungai Gertak Sanggul as mapped in F6.170.

6.5.3 Socio-economic ESAs

Fishing activities are actively undertaken at the south coast of Penang Island. There are also aquaculture and hatchery industries operated at these areas. This makes the south coast an important ESA that needs to be considered.

6.5.3.1 Fisheries

As mentioned above, the south coast of Penang Island is also populated by fishermen. The proposed Project area is originally their fishing ground, extending from Teluk Tempoyak to Gertak Sanggul. The study area is located in the Southwest District of Penang, with a population of 197,131 people as of year 2010 (2010 Census). ISMP Pulau Pinang also stated that the southern part of the island has fish landing points as listed below (T6.119).

T6.119
List of fish landing points at the south of Penang Island

Point	Fish Landing Location
F1	Sungai Pulau Betung
F2	Gertak Sanggul
F3	Teluk Kumbar
F4	Sungai Batu
F5	Permatang Tepi Laut
F6	Permatang Damar Laut
F7	Teluk Tempoyak Besar
F8	Teluk Tempoyak Kecil
F9	Batu Maung
F10	Sri Jerejak

6.5.3.1.1 Fishermen Population

The majority of the fishermen living in these villages are 71.6% Malay while the other 28.4% are Chinese (Field data, 2016). The number of fishermen working in licensed vessels are 2,757 (DOF, Penang, 2016 - *unpublished*).

6.5.3.1.2 Fish Landing Volume and Value

Some fish-landing points are within the rivers such as in Sungai Bayan Lepas and Sungai Teluk Kumbar. The fishermen had built small facilities with sheds and platforms on stilts to ease them in berthing their boats when they return from fishing. These fishermen's facilities are present along the river as shown in F6.174.

Fish landings in the study area amounted to 4,169.37 tonnes in year 2015, excluding the landings at LKIM in Batu Maung. The landings at LKIM in Batu Maung mostly come from distant and offshore waters. The highest fish landing was recorded at Teluk Kumbar with 1,083.19 tonnes (26% of total fish landing), followed by Pulau Betung with 802.62 tonnes (19.3%) and Teluk Tempoyak with 579.97 tonnes (13.9%). T6.120 shows the fish landings recorded in tonnes by month within the study area in year 2015.

F6.174 Fishermen's facilities found within Sungai Bayan Lepas

T6.120 Fish landing in tonnes by month in 2015 at south of Penang Island

Month	Fish Landing Point							Total
	Sri Jerjak	Teluk Tempoyak	Permatang Damar Laut	Sungai Batu	Teluk Kumbar	Gertak Sanggul	Pulau Betung	
January	30.42	168.25	24.96	26.58	66.27	22.23	49.14	**387.85**
February	34.32	30.76	28.16	30.30	74.90	25.08	55.44	**278.96**
March	56.16	49.92	46.08	48.92	122.28	41.04	90.72	**455.12**
April	35.10	31.69	28.8	31.10	76.65	25.65	56.70	**285.69**
May	34.32	30.67	28.16	30.37	74.93	25.08	55.44	**278.97**
June	36.66	32.54	30.08	32.35	80.00	26.79	59.22	**297.64**
July	41.34	36.33	33.92	36.38	90.17	30.21	66.78	**335.13**
August	42.12	37.07	34.56	36.97	91.83	30.78	68.04	**341.37**
September	39.78	34.65	32.64	34.64	86.61	29.07	64.26	**321.65**
October	46.8	40.14	38.40	40.72	101.88	34.20	75.60	**377.74**
November	53.82	47.28	44.16	47.01	117.24	39.33	86.94	**435.78**
December	46.02	40.67	37.76	40.62	100.43	33.63	74.34	**373.47**
Total	**496.86**	**579.97**	**407.68**	**435.96**	**1,083.19**	**363.09**	**802.62**	**4,169.37**

Source: Department of Fisheries (DOF), Penang, 2016 – unpublished

The wholesale value of fish landed at the study area in 2015 was estimated at RM42.09 million. This contributed about 12.4% of the total wholesale value in Penang Island (DOF, Penang, 2016 - *unpublished*). Several commercial species had contributed to the value such as *Bawal, Senangin, Kerapu, Jenahak* and *Udang Putih Besar*.

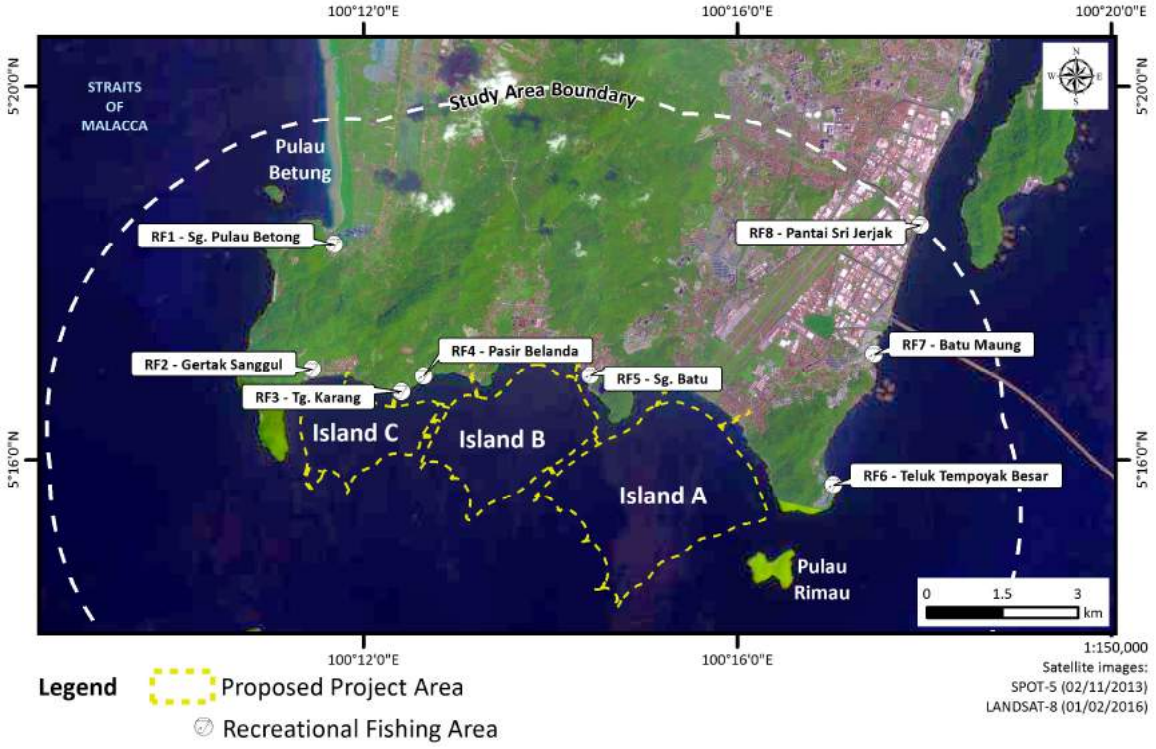
6.5.3.1.3 Income

Based on the survey, the mean gross income of the fishermen is RM1,989.50 per month, ranging from RM500 to RM9,000 per month. 93% reported that their income comes entirely from fishing, while 7% supplement their income from other sources. These other sources include in operating restaurants and boat rentals for sports fishing to outsiders or domestic tourists.

6.5.3.2 Recreational Fishing

Recreational fishing activities are also carried out by the local people. The activities are mainly restricted to weekends and public holidays. Several major locations near the Project area that are commonly visited for recreational fishing are Pulau Kendi and Teluk Kumbar. The staging areas where these enthusiasts depart from by boat are Pantai Sri Jerjak, Batu Maung, Teluk Tempoyak Besar, Sungai Batu, Pasir Belanda, Tanjung Karang, Gertak Sanggul and Pulau Betung. Recreational fishing within the study area is categorised into two types which are shore-based angling and boat-based angling. The locations are shown in F6.175 and tabulated in T6.121.

It is difficult to estimate the economic value of recreational fishing as some of the fishers are outsiders. It is estimated that the direct economic value from recreational fishing amounts to RM5.229 million per year.



F6.175 Recreational fishing/angling staging locations at the Project study area

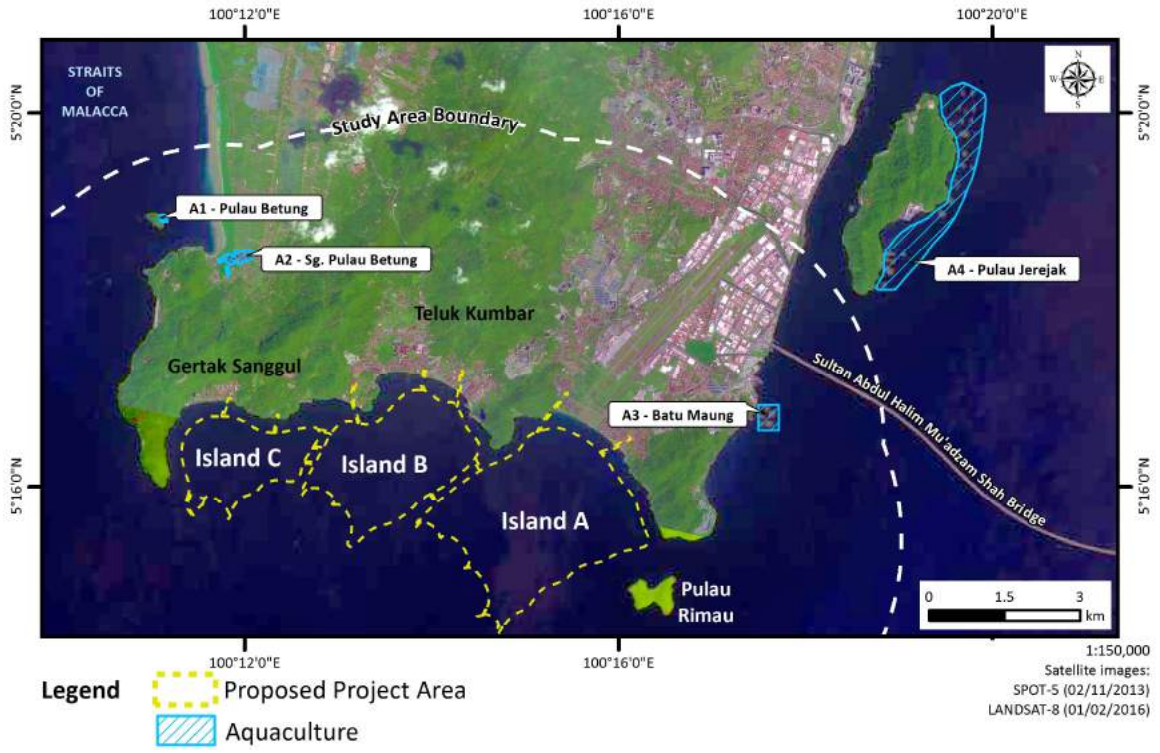
T6.121 Coordinates of the recreational fishing/ angling staging locations

	Location	Coordinates	
		Latitude	Longitude
Shore-based angling	Gertak Sanggul	5° 16.974'N	100° 11.453'E
	Tanjung Karang	5° 16.729'N	100° 12.407'E
	Sungai Batu	5° 16.905'N	100° 14.429'E
	Teluk Tempoyak Besar	5° 15.732'N	100° 17.029'E
Boat-based angling	Pantai Sri Jerjak	5° 18.608'N	100° 17.957'E
	Batu Maung	5° 17.138'N	100° 17.466'E
	Pasir Belanda	5° 16.898'N	100° 12.648'E
	Pulau Betung	5° 18.302'N	100° 11.688'E

6.5.3.3 Aquacultures

Penang has the second highest aquaculture production in Peninsular Malaysia. According to recent fisheries statistics, in 2013 Penang had contributed 41,051.25 tonnes. (Department of Fisheries Malaysia, 2013).

The locations of aquacultures in Penang had been indicated in RSNPP and ISMP Pulau Pinang. The shoreline survey had also helped with validating the indicated locations. Aquacultures near Teluk Tempoyak at the southeast of Penang Island, Pulau Betung and Sungai Pulau Betung at southwest of Penang Island are actively well-managed, consisting of cage cultures and pond cultures respectively. RSNPP had gazetted certain areas at southern Penang Island as Aquaculture Zone for state development planning. These areas are Kampung Perlis Zone near Sungai Pulau Betung, Pulau Kendi Zone and Pulau Rimau Zone. Despite the gazetted areas mentioned, currently there are no aquaculture activities found in Pulau Rimau and Pulau Kendi. The existing aquacultures present within the study area are shown in F6.176. Photos of the aquacultures are shown in F6.177 to F6.180.



F6.176 Aquacultures within the Project study area

F6.177 Cage cultures near Teluk Tempoyak

F6.178 Cage cultures near Pulau Betung

F6.179 Pond cultures near Sungai Pulau Betung

F6.180 Oyster pond culture near Sungai Pulau Betung

6.5.3.4 Hatcheries

Hatcheries basically are facilities where eggs are hatched under controlled artificial conditions, typically for fish and shrimps. The hatcheries facilities that rear saltwater fish or shrimp eggs are found built near coastal areas since they use sea water pumped from the open sea to operate. They comprise of quarantine, maturation, spawning, hatching, larval rearing, indoor or outdoor algal culture and artemia preparation areas. There are 11 hatcheries identified near the proposed Project area as listed in T6.122 (also shown in F6.150). The types of hatcheries operating at the south of Penang Island are mostly shrimp and prawn fry. There is only one hatchery that produces oysters which is at Pulau Betung. The hatcheries extract sea water using pipelines in which the water intake points are shown in F6.181. Details of hatcheries operating within the Project study area are summarised in T6.123.

Name	Location	Coordinates	Type
Gertak Sanggol Hatchery Sdn. Bhd.	Teluk Kumbar	5° 16' 56.15" N 100° 13 '17.48" E	Shrimp fry
Gertak Sanggol Hatchery Sdn. Bhd.	Gertak Sanggul	5° 16' 59.02" N 100° 13' 4.57" E	Shrimp fry
Soonjaya Hatchery	Gertak Sanggul	5° 17' 2.94" N 100° 11' 51.28" E	Shrimp fry
BE Biomarine (M) Sdn. Bhd.	Teluk Kumbar	5° 16' 52.21" N 100° 13' 15.28" E	Shrimp fry
Ocean Sea Culture Hatchery	Teluk Kumbar	5° 16' 54.75" N 100° 13' 11.25" E	Shrimp fry
Exauhall (M) Sdn. Bhd.	Teluk Kumbar	5° 16' 53.67" N 100° 13' 10.00" E	Prawn fry
Yu Full Aquaculture Trading	Gertak Sanggul	5° 16' 52.60" N 100° 11' 22.82" E	Shrimp fry
Global Agro Life Sdn. Bhd.	Gertak Sanggul	5° 16' 53.74" N 100° 11' 26.21" E	Shrimp fry
Permatang Aquaculture	Permatang Damar Laut	5° 16' 28.91" N 100° 16' 5.63" E	Prawn fry
Ocean Star Aquaculture	Permatang Damar Laut	5° 16' 36.17" N 100° 15' 49.83" E	Shrimp fry
Sea Harvest Aqua Marine Sdn. Bhd.	Pulau Betung	5° 18' 14.79" N 100° 11' 49.50" E	Oyster

T6.122 List of hatcheries operators and their locations within the Project study area

F6.181 Water intake pipes seen on the beaches. A: Global Agro Life Sdn. Bhd., B: Soonjaya Hatchery, C: Yu Full Aquaculture, D: Ocean Star Aquaculture, E: Permatang Aquaculture, F: Ocean Sea Culture, G: Gertak Sanggol Hatchery

T6.123 Details of hatcheries operating within the Project study area

Location	Gertak Sanggul	Teluk Kumbar	Permatang Damar Laut	Pulau Betung	Total
No. of culturists	3	4	2	1	10
No. of hatcheries	3	6	2	1	12
Production					
Udang Putih					
■ Naupli	40 million	755.8 million	-	-	795.8 million
■ Post Larvae (PL9-15)	-	396.2 million	105.0 million	-	314.7 million
■ Broodstock	-	1,200	-	-	1,200
Udang Harimau					
■ Naupli	-	4.20 million	-	-	4.20 million
■ Post Larvae (PL9-15)	-	4.27 million	4.5 million	-	8.77 million
Udang Galah	-	6 million	12 million	-	18 million
Tiram	-	-	-	6 million	6 million
Wholesale Value (RM)					
Udang Putih					
■ Naupli	28,000	40,600	-	-	58,600
■ Post Larvae (PL9-15)	-	4,462,000	1,195,000	-	5.657 million
■ Broodstock	-	144,000	-	-	144,000
Udang Harimau					
■ Naupli	-	29,400	-	-	29,400
■ Post Larvae (PL9-15)	-	128,100	135,000	-	263,100
Udang Galah	-	420,000	720,000	-	1.14 million
Tiram	-	-	-	1.5 million	1.5 million
Total (RM)	**28,000**	**5.224 million**	**2.05 million**	**1.5 million**	**8.802 million**

Source: Field data, 2016