

CHAPTER 4: SOCIO-ECONOMIC STUDY

4.1 Introduction

In every decision-making and policy consideration, socio-economic aspects have invariably been included in the studies. Public perception is very important as to reduce conflicts between policy makers and locally-affected communities and to assure a more transparent process in decision-making (Marin et al., 2009). Including public opinion in a decision-making can indirectly educate and encourage their participation. Therefore, it can be considered the best approach in the decision making (Santos et al., 2005).

Environmental issues and public have a strong relationship. Public action may become the determinant in the quality of the environment. Public's action is much dependant on how they perceive the environment, their knowledge and sense of responsibility (Roca et al., 2009). These may be affected by the demographic factors such as gender, age, education level and others.

From previous chapter, the amount and composition of debris was found to be dependent on public's activity and beach management. The integration of both scientific and socio-economic study is crucial. Therefore, the objective of this chapter is to determine the relationship between public to the quality of environment.

4.2 Materials and Methods

4.2.1 Preparation of Questionnaires

A total of 30 questions were prepared. It includes the common practices by Malaysians and the current management of Malaysian beaches. Questions were divided into four sub-sections; (i) background information (8 questions), (ii) info on beach users (5 questions), (iii) awareness and responsibility (11 questions), (iv) preferences in beach holiday aspects (3 questions), and (v) users' knowledge on marine pollution issues (3 questions) (Appendix B).

4.2.2 Public Survey

A total of 180 questionnaires were distributed to the users of the selected beaches. The number of respondents from each beach was 30. The low number of respondents is due to the low number of beach users during sampling period. As the survey consists of questions related to respondents' activities on each beach, the survey could not consider general public who are not at the beach during sampling period to be the respondents. Although there was higher number of beach users in some of the beaches, the number of respondent was kept at 30 to have fair comparison between beaches.

4.2.3 Statistical Analysis

The analysis of data was done using SPSS 18.0. Chi-square test was conducted to see the differences between genders. Cross tabulation table were also used to see the relation of two different variables.

4.3 Results and Discussions

4.3.1 Background study of beach users

Beach users' background is important in this study. This is because different target group has different needs. Besides identifying the common group of beach users, the objective to study beach users' profile is to relate their background information to their behavior/attitude, how they perceive the environment and awareness. Table 4.1 describes the background of respondents within this study:

Table 4.1: Charts of respondents' background details

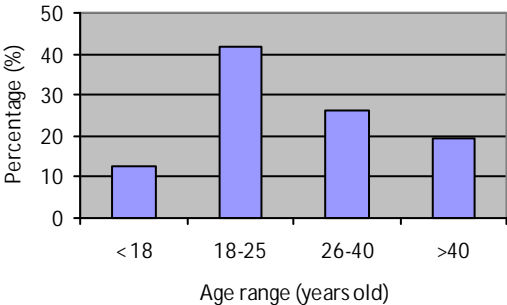
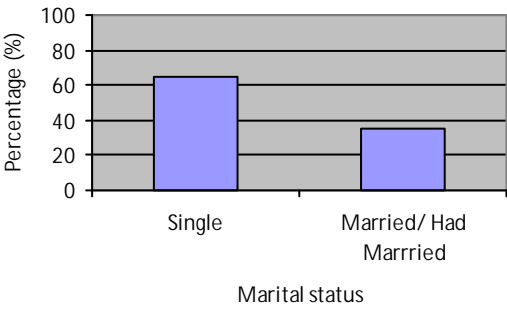
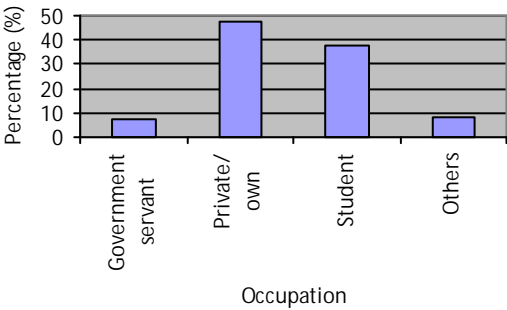
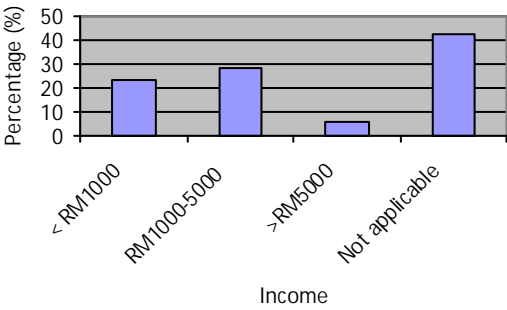
Variables	Charts										
Age	 <table border="1" data-bbox="792 1478 1295 1780"><caption>Data for Figure 4.1: Percentage of respondents by age range</caption><thead><tr><th>Age range (years old)</th><th>Percentage (%)</th></tr></thead><tbody><tr><td><18</td><td>12</td></tr><tr><td>18-25</td><td>42</td></tr><tr><td>26-40</td><td>26</td></tr><tr><td>>40</td><td>19</td></tr></tbody></table>	Age range (years old)	Percentage (%)	<18	12	18-25	42	26-40	26	>40	19
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Table 4.1: Charts of respondents' background details (cont'd)

<p>Gender</p>	<p>A bar chart showing the percentage distribution of respondents by gender. The y-axis is labeled 'Percentages (%)' and ranges from 0 to 100 in increments of 20. The x-axis is labeled 'Gender' and has two categories: 'Female' and 'Male'. The bar for 'Female' reaches approximately 52%, and the bar for 'Male' reaches approximately 48%.</p> <table border="1"> <thead> <tr> <th>Gender</th> <th>Percentage (%)</th> </tr> </thead> <tbody> <tr> <td>Female</td> <td>52</td> </tr> <tr> <td>Male</td> <td>48</td> </tr> </tbody> </table>	Gender	Percentage (%)	Female	52	Male	48						
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Table 4.1: Charts of respondents' background details (cont'd)

<p>Marital status</p>	 <p>A bar chart showing the percentage of respondents by marital status. The y-axis is labeled 'Percentage (%)' and ranges from 0 to 100 in increments of 20. The x-axis is labeled 'Marital status' and has two categories: 'Single' and 'Married/ Had Married'. The 'Single' bar reaches approximately 65%, and the 'Married/ Had Married' bar reaches approximately 35%.</p> <table border="1"> <thead> <tr> <th>Marital status</th> <th>Percentage (%)</th> </tr> </thead> <tbody> <tr> <td>Single</td> <td>65</td> </tr> <tr> <td>Married/ Had Married</td> <td>35</td> </tr> </tbody> </table>	Marital status	Percentage (%)	Single	65	Married/ Had Married	35				
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Not applicable	43										

Age of most of the respondents was between 18-25 years old (41.7%) followed by those between 26-40 years old (26.1%) range. The age range may be affected by the ability of people within that group to have more active lifestyles, move around and decide their activities. The respondents also comprised of mostly female (52.8%) compared to 47.2% of male. Majority of beach users within this study are Malays/ Bumis and a Muslim

(74.4%), as many of the beaches are close to Malay village and it is also the biggest ethnic group in Malaysia.

As for education level, most of the respondents have tertiary education (45%) or secondary level (43.9%). Other background information on beach users found during the survey was that most of them are single (64.4%), compared to those married/ had married with 35.6%. About 47.2% of all beach users surveyed work in private sector, followed by students (37.8%) and government servants (7.2%). Most of the beach users are from middle-income people with a salary between RM1000-5000 per month (28.3%).

Identification of beach user helps decision maker to make a better judgment in providing facilities, implementing laws, developing the area and so on. They can decide whether to provide facilities to the common group demand, or to lessen services in order to control the usage of a beach. Besides responding to their demand, the understanding of knowledge, awareness and attitude of these biggest groups of beach user may determine the quality of beach surrounding them. However, public perceptions should be treated with caution since it is not to create beaches on demand, but to improve beach plans (Roca et al., 2009).

4.3.3 Information on beach users

Besides basic background information, distance, purpose of visit, duration of time spent, and their frequency of visit is also essential for the study. It gives a better overall understanding to the demand and manners of the beach users. The aspects mentioned are summarized in Table 4.2 which shows the characteristics of users from all beaches studied.

Table 4.2: Information on beach users

Variable	Recreational Beaches			Fishing Beaches			Total
	Teluk Kemang	Batu Burok	Tanjung Aru	Pasir Panjang	Seberang Takir	Teluk Likas	
Type of user							
Visitor/ tourist	20	22	18	15	13	14	102
Locals/ resident	4	4	8	6	6	9	37
Workers	6	4	4	8	8	6	36
Others	0	0	0	1	3	1	5
Distance from home							
< 30km	21	21	18	17	24	26	127
30-100km	8	1	10	2	1	0	28
>100km	1	2	2	11	5	4	25
Duration of time spent on beach							
< 1 hour	5	15	10	14	7	15	66
1-5 hours	9	13	18	11	18	9	88
> 5 hours	6	2	2	5	5	6	26
Frequency of visit							
1 st time	7	3	4	11	5	4	34
Less than 10 times	15	9	8	4	2	4	42
Occasionally	3	12	14	5	12	9	55
Regularly	5	6	4	10	11	13	49

Majority of the respondents came as a visitor/tourist (56.7%) followed by nearby residents (20.6%) people who came for work (fishermen, hawkers, etc.) (20.0%), and 5 'Others' (including those came for a lunch break, those passing by, and so on). The high percentages (15.5%) of workers in recreational beaches are represented by the hawkers, food stall owners/ workers, the water-sport activities providers, and so on. It illustrates the function of beaches in Malaysia that may attract not only tourist, but also as a place that may generate income to the locals.

In this study, it is recorded that most of the beach users are local visitors as 127 out of 180 (70.6%) respondents live within 30 km distance to the beach. Another 28 (15.6%) of the respondents live in the range of 30-100 km from the beach. A similar number was recorded for beach users that live the farthest, which is more than 100 km in distance (13.9%)

For the duration of time spent on the beach, at any single visit most of the beach users spend 1 to 5 hours on the beach (48.9%) followed by 36.7% beach users that spend less than 1 hour and another 14.4% that spend more than 5 hours. Respondents who spend more than 5 hours are mostly workers (60.5%) while respondent who spent less than 1 hour on the beach was mostly nearby residents (76.9%) and 'Others' (64.7%) that may come only for a meal. Table 4.3 is the cross tabulation between purpose of visit and time spent.

Table 4.3: Cross tabulation between purpose of visit and time duration at beach

			Time			Total
			< 1 hour	1-5 hours	> 5 hours	
Purpose	Holiday	Count	32	65	2	99
		%	32.3%	65.7%	2.0%	100.0%
	Work	Count	3	12	23	38
		%	7.9%	31.6%	60.5%	100.0%
	Resident	Count	20	5	1	26
		%	76.9%	19.2%	3.8%	100.0%
	Others	Count	11	6	0	17
		%	64.7%	35.3%	.0%	100.0%
Total	Count		66	88	26	180
	%		36.7%	48.9%	14.4%	100.0%

For the frequency of visit, it is recorded that most of the respondents are repeat visitors. Only 34 out of 180 (18.9%) are first time visitors. The majority of the respondents came occasionally (30.6%), regularly (27.2%), and less than 10 times (23.3%). A repeat user may also signify satisfied user. As in a study conducted in Spain, foreign tourists, adults and elderly people are satisfied group of user, while local residents visited the beach less frequently as they are more aware of the water pollution problem throughout the years (Roca et al., 2009).

From Table 4.4, it was found that respondents who came occasionally are mostly nearby residents (69.2%), and those came regularly are mostly workers (76.3%). It shows that people who had known the beach may not have bad experiences that prevent them to visit the beaches again. It also illustrates the importance to consider this group of people who came more frequently, and may bring a bigger impact to the beach.

Table 4.4: Cross tabulation between purpose of visit and frequency of visit

			Frequency				Total
			First time	< 10 times	Occasionally	Regularly	
Purpose	Holiday	Count	23	31	31	14	99
		%	23.2%	31.3%	31.3%	14.1%	100.0%
	Work	Count	0	7	2	29	38
		%	.0%	18.4%	5.3%	76.3%	100.0%
	Resident	Count	1	1	18	6	26
		%	3.8%	3.8%	69.2%	23.1%	100.0%
	Others	Count	10	3	4	0	17
		%	58.8%	17.6%	23.5%	.0%	100.0%
Total	Count		34	42	55	49	180
	%		18.9%	23.3%	30.6%	27.2%	100.0%

4.3.4 Awareness and attitude of beach user

The study of public awareness and attitude is important as to understand their action towards certain aspects that may affect beach quality. This section looks at the general opinion of beach users, how they determine the quality of the beach, their satisfaction towards certain aspects, and their expectations and demand.

The first important aspect is beach users' perspective of a particular beach (Figure 4.1). Most of the respondents described the beach as 'Scenic area but not clean' (31.7% of total respondent). This is especially from beach users of Pasir Panjang and Seberang Takir. On the other hand, most of the respondents in Teluk Likas described the beach as 'Dirty' (50%). This is in accordance to the abundance of debris found on the beaches, where Seberang Takir and Teluk Likas recorded the highest amount of debris.

Majority of the respondents in Batu Burok (50%) and Tanjung Aru (56.7%) describe the beach as ‘Very clean’. It shows the relationship between public perception with the actual amount of debris found, as recreational beaches of Batu Burok and Tanjung Aru recorded the smallest amount of debris.

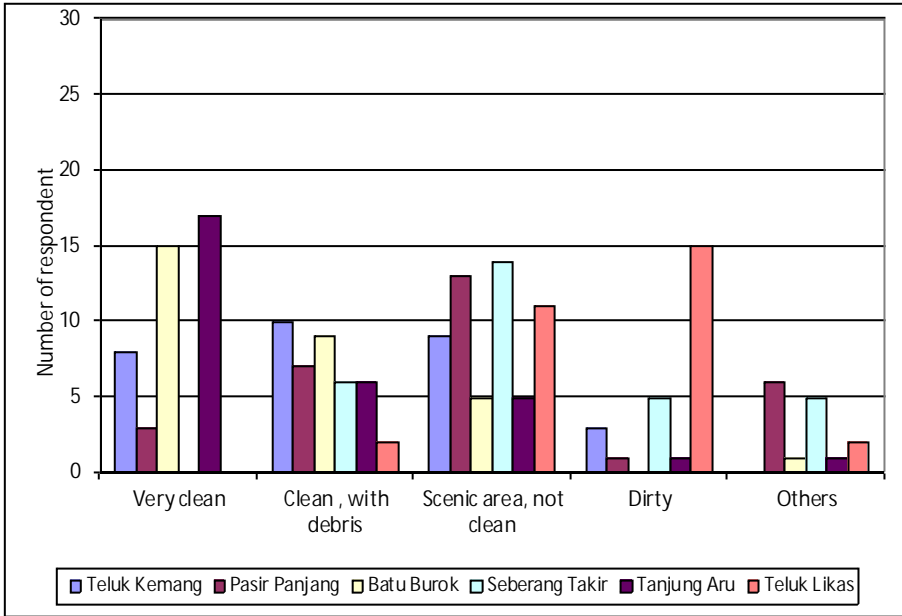


Figure 4.1: Description of beaches based on beach users perception

Although most of the respondents gave negative description towards the beach cleanliness, most of the respondents thought it did not change over the years (43.3%) (Figure 4.2). Some thought the beach has become dirtier (23.3%), but there is also positive response saying that the beach is getting cleaner (13.9%) especially in Teluk Kemang. From the total number of respondent in Teluk Kemang, 26.7% thought that the beach has become cleaner compared to a slightly higher percentage of respondents (33.3%) who thought the beach had not shown any changes.

Excluding the first time visitor who could not answer the question on changes over the years, majority of the respondents thought that the beaches do not experience any changes in terms of cleanliness, except for respondents in Seberang Takir. Most of the respondents in Seberang Takir thought the beach is dirtier (43.3%). This may be due to the sampling time in Seberang Takir which was just after the monsoon season. Flood caused household waste to be carried offshore.

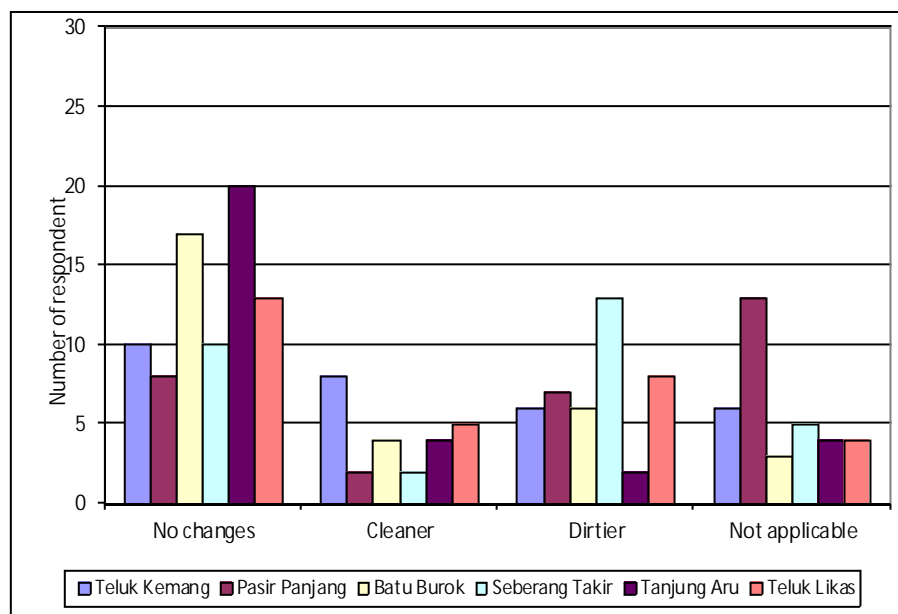


Figure 4.2: Comparison of beach cleanliness

Figure 4.3 illustrates the factors that affect the decision of respondents to visit the respective beach. The high number of respondent could not answer the question (Not applicable), due to workers being interviewed. However, from the total number of available respondents, 28.3% chose their respective beaches because of its accessibility. Other important aspects considered is its free entrance concept (affordable holiday) (12.8%), the beauty and cleanliness (12.2%), and facilities and activities provided (8.9%).

Surprisingly, beauty and cleanliness is not the most important aspect considered by the beach users in Malaysia. It illustrates the attitude of beach user who may not be bothered by the presence of litter, hence may not feel responsible towards the condition. Conflicting with a study by Roca and Villares (2008), users of Spain beaches were motivated by the sand and water quality, compared to landscape, tranquility, accessibility and good facilities.

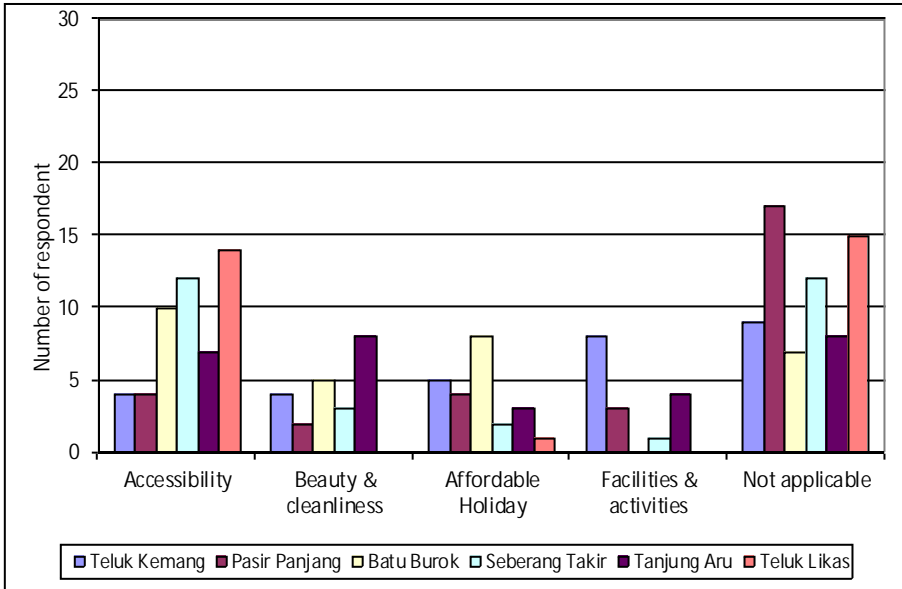


Figure 4.3: Factors considered by respondent in selecting a beach

Figure 4.4 shows the satisfactory level of the beach users towards the facilities provided on/ near the beach including toilets, changing rooms, recreational facilities and jetties. In total, majority of the beach users were satisfied with the facilities provided where 35.6% rated the facilities as ‘Satisfactory’ while 40.6% rated the facilities as ‘Acceptable’. In general, it can be concluded that most of the current users are satisfied with the facilities provided, thus new development may not be necessary.

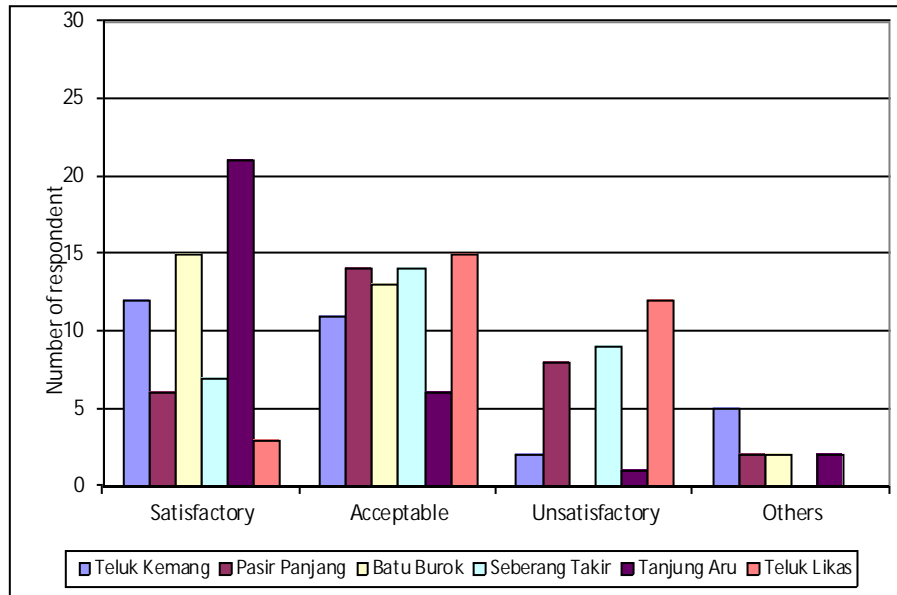


Figure 4.4: Satisfactory level of beach users towards facilities provided

Figure 4.5 shows the willingness of beach users who were asked whether they will be recommending the beach to their relatives or friends. More than 50% of users on each beach answered 'Yes' to the question, except for users of Seberang Takir and Teluk Likas beach who recorded a higher number for not suggesting the beach to their relatives or friends. It is probably due to the abundance of debris on both beaches.

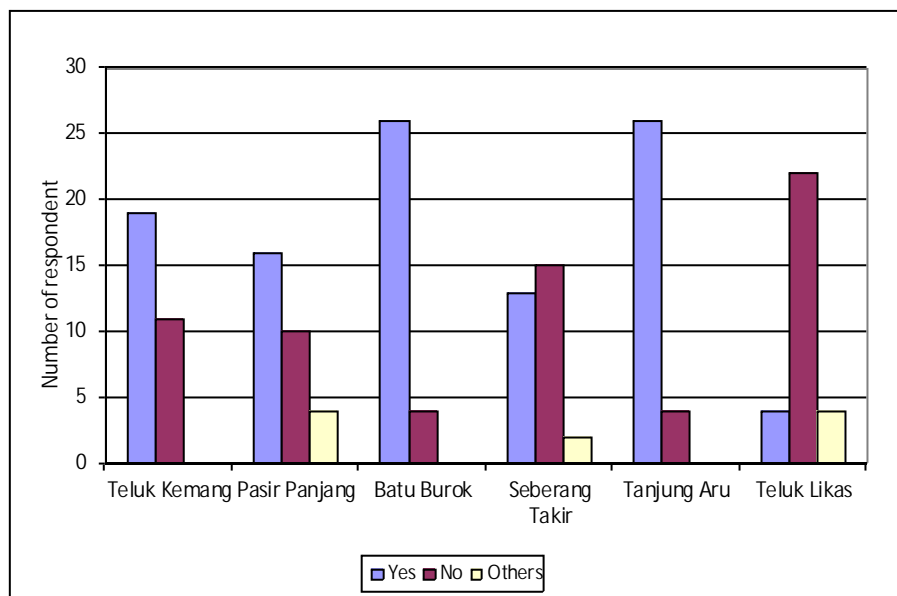


Figure 4.5: Recommending the beach to others

Figure 4.6 – 4.11 illustrate the opinion of beach users towards the condition of beach and other general issues without looking at different beaches. This six questions allow respondents to give more than one answer, thus results are reported as percentages.

Figure 4.6 shows that most of the respondents (42.2%) suggested that beach users often throw their rubbish directly onto the beach area where they had their activities. About 32.8% thought that beach users use the dustbin provided to get rid of the rubbish, while another 16.1% suggested that beach users throw their waste into the sea. Out of the total respondents, 8.9% also answered ‘Others’ as some suggested that the beach users bring back their waste home.

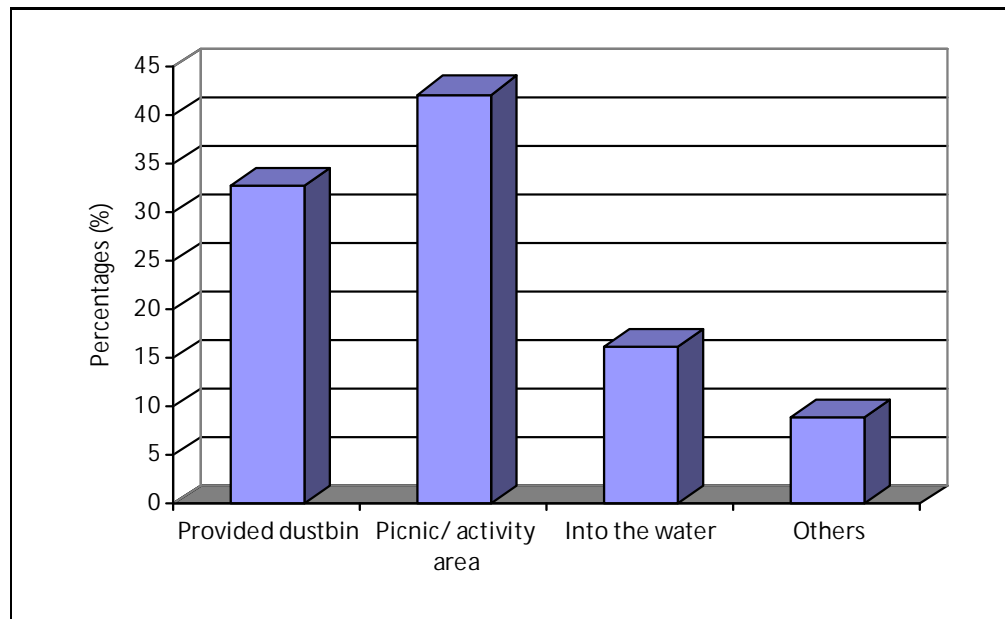


Figure 4.6: Public opinion on where debris were disposed by beach users

Figure 4.7 illustrates the opinion of beach users on the most common type of debris found on beaches. An astounding 75% of respondents feel that wrappers, food containers and other anthropogenic items are the most common type of debris found on beach. Dried

leaves/ seashells and fishing gears were also listed as the most abundant type of debris found according to the 8.9% and 8.3% respondents, respectively. It is in agreement with results found in this study. Most of the debris found on beaches especially with recreational function is anthropogenic items. Although public do not consider fishing gear as the most common item found on beach, it is actually abundant based on this study.

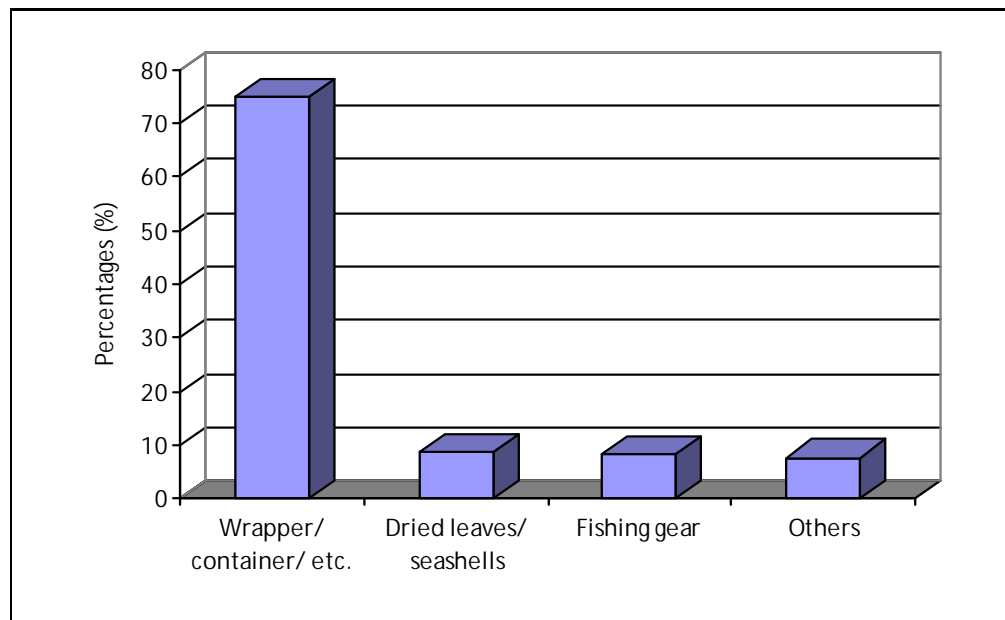


Figure 4.7: Public opinion on the most common type of debris found on beaches

Respondents were asked on their opinion of the major reason of littering problem. Approximately, 63% of respondents feel the bad attitude of beach users is the main cause of litter problem (Figure 4.8). Only 36.1% agreed that insufficient and unavailability of dustbin as the main cause of littering. It shows that, most of the respondent did not blame the local government for the presence of debris on the beach. It may suggest that public have some awareness about the matter, but it does not mean that most of them dispose their rubbish properly.

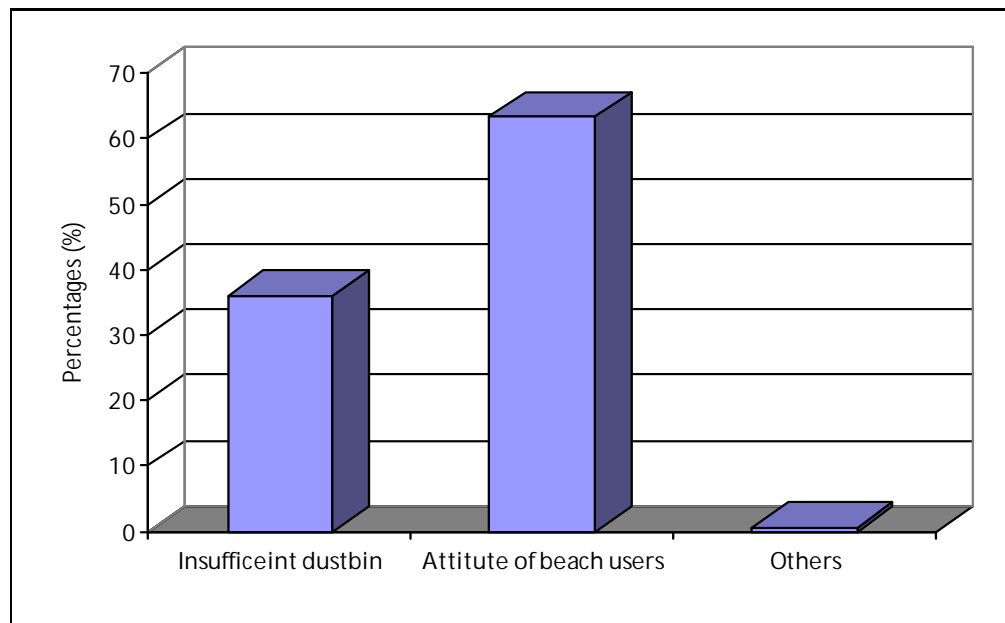


Figure 4.8: Public opinion on the reasons why people litter the beach

Figure 4.9 illustrates the sense of responsibility among the respondents. Majority of them (55%) do not feel responsible towards litter found on beaches. Based on Chi-Square Tests only 'Gender' gave a significant difference $\chi^2(1, N=180) = 9.46, p < 0.05$ compared to other background information of respondents (age, gender, education, income, etc.). Based on the result, 'Female' have a better sense of responsibility when they found litter on beaches.

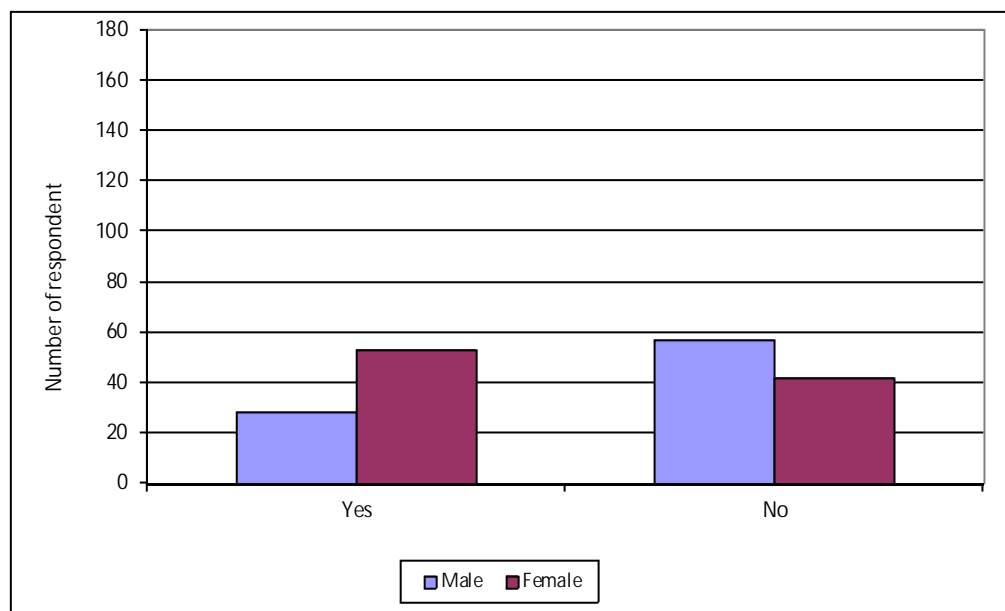


Figure 4.9: Sense of responsibility towards litter on beaches

Figure 4.10 shows the public opinion on who is the responsible body towards litter found on beaches. Similar percentage of respondent thought that litter found on beaches is under the responsibility of beach users themselves (47.2%) and local municipality (46.7%). Only 5.6% feels that the resident is also responsible towards the waste found on the beach.

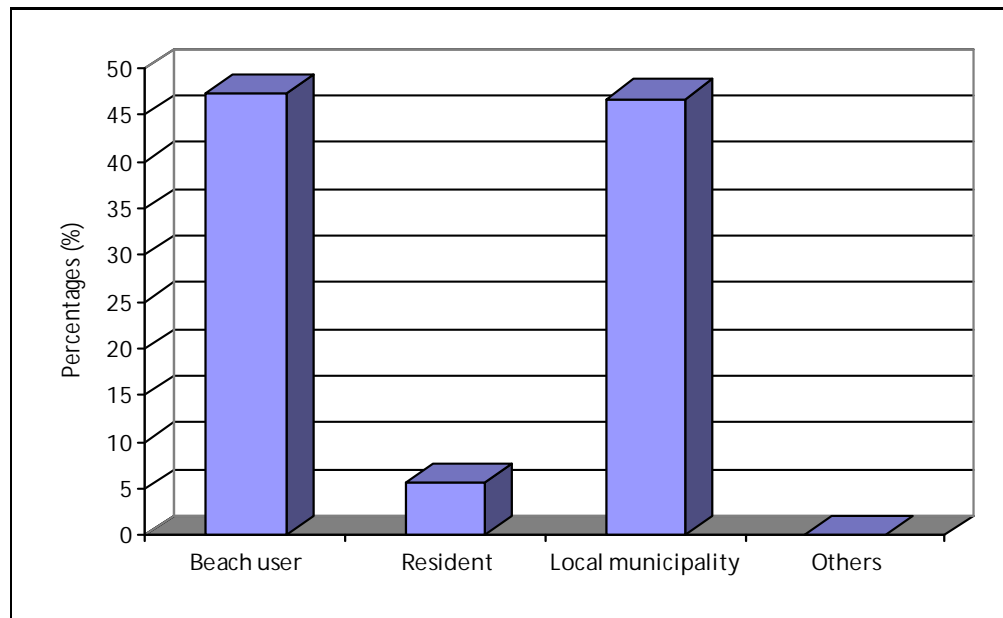


Figure 4.10: Respondents knowledge on the responsible authority to manage marine waste/beach debris

Figure 4.11 illustrates the opinion of public on the fate of waste/ debris after being disposed on beaches. An astounding 57.8% believed that the waste will be collected by the local municipality every day. Another 25.6% suggested that the waste will be pulled by waves towards the sea, while 10% of respondent thought that the waste will degrade naturally. The result is quite disappointing as most of the beaches studied did not receive any waste collecting service from the municipality, especially for fishing beaches. To some extent, the public view on this issue may explain the high level of debris found on the sampled beaches.

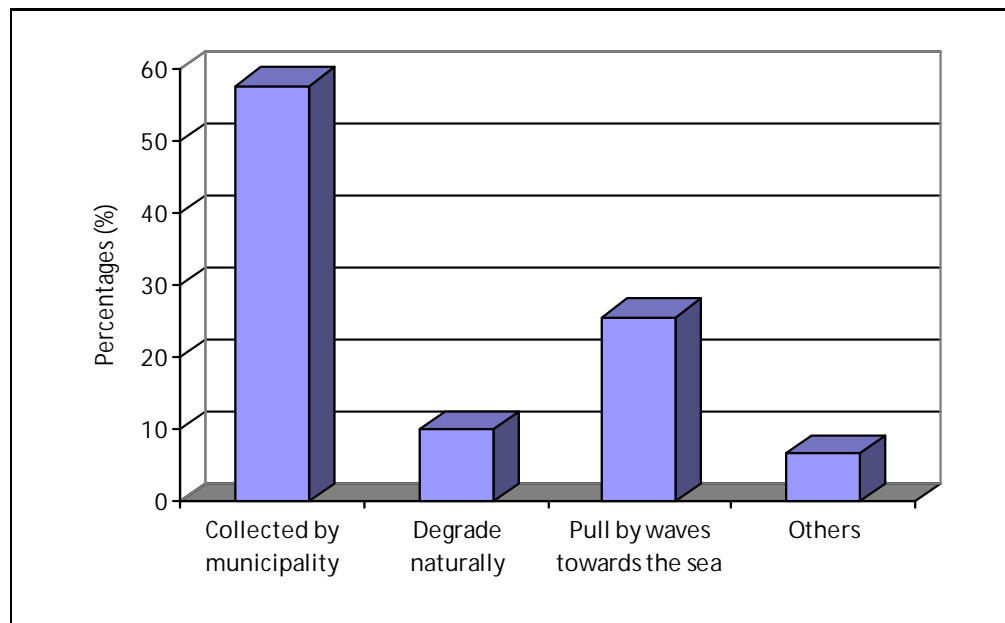


Figure 4.11: Public opinion on the fate of debris disposed on beaches

Questioned on their opinion of the major impact from beach littering, half of the respondents (50%) believe that it only make the beach look dirty (Figure 4.12). 38.3% agreed that it may actually harm the ecosystem and the wildlife. Another 7.2% suggested that littering on beaches may not give significant impact. There are also respondents who gave their own opinion on the major impact of beach littering including disturbing other beach users, and troubling fishing activities for the fishermen.

Although most of the beach users were aware of the negative impacts from beach littering, 56.7% of respondent feels that it is unfair if they have to pay some fee to use the beach although it can guarantee a more efficient service from the municipality (Figure 4.13). Another 22% of respondents feel it is fair, while another 21.1% of them thought it depends on the amount of fees required. Based on Chi-Square Tests, only 'Education' has a significant impact towards the respondents' response $\chi^2(6, N=180) = 12.167, p < 0.05$. It is probably because education can create some awareness to the public.

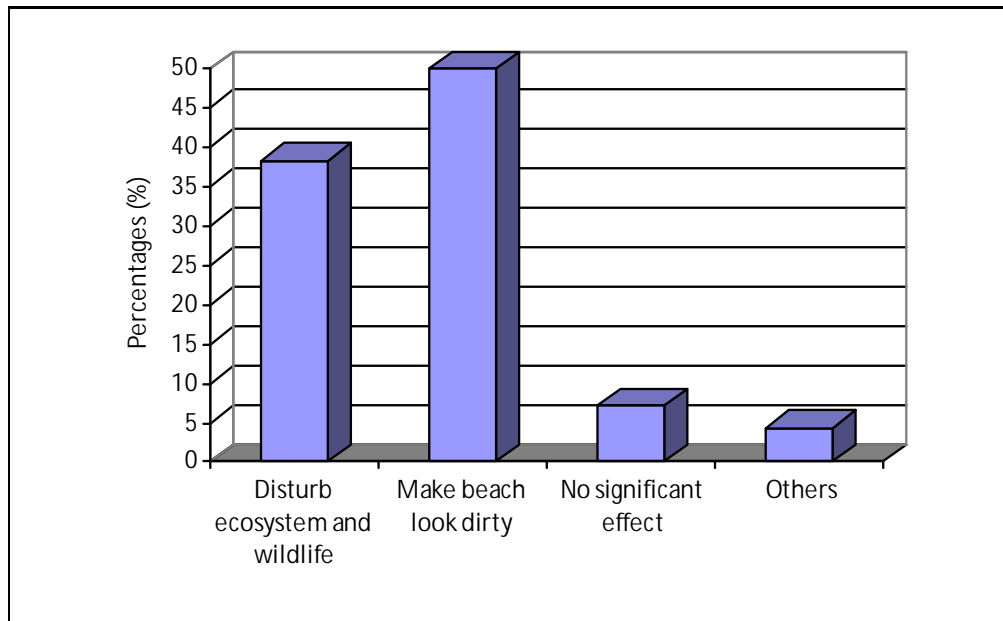


Figure 4.12: Public opinion on the major impact of beach littering

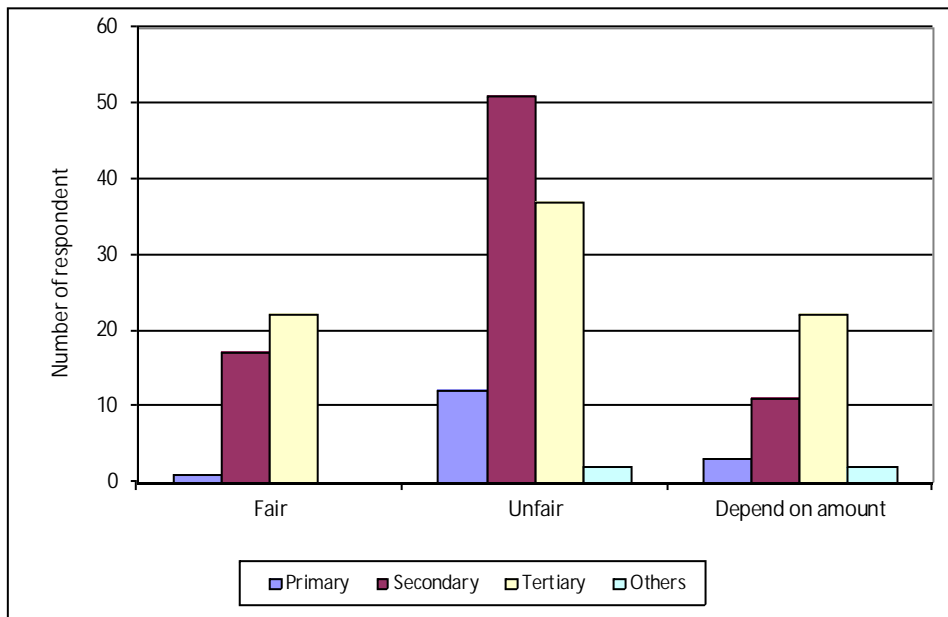


Figure 4.13: Public opinion on the need of fees/ payment for more efficient system

4.3.5 Public preferences in beach holiday aspect

This section aims to understand the preferences of respondents regarding beach holiday aspects. Figure 4.14 – 4.16 illustrate the preferences of beach users. From the total number of 180 respondents, 36.1% ranked beach activities as their first priority compared to other type of activities listed. It shows the importance in managing beach ecosystem as it has a big potential in terms of recreational value for users in Malaysia.

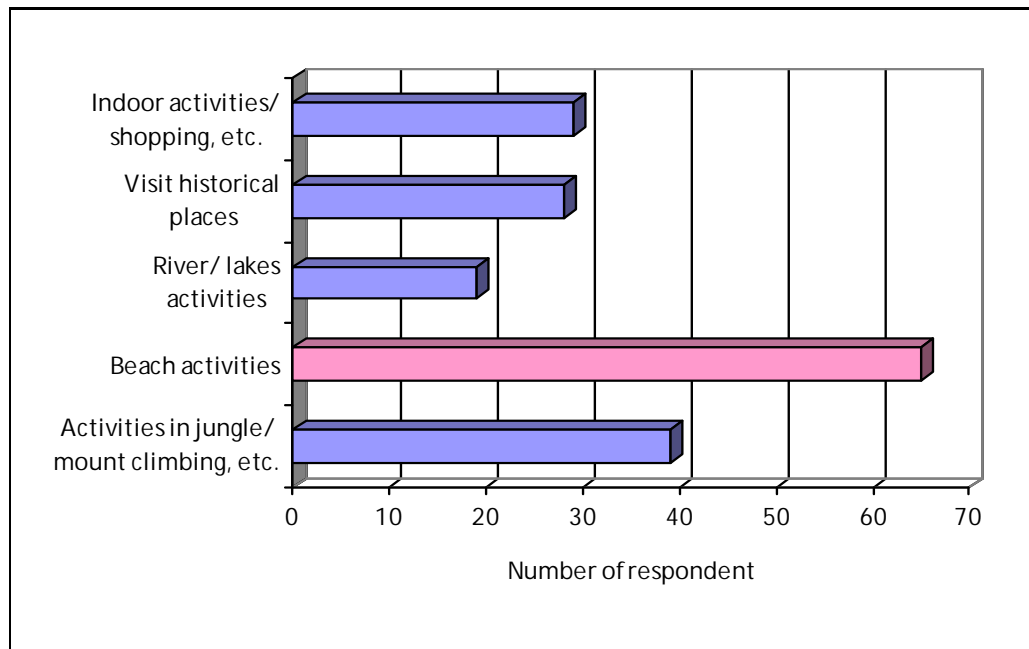


Figure 4.14: Preferences by respondents on holiday options

Figure 4.15 shows the most important aspect considered by the beach user when they choose a beach for holiday. Beauty and cleanliness of the beach is the main priority for most of the user (27.8%). ‘Accessibility’ is also listed as main criteria for many of the respondents (22.8%).

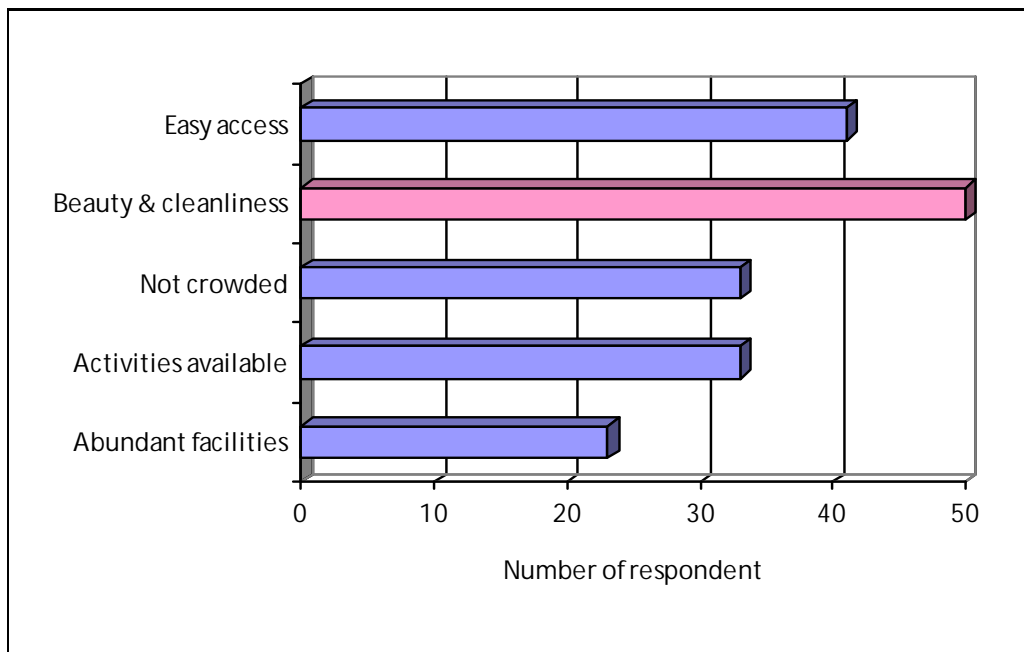


Figure 4.15: Preferred criteria of beaches to be considered for a holiday

For those who choose to spend their holiday on the beach, there are certain activities of their preferences. From the survey, it was found out that most of the beach users enjoy sightseeing/ strolling alongside the beach (31.7%) compared to other activities including swimming, water-sport activities, picnic, and collecting seashells (Figure 4.16). It shows that the local developer should also prioritize the preferences of this group of people in providing necessary services.

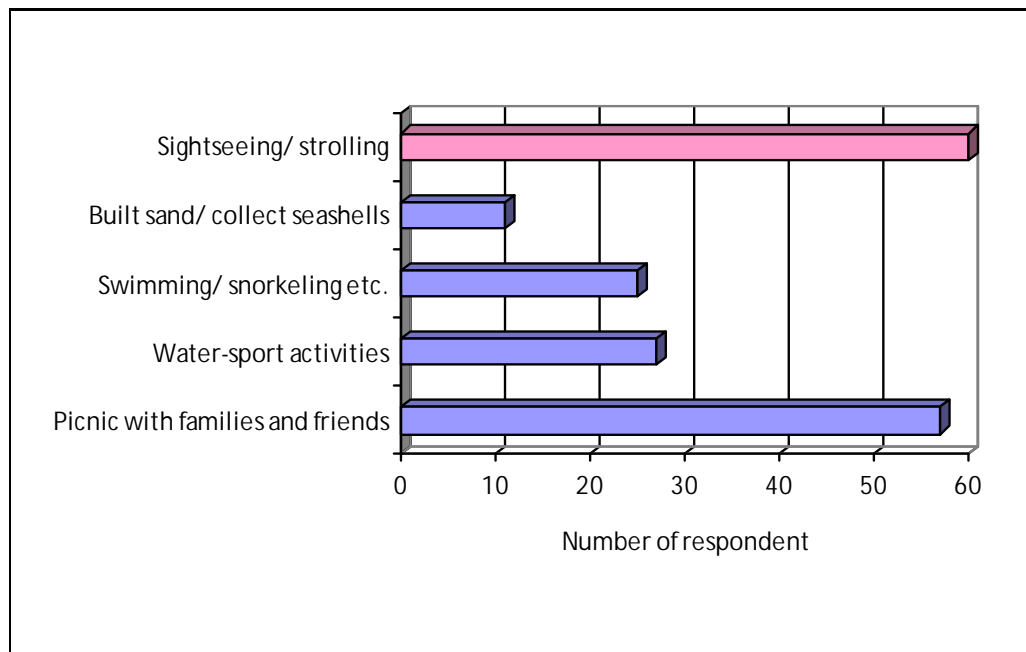


Figure 4.16: The beach activities preferred by the beach user

4.4 Conclusion

The study had shown that there are differences in public opinion and attitude in different types of beach. In general, the awareness of Malaysian beaches users is low. Therefore, future development should consider the socio-economic aspect to promote beach tourism without neglecting the need to incorporate the environmental concerns.

CHAPTER 5: GENERAL DISCUSSIONS

Malaysia has very little information on marine debris issue. A snapshot data from Ocean Conservancy's International Coastal Cleanup is perhaps the most available documented status of marine debris on Malaysian beaches. Therefore, this study will provide some scientific and quantitative data on marine debris abundance, composition and sources, as an input for future development and decision making. Awareness and opinion from the beach users had also been assessed to integrate the social aspects into the study.

From the study, it was found that current state of Malaysian beaches is similar to other beaches worldwide in terms of pollution. Malaysian beaches experience debris pollution problem to the same extent as much as 1.379 items/ m², weighing 15.525 g/m². This amount is much higher than most of the data reported in studies listed by Bravo et al. (2009), where less than 0.5 items/ m² were recorded. However, it is not as much as the debris found on Transkei Coast of Africa that recorded 19.6 – 72.5 items/ m², weighing 42.8-164.1 g/ m² (Madzena & Lasiak, 1997).

Most debris found on recreational beaches consists of food packaging items, water bottles, newspapers, corncobs, ice-cream sticks and many other recreational related items. On the other hand, abandoned nets, rubber and ropes were found on fishing beaches. Items found on both beach types reflect activities conducted in the area, as also found on recreational and fishing beaches worldwide (Bravo et al., 2009; Claereboudt, 2004; Hess et al., 1999). The most prevalent type of debris found on Malaysian beaches was plastic; more than 50% on most beaches studied. Plastic even constitute 96% of debris in one of the beach. This is

in accordance with many studies which were reported in the review by Derraik (2002), where plastic was found to vary consistently between 60 to 80% of the total debris found on the listed beaches. The high abundance of plastic among other debris is very alarming. Plastic has been known to harm and even kill a lot of wildlife (Raum-Suryan et al., 2009; Boren et al., 2006; Hamni & Pyle, 2000). Although it is not covered within this study, the abundance of plastic will bring harmful effects to marine life on Malaysian waters too. It indicates the urgent need to study the effects of plastic to wildlife.

There are many factors that contribute to the composition and abundance of debris on beaches. Major factors affecting the abundance of debris in this study are activities conducted, beach management and also season. Recreational beaches such as Teluk Kemang and Batu Burok have a high accumulation rate of debris (>0.1256 item/m²/day). However, the amount of debris found on each sampling event in these two beaches was not as much as that found at Pasir Panjang and Seberang Takir beaches that have a lower debris accumulation rate (<0.0917 item/m²/day). A regular cleanup that is practised in Teluk Kemang and Batu Burok has therefore proven to be very important in debris pollution control.

Besides beach activities conducted and beach management, changes in season can also affect the abundance and composition of debris on beaches. This is illustrated in the high abundance of household waste ($>70\%$) in Seberang Takir beach. Monsoon in the East Coast of Peninsular Malaysia is the cause of flooding in the area. The floods washed municipal waste from adjacent residential area, offshore. Since natural events are hard to

control, a better management of solid waste inland will play an important role in mitigating the debris pollution.

In addition to the responsibilities of the local authorities, public and beach users may also play a significant role in controlling marine debris on the beaches. Therefore, the study of public perceptions and public preferences are also needed. It is important to improve traditional management tools that often consider single perspective-based, focusing only on water quality or health related aspects. It acts as a bottom-up approach to assist managers to provide better services not only to the public, but also to the environment.

In this study, it was found that beach is more preferable as holiday destination compared to other recreational activities. Distance and accessibility, affordability followed by beach cleanliness are the factors considered in selecting beach area. Various factors affect the cleanliness of a beach. In general, public admit that the most possible contributor of debris on beaches are beach users. However, most of them do not feel responsible whenever they found debris on the beach. Additionally, they are not willing to pay additional fees for beach cleaning. Most of the beach users are satisfied with the facilities provided on beaches and are willing to recommend the beach they visited to others. Approximately, 43% respondents feel that there have been no changes in terms of the cleanliness of the beaches in Malaysia over the years.

From this study, some weaknesses in the current beach management in Malaysia have been identified. Malaysia experiences overlapping of jurisdiction between several agencies thus lead to ineffective strategy to deal with full scale marine issues (Nasuchon, 2009). There

are at least 14 ministries and 26 departments/units/authorities that have responsibilities related to maritime sector with approximately 74 laws including major laws such as Environmental Quality Act 1974: (1985) and Fisheries Act 1963: (1985) (Saharuddin, 2001).

There is no specific legislation in Malaysia that addresses the presence of marine debris. Thus, no specific classification is available to categorize cleanliness level for Malaysian beaches. Therefore, this study proposes a simple probable index to address debris on Malaysian beaches, as shown in Table 5.1.

Table 5.1: Probable index to address debris on Malaysian beaches

	Recreational beaches			Fishing/ rural beaches		
	CLEAN, safe for recreational purposes	MODERATELY CLEAN, safe for recreational purposes with certain precautions	DIRTY, not advisable for recreational purposes	CLEAN, safe for fishing purposes	MODERATELY CLEAN, safe for fishing purposes with certain precautions	DIRTY, not advisable for fishing purposes
Number of debris	< 0.5 m ⁻²	0.5 – 3 m ⁻²	> 3 m ⁻²	< 2 m ⁻²	2 - 5 m ⁻²	> 5 m ⁻²
Weight of debris	< 2 gm ⁻²	2 – 3 gm ⁻²	> 3 gm ⁻²	<10gm ⁻²	10 – 15 gm ⁻²	> 15gm ⁻²

The index is based on the abundance of debris within this study. However, a comprehensive study is recommended to provide a more detail and accurate index for debris on beaches. Malaysia may adopt efforts done in other countries such as implementing beach awards that evaluate certain environmental criteria before granting the

award, such as Blue Flag or Red Herring (McKenna et al., 2011). It is also important to have a specific legislation on marine debris that is often adopted in developed countries such as Marine Debris Research, Prevention, and Reduction Act (US), Marine Plastic Pollution Research and Control Act (US), and Integrated Policy for Marine Debris, Initiation of National Projects (1999) (South Korea) (Ministry of Marine Affairs & Fisheries [MOMAF], 2005; “Laws, regulations, Treaties”, 2011).

From the weaknesses identified in managing debris on Malaysian beaches, this study suggests a more detailed research. Also, several other issues need to be addressed before any policy consideration. These include the impact of debris on wildlife on Malaysian waters, the patterns or distribution of debris not only within Malaysia but possibly from neighboring countries, the application of technology in debris collection and many other related areas. It is hoped that this study will initiate efforts to collate information in order to have a better system in managing marine debris problem in Malaysia.

CHAPTER 6: CONCLUSIONS

In summary, it can be concluded that:

1. The abundance of solid waste was higher on fishing beaches (0.333-1.379 item/ m² & 4.983-15.525g/ m²) compared to recreational beaches (0.062-0.211 item/ m² & 0.233-1.963 g/ m²). In contrast, rate of debris accumulation on most recreational beaches are higher than fishing beaches. The regular cleaning is responsible in reducing the abundance of debris on these recreational beaches. The composition of debris on Malaysian beaches includes plastic, polystyrene, paper, and other anthropogenic items. It illustrates the necessity to highlight man-made debris in managing Malaysian beaches.
2. Sources of solid waste on Malaysian beaches are mostly from human activities which include recreational, fishing and shipping activities. Natural factors such as flood and rainy season also caused the presence of debris on beaches but that is also contributed by the poor management of municipal solid waste inland.
3. Currently, Malaysia does not have any specific legislation concerning debris on beaches. A more comprehensive plan is needed for beach management and also better solid waste management inland.

4. An index may help to identify the level of debris contamination on beaches. Based from this study, the number of debris on beaches should be less than 0.5 item/ m² or 2 g/ m² to be considered as clean.

5. Besides the improvement in the management aspect, education to the public is also important as Malaysian public have low awareness regarding marine pollution issue. They do not feel responsible for the beach cleanliness.