CHAPTER 4

RESULTS

The results of the study are presented in the following sequence:

(i) Fisheries resources

(ii) Aquaculture resources

(iii) Mangrove resources

(iv) Recreational benefits

(v) Coastal protection

(vi) Option, existence and bequest values

(vii) Total Economic Value

(viii) Socio-economic background of the local coastal community

(ix) Perception study of the local coastal community

(x) Level of awareness of the local coastal community

4.1 Fisheries Resources

The marine fisheries landings for the state of Selangor are shown in Table 4.1. Based on the landings shown in Table 4.1, the average annual landings was calculated at 113,292.67 mt/yr in production or USD150,658,056/yr (RM376,645,139.00/yr) in value. Marine fisheries are considered off-shore fisheries and are only partly dependent on mangroves.

After consultation with the marine researchers and experts (A. Sasekumar, Chong, V.C.; pers. comm.), and considering the work by Sasekumar *et al.* (1994), it is assumed that mangrove forest contributes to 50% of the marine fisheries production After taking this point into consideration, the marine fisheries productivity and value for the state of Selangor was calculated to be 56,646.33 mt/yr and worth USD75,329,028/yr (RM188,322,569.50/yr) respectively. Based on the total mangrove area of 15,093 ha for the state of Selangor, productivity per ha per year was estimated at 3.75 mt/ha/yr or USD4,991/ha/yr (RM12,477.48/ha/yr).

For Kuala Selangor which has a total of 379 ha of mangroves, productivity and value of landings were estimated to be 1,422 mt/yr and USD1,891,589.0/yr (RM4,728,972.0/yr) respectively.

Riverine fisheries value was estimated from Chong (1996). The total production in 1994 was 3,320 kg worth about USD13,200. Based on the total mangrove area in Kuala Selangor district (379 ha), the productivity was estimated to be 8.76 kg/ha/yr worth USD34.8/ha/yr.

Table 4.1: Marine Fisheries Landings for the State of Selangor (1995-1997)

Year	1995	1996	1997
Total Landings (mt)	111,105.00	110,368.00	118,405.00
Total Value (RM)*	310,827,424.00	433,589,064.00	385,518,929.00

* Value of landings was calculated based on market price of the respective years.
Source: DOF Selangor 1996, 1997 & 1998 (in press)

4.2 Aquaculture Resources

Aquaculture activities in Kuala Selangor include the culture of blood cockle (*Anadara granosa* or locally known as kerang) on mudflats, rearing of green mussel (*Perna viridis* (Linnaeus) or locally known as kupang or siput sudu) and crab fattening. The crab being reared or fattened is the mangrove crab (*Scylla* sp. or locally known as ketam batu or ketam bakau).

Table 4.2 shows the aquaculture production data for Kuala Selangor district from 1995 to 1997 in production (kg) and value (RM).

Based on the aquaculture production of Kuala Selangor district for three years (1995, 1996 and 1997), the average production was estimated to be 4,913,567 kg/yr worth USD 3,000,828.43/yr (RM7,502,071.07/yr) in value. Based on the total mangrove forest in Kuala Selangor (379 ha) which is assumed to support the aquaculture activities, the aquaculture production in Kuala Selangor district was estimated to be 12,965 kg/ha/yr or USD7,917.75/ha/yr (RM19,794.38/ha/yr).

Table 4.2: Aquaculture Production Data for Kuala Selangor District, Malaysia (1995-1997)

Resource (1995)	Production (kg)	Retail price (RM)	Value (RM)
Mangrove crab	8,900	12.70	113,030.00
Adult cockle	10,002,140	0.67	6,701,433.80
Green mussel	15,850	1.17	18,544.50
Total	**45,090**		**6,833,008.30**

Resource (1996)	Production (kg)	Retail price (RM)	Value (RM)
Mangrove crab	8,100	12.98	105,138.00
Adult cockle	7,113,300	0.91	6,473,103.00
Green mussel	5,800	1.22	7,076.00
Total	**7,127,200**		**6,585,317.00**

Resource (1997)	Production (kg)	Retail price (RM)	Value (RM)
Mangrove crab	7,000	12.83	89,810.00
Adult cockle	7,561,410	1.19	8,998,077.90
Total	**7,568,410**		**9,087,887.90**

Source: DOF, Selangor 1996, 1997 & 1998 (in press)

4.3 Mangrove Resources

The result in this section was based on the data provided by 61 collectors where seven types of resources were harvested. The species, common name and local name of the harvested resources are shown in Table 4.3. The amount of products collected, to be sold and for subsistence is shown in Table 4.4. The total annual net benefit generated by the local coastal community was estimated to be USD101.92/ha/yr (RM254.81/ha/yr) as shown in Table 4.5.

Table 4.3: Species, Common Name and Local Name of Harvested Fisheries Resources from the Mangrove Forest in Kuala Selangor District, Malaysia

Resources	Species	Common name	Local name
1. Fish	*Plotosus canius* Ham.-Buch	Catfish eel	Ikan semilang
	Arius caelatus (Val.)	Catfish	Ikan duri
	Lates calcarifer	Sea bass/sea perch	Ikan siakap
2. Crab	*Scylla* sp.	Mangrove crab	Ketam batu/bakau
3. Shrimp	*Penaeus* spp., *Metapenaeus* spp.	Penaeid shrimp	Udang
4. Cockle	*Anadara granosa*	Blood cockle	Kerang
5. Mussel	*Perna viridis* (Linnaeus)	Green mussel	Siput sudu/kupang
6. Clam	*Orbicularia orbiculata*	Short-necked clam	Siput lala

Table 4.4: Products Harvested from the Mangrove Forest in Kuala Selangor District, Malaysia

Resources	Selling purpose (kg)	Subsistence purpose (kg)
Fish (main species only)		
Catfish eel	5,235.6	52.0
Catfish	981.7	9.8
Sea bass	327.2	3.2
Total	6,544.5	65.0
Mangrove crab	616.0	464.0
Penaeid shrimp	1,395.5	0.0
Blood cockle	14,008.0	50.0
Green mussel	0.0	127.0
Short-necked clam	40.0	0.0
Mangrove wood (poles)	0.0	0.32 pcs
Mangrove wood (firewood)	0.0	70.0
TOTAL	**22,604.0**	**776.0 kg and 0.32 pcs**

Table 4.5: Direct Use Value of Local Utilization of Mangrove Forest by the Local Coastal Community in Kuala Selangor District, Malaysia

Benefit	Value
Mean annual net benefit per household	USD 7,243.10/hh/yr (RM18,107.73/hh/yr)
Total annual net benefit	USD38,629.83/yr (RM96,574.57/yr)
Total annual net benefit per ha	USD101.92/ha/yr (RM254.81/ha/yr)

Note: hh = household

4.4 Recreational Benefits

Recreational benefits were calculated in terms of consumer surplus for 2 sites i.e. KSNP and Kg. Kuantan (KK). The estimated consumer surplus yielded from KSNP and KK were USD10,095.40/yr (RM25,238.42/yr) and USD146,148.00/yr (RM365,352.40/yr) respectively. The sum of both sites provided the total recreational benefits from mangroves which came to USD156,236.30/yr (RM390,590.82/yr) or based on 379 ha of mangroves in Kuala Selangor; USD915/ha/yr (RM2,287/ha/yr).

The estimation of the recreational benefits is shown as follows:

(a) Determination of Zone of Origin

Zones of origin which were divided into districts (in Kuala Selangor) of increasing distances are shown in Table 4.6.

Table 4.6: Zone of Origin of Local Tourists visiting Kuala Selangor Nature Park (KSNP) and Kg. Kuantan in Kuala Selangor District, Malaysia

Zone	District	KSNP	Kg. Kuantan
1	Kuala Selangor	13	7
2	Klang	9	4
3	Gombak	2	1
4	Petaling	4	4
5	Kuala Lumpur	13	8
6	Hulu Langat	7	1
7	Kuala Langat	2	-
8	Other states	9	9
Total		**59**	**34**

Note: No respondents were recorded from Sabak Bernam, Hulu Selangor and Sepang.
Other states includes Perak, N. Sembilan, Melaka, Pahang, Johor, Penang and Kelantan

(b) Calculation of Annual Visitation Rate

Annual visitation rate was calculated based on number of visits/1,000 population. Results of the calculation based on the formula given in Section 3.5.5 are tabulated in Table 4.7.

(c) Calculation of Total Travel Cost

Average travel cost per round trip (to and from each zone to the recreation site) was calculated. Travel time which is the average time taken for the round trip was converted to monetary term based on the average per capita income of USD5,000/yr (for Malaysia). Calculated cost of travel time was RM0.02/minute. Kg. Kuantan is located about 5 km from KSNP. Therefore, an additional 20 minutes of travel time

was added up. The average total cost per visit to KSNP and Kg. Kuantan based on the respective zones are shown in Table 4.8.

Table 4.7: Estimation of Annual Visitation Rate (VR) of Local Tourists to Kuala Selangor Nature Park (KSNP) and Kg. Kuantan in Kuala Selangor District by Zone

Zone	Population	KSNP			Kg. Kuantan		
		sample	%	VR	sample	%	VR
1	145,800	13	22.0	17.4	7	20.6	43.1
2	504,700	9	15.3	3.5	4	11.8	7.1
3	463,400	2	3.4	0.8	1	2.9	1.9
4	808,200	4	6.8	1.0	4	11.8	4.4
5	1,145,000	13	22.0	2.2	8	23.5	6.3
6	551,500	7	11.9	2.5	1	2.9	1.6
7	157,600	2	3.4	2.5	-	-	-
8	9,660,000	9	15.3	0.2	9	26.5	0.8
Total		**59**	**100.1***		**34**	**100.0**	

Note: * percentage did not add up to 100 because of rounding error
%: percentage of total sample (local tourists)

Table 4.8: Estimation of Average Total Cost (TC) per visit to Kuala Selangor Nature Park (KSNP) and Kg. Kuantan in Kuala Selangor District by Local Tourists

Zone	Average total cost to KSNP			Average total cost to Kg. Kuantan		
	TC (RM)	Time (mins)	Total TC (RM)	TC (RM)	Time (mins)	Total TC (RM)
1	4.90	20	5.30	4.90	40	5.70
2	12.70	100	14.70	12.70	120	20.80
3	18.30	20	20.70	18.30	140	21.10
4	19.40	180	23.00	19.40	200	23.40
5	21.20	120	23.60	21.20	140	24.00
6	17.90	180	21.50	17.90	200	21.90
7	24.30	180	27.90	-	-	-
8	68.85	240	73.65	68.85	260	74.05

(d) Estimation of Regression Equation

Regression equations for both sites were estimated by regressing visitation rates (VR) on total travel cost (tc) for all zones. The results are shown below:

For KSNP: $VR = 7.5625 - 0.145\ (tc)$; $R^2 = 0.274$ ($F = 2.261$; $t = -1.504$; standard error = 5.1698)

For Kg. Kuantan: $VR = 13.5243 - 0.225\ (tc)$; $R^2 = 0.121$ ($F = 0.825$; $t = 0.908$; standard error = 14.5381)

Although the value of R^2 in this study was low, it was accepted considering that there are many other studies with low R^2 values ranging from 0.15 to 0.33 (Farber 1988, Sellar *et al.* 1985, Gum & Martin 1975; all cited in Mohd Esa, 1997). Mohd Esa (1997) recorded a value of $R^2 = 0.2615$.

(e) Calculation of Visitation Rates at Various Admission Fees

Based on the regression equations above, visitation rates at various admission fees were calculated for all zones (Tables 4.9 and 4.10).

Table 4.9: Calculated Visitation Rates (VR) at Various Admission Fees for Kuala Selangor Nature Park by Zone (including travel cost)

Zone	1	2	3	4	5	6	7	8	Total VR
Travel cost (RM) / Admisson fee (RM)	5.30	14.70	20.70	23.00	23.60	21.50	27.90	73.65	
0.00	990.6	2741.0	2113.6	3416.7	4740.9	2451.4	554.3	-	17008.4
2.00	948.3	2594.7	1979.2	3182.3	4408.8	2291.5	508.6	-	15913.3
4.00	906.0	2448.3	1844.8	2947.9	4076.8	2131.5	462.9	-	14818.2
6.00	863.7	2301.9	1710.4	2713.5	3744.7	1971.6	417.2	-	13723.1
8.00	821.4	2155.6	1576.0	2479.2	3412.7	1811.7	371.5	-	12628.0
10.00	779.1	2009.2	1441.6	2244.8	3080.6	1651.7	325.8	-	11532.9
12.00	736.9	1862.8	1307.3	2010.4	2748.6	1491.8	280.1	-	10437.8
14.00	694.6	1716.5	1172.9	1776.0	2416.5	1331.9	234.4	-	6342.7
16.00	652.3	1570.1	1038.5	1541.6	2084.5	1171.9	188.6	-	8247.6
18.00	610.0	1423.8	904.1	1307.3	1752.4	1012.0	142.9	-	7152.5
20.00	567.7	1277.4	769.7	1072.9	1420.4	852.1	97.2	-	6057.4
22.00	525.5	1131.0	635.3	838.5	1088.3	692.1	51.6	-	4962.3
24.00	483.2	984.7	500.9	604.1	756.3	532.2	5.8	-	3867.2
26.00	440.9	838.3	366.5	369.8	424.2	372.2	-	-	2812.0
28.00	398.6	691.9	232.2	135.4	92.2	212.3	-	-	1762.6
30.00	356.3	545.6	97.8	-	-	52.4	-	-	1052.1
32.00	314.1	399.2	-	-	-	-	-	-	713.3
34.00	271.8	252.9	-	-	-	-	-	-	524.6
36.00	229.5	106.5	-	-	-	-	-	-	336.0
38.00	187.2	-	-	-	-	-	-	-	187.2
40.00	144.9	-	-	-	-	-	-	-	144.9
42.00	102.6	-	-	-	-	-	-	-	102.6
44.00	60.4	-	-	-	-	-	-	-	60.4
46.00	18.1	-	-	-	-	-	-	-	18.1

Table 4.10: Calculated Visitation Rates (VR) at Various Admission Fees for Kg. Kuantan by Zone (including travel cost)

Zone / Travel cost (RM) / Admisson fee (RM)	1	2	3	4	5	6	7	Total VR
	5.70	20.80	21.10	23.40	24.00	21.90	74.05	
0.00	1784.9	4463.7	4067.2	6675.2	9302.3	4741.1	-	31034.4
2.00	1719.2	4236.6	3858.6	6311.5	8787.1	4493.0	-	29406.0
4.00	1653.6	4009.5	3650.1	5947.8	8271.8	4244.8	-	27777.6
6.00	1588.0	3782.4	3441.6	5584.1	7756.6	3996.6	-	26149.3
8.00	1522.4	3555.3	3233.0	5220.4	7241.3	3748.4	-	24520.9
10.00	1456.8	3328.1	3024.5	4856.7	6726.1	3500.3	-	22892.5
12.00	1391.2	3101.0	2816.0	4493.0	6210.8	3252.1	-	21264.1
14.00	1325.6	2873.9	2607.5	4129.3	5695.6	3003.9	-	19635.8
16.00	1260.0	2646.8	2398.9	3765.6	5180.3	2755.7	-	18007.4
18.00	1194.4	2419.7	2190.4	3402.0	4665.1	2507.6	-	16379.0
20.00	1128.8	2192.6	1981.9	3038.3	4149.8	2259.4	-	14750.7
22.00	1063.1	1965.5	1773.3	2674.6	3634.6	2011.2	-	13122.3
24.00	997.5	1738.3	1564.8	2310.9	3119.3	1763.0	-	11493.9
26.00	931.9	1511.2	1356.3	1947.2	2604.1	1514.9	-	9865.6
28.00	866.3	1284.1	1147.7	1583.5	2088.8	1266.7	-	8237.2
30.00	800.7	1057.0	939.2	1219.8	1573.6	1018.5	-	6608.8
32.00	735.1	829.9	730.7	856.1	1058.3	770.3	-	4980.4
34.00	669.5	602.8	522.2	492.4	543.1	522.2	-	3352.1
36.00	603.9	375.6	313.6	128.7	27.8	274.0	-	1723.7
38.00	538.3	148.5	105.1	-	-	25.8	-	817.7
40.00	472.7	-	-	-	-	-	-	472.7
42.00	407.0	-	-	-	-	-	-	407.0
44.00	341.4	-	-	-	-	-	-	341.4
46.00	275.8	-	-	-	-	-	-	275.8
48.00	210.2		-	-	-	-	-	210.2
50.00	144.6		-	-	-	-	-	144.6
52.00	79.0		-	-	-	-	-	79.0
54.00	13.4						-	13.4

(f) Derivation of User's Demand Curve

Based on the visitation rates calculated, a user's demand curve was derived for each recreation site. (Please refer to Figures 4.1 and 4.2).

(g) Calculation of Consumer's Surplus

The total area under the user demand curve was calculated to give the consumer's surplus for each site. (Please refer to Tables 4.11 and 4.12).

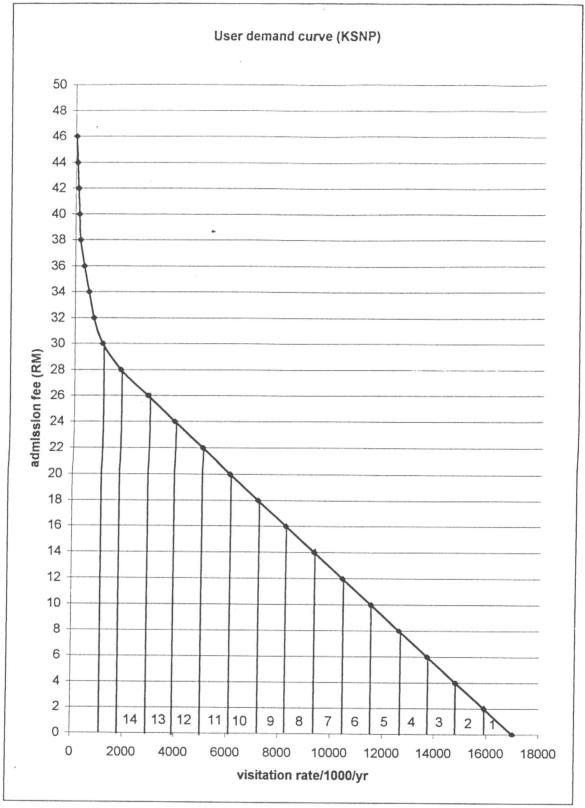

Figure 4.1: User's Demand Curve for Kuala Selangor Nature Park

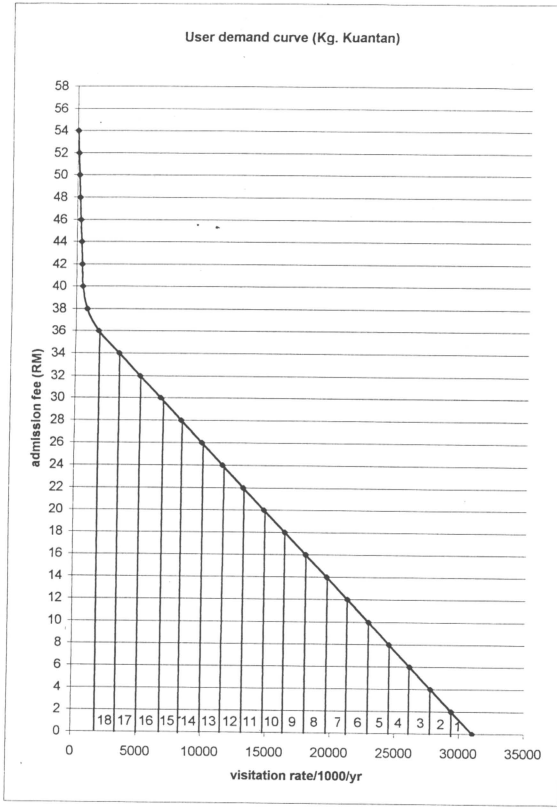

Figure 4.2: User's Demand Curve for Kg. Kuantan

Table 4.11: Estimated Consumer's Surplus (RM) for Kuala Selangor Nature Park

Section	Width (w)	Area 1	Area 2	Subtotal (RM)
1	1095	1095	0	1095
2	1095	1095	2190	3285
3	1095	1095	4380	5475
4	1095	1095	6570	7665
5	1095	1095	8760	9855
6	1095	1095	10950	12045
7	1095	1095	13140	14235
8	1095	1095	15330	16425
9	1095	1095	17520	18615
10	1096	1096	19728	20824
11	1095	1095	21900	22995
12	1095	1095	24090	25185
13	1055	1055	25320	26375
14	1049	1049	27274	28323
15	711	711	19908	20619
16	339	339	10170	10509
17	188	188	6016	6204
18	189	189	6426	6615
19	149	149	5364	5513
20	42	42	1596	1638
21	42	42	1680	1722
22	43	43	1806	1849
23	42	42	1848	1890
24	18	18	828	846
Total (RM)				**269802**

Note: width = difference between each section
Area 1 = area of triangle for each section
Area 2 = area of rectangle for each section
Total area of each section = Area 1 + Area 2
Total consumer surplus = Total area of (section 1 + ... + section 13)

Table 4.12: Estimated Consumer's Surplus (RM) for Kg. Kuantan

Section	Width	Area 1	Area 2	Subtotal
1	1628	1628	0	1628
2	1628	1628	3256	4884
3	1629	1629	6516	8145
4	1628	1628	9768	11396
5	1628	1628	13024	14652
6	1629	1629	16290	17919
7	1628	1628	19536	21164
8	1629	1629	22806	24435
9	1628	1628	26048	27676
10	1628	1628	29304	30932
11	1629	1629	32580	34209
12	1628	1628	35816	37444
13	1628	1628	39072	40700
14	1629	1629	42354	43983
15	1628	1628	45584	47212
16	1629	1629	48870	50499
17	1628	1628	52096	53724
18	1628	1628	55352	56980
19	906	906	32616	33522
20	345	345	13110	13455
21	66	66	2640	2706
22	66	66	2772	2838
23	65	65	2860	2925
24	66	66	3036	3102
25	65	65	3120	3185
26	66	66	3300	3366
27	66	66	3432	3498
28	13	13	702	715
Total				**596894**

Note: width = difference between each section
Area 1 = area of triangle for each section
Area 2 = area of rectangle for each section
Total area of each section = Area 1 + Area 2
Total consumer surplus = Total area of (section 1 + ... + section 21)

4.5 Coastal Protection

The value of mangroves in protecting coastal areas were estimated based on replacement cost of building and maintaining a structural embankment (rip-rap) and the cost of replanting mangroves. The cost of constructing and maintaining a simple stone-piled embankment or a rip-rap was estimated to be USD13,842/ha/yr (RM34,605/ha/yr) while the cost of replanting was USD36.24/ha/yr (RM90.59/ha/yr). Data on the cost of construction and maintenance of structural embankments in Kuala Selangor District is shown in Table 4.13. Detailed calculation of replacement cost for coastal protection with structural embankments is shown in Table 4.14 while the calculation of mangrove replanting cost in Kuala Selangor is shown in Table 4.15.

Table 4.13: Data on the Cost of Structural Embankment in Kuala Selangor District, Malaysia

Month/1998	Length of coastline (km)	Type of protection	Cost USD (RM)	USD/km (RM/km)
Early 1998	1.5 (Bagan Pasir -Kg. Sg. Yu)	Rip-rap (construction)	28,000.00 (70,000.00)	18,666.80 (46,667.00)
March	0.5 (Bagan Pasir)	Rip-rap & vetiver grass (maintenance)	20,000.00 (50.000.00)	40,000.00 (100,000.00)
April	0.5 (Bagan Pasir)	Rip-rap (maintenance)	8,000.00 (20,000.00)	16,000.00 (40,000.00)
May-June	0.04 (Parit 3, Sg. Burong)	sea pile (construction)	120,000.00 (300,000.00)	3,000,000.00 (7,500,000.00)
One year	13.0 (Tg Karang-Sekinchan)	maintenance	160,000.00 (400,000.00)	12,307.60 (30,769.00)

Source: Drainage and Irrigation Department, Kuala Selangor (pers. comm.)

Based on Table 4.13, the one-time cost of constructing structural embankments ranged from USD18,666.8 - 3,000,000/km (RM46,667 - 7,500,000.00/km)

depending on the type of structure. The maintenance cost per year ranged from USD12,307.60 - 40,000/km/yr (RM30,769 - 100,000.00/km/yr).

The estimation on the replacement cost of mangroves by structural embankment will use rip-rap structure as model. The reason being, the data on construction and maintenance for rip-rap structure is more complete as compared to other types of structures shown in Table 4.13.

Table 4.14: Detailed Estimation of Replacement Cost for Mangroves by Rip-Rap Structure in Kuala Selangor District, Malaysia

Items	Cost USD/km
Construction cost/km	USD18,666.8/km
Maintenance cost/km	March : USD40,000.00 April : USD16,000.00
Total maintenance cost/km for half a year	USD56,000.00
Projection of maintenance cost/km/yr	USD56,000.00 x 2 = USD112,000.00/km/yr
Total cost (construction cost + maintenance)/km/yr	**= USD18,666.8 + USD112,000 = USD130,666.8/km/yr**
Total length of coastline currently covered with mangroves	40.15 km
Total value of mangroves protecting the coastline	USD130,66.8/km/yr x 40.15 km = USD5,246,272.0/yr
Total value of mangroves protecting the coastline in USD/ha/yr	**USD5,246,272.0/yr ÷ 379 ha = USD13,842/ha/yr**

The rip-rap at Bagan Pasir was constructed with the cost of USD18,666.80/km/yr (RM46,667/km/yr) in early 1998. The maintenance cost for March, 1998 was USD40,000.00/km (RM100,000.00/km) and in April, 1998; USD16,000.00/km (RM40,000.00/km). At the time of observation (in June, 1998), there were no further maintenance done after April, 1998. In order to give the replacement cost in USD/ha/yr unit, the total length of coastline in Kuala Selangor district currently

covered with mangroves, which is 40.15 km (estimated using GIS map traced from 1980s topography map) was 'replaced' with rip-rap at the cost of USD130,666.8/km/yr. This gave a value of USD5,246,272.0/yr. Assuming that the mangroves at the coastline is supported by the total mangroves in Kuala Selangor district, which is 379 ha, the value for replacement cost in terms of USD/ha/yr was estimated to be USD13,842/ha/yr.

Table 4.15: The Cost of Mangrove Replanting Programme in Kuala Selangor District, Malaysia (1992-1998)

Year	Location	Block	Area (ha)	Cost USD (RM)
1992	North Banjar	A	50	11,080.00 (27,700.00)
		B	60	2,969.44 (7,423.60)
1993	North Banjar	NA	50	8,000.00 (20,000.00)
1994	North Banjar	B	50	13,000.00 (32,500.00)
1995	North Banjar	NA	30	9,336.00 (23,340.00)
1996	North Banjar	C	70	19,600.00 (49,000.00)
		A	20	5,480.00 (13,700.00)
		B	25	6,850.00 (17,125.00)
1997	North Banjar	D	70	19,600.00 (49,000.00)
1998	North Banjar	F	30	15,400.00 (38,500.00)
		E	40	14,240.00 (35,600.00)
Total cost for 7 years (1992-1998)			**495**	**125,555.44 (313,888.60)**

Source: Selangor State Forestry Department; unpublished data

Based on Table 4.15, the total cost of planting mangrove trees for 7 years in an area of 495 ha was USD125,555.44 (RM313,888.60). Therefore, the average cost of planting mangrove trees per ha per year is:

USD125,555.44/495 ha ÷ 7 yr = USD36.24/ha/yr (RM90.59/ha/yr).

The cost of constructing and maintaining structural embankment (rip-rap) will be used to reflect the cost of coast protection. The cost of mangrove replanting are shown as a comparison.

4.6 Option, Existence and Bequest Values

Option, existence and bequest values were estimated in terms of individual WTP respectively as shown in Tables 4:16, 4.17 and 4.18. The values shown are based on 379 ha of mangroves. Preservation value, which is based on the average of all three values (option, existence and bequest) was estimated at USD 33,553.94/ha/yr (RM83,884.85/ha/yr) and shown in Table 4.19.

Table 4.16: Estimation of Option Value

Option value	Average USD (RM)	% WTP	Effective pop. size	Effective pop. > 15 yr	Value USD (RM)
Local community	7.23 (18.07)	84	142,226	91,025	552,660 (1,381,650.27)
Local tourist	14.83 (37.07)	77	11,638	11,638	132,878 (332,193.91)
Foreign tourist	16.12 (40.29)	11	3,192	3,192	5,659 (14,146.62)
Malaysian public	13.68 (34.19)	84	2,000,000	1,280,000	14,704,435 (36,761,088.00)
Total					**15,395,632** **38,489,078.80**

Table 4.17: Estimation of Existence Value

Option value	Average USD (RM)	% WTP	Effective pop size	Effective pop > 15 yr	Value USD (RM)
Local community	4.71 (11.78)	89	142,226	91,025	381,730 (954,324.31)
Local tourist	11.85 (29.62)	74	11,638	11,638	102,036 (255,090.99)
Foreign tourist	14.60 (36.50)	13	3,192	3,192	6,058 (15,146.04)
Malaysian public	8.86 (22.16)	84	2,000,000	1,280,000	9,530,693 (23,826,432.00)
Total					**10,020,397 (25,050,993.34)**

Table 4.18: Estimation of Bequest Value

Option value	Average USD (RM)	% WTP	Effective pop size	Effective pop > 15 yr	Value USD (RM)
Local community	6.53 (16.32)	89	142,226	91,025	532,848 (1,322,119.92)
Local tourist	16.47 (41.17)	76	11,638	11,638	145,657 (364,143.71)
Foreign tourist	16.12 (40.29)	13	3,192	3,192	6,687 (16,718.74)
Malaysian public	10.82 (27.06)	87	2,000,000	1,280,000	12,053,606 (30,134,016.00)
Total					**12,734,799 (31,836,998.37)**

Note: population of Malaysian above 15 years is 64% based on World Factbook on http://www.odci.gov/publication/factbook/my.html
Pop = population

Table 4.19: Estimation of Preservation Value

Category	Value USD/ha/yr (RM/ha/yr)
Option value	40,622 (101,554)
Existence value	26,439 (66,098)
Bequest value	33,601 (84,003)
Preservation value	**33,553.94 (83,884.85)**

4.7 Total Economic Value (TEV)

The TEV was calculated by adding up all the use and non-use values (see Figure 2.1). Based on this study, the TEV of mangroves in Kuala Selangor was estimated to be USD61,357/ha/yr (RM153,392/ha/yr) (Table 4.20). This value should not be considered the entire TEV for mangrove forests in Kuala Selangor mangrove forests as there are other values not included in this calculation such as the carbon sequestration and water filtration services of the mangroves.

Table 4.20: Total Economic Value of Mangroves in Kuala Selangor District, Malaysia

TEV Components	Value (USD/ha/yr)	Value (RM/ha/yr)
Use values		
Fisheries resources	4,991.00	12,477.50
Aquaculture production	7,917.75	19,794.38
Mangrove resources	101.92	254.81
Riverine resources	34.83	87.07
Recreational benefits	914.725	2,286.80
Coastal protection	13,842	34,605
Sub-total	**27,803**	**69,507**
Non-use values		
Preservation value	33,553.94	83,884.85
Option value	(40,621.72)	(101,554.30)
Existence value	(26,439.04)	(66,097.61)
Bequest value	(33,601.05)	(84,002.63)
Sub-total	**33,553.94**	**83,884.85**
Total	**61,357**	**153,392**

Note: Option value (which is under use values) is added up with existence and bequest values to derive preservation value, which is the average of all three values.

4.8 Socio-economic Information of the Respondents from the Local Coastal Community

The basic socio-economic information for respondents from the local coastal community was compiled into Table 4.21 and elaborated in the subsequent sections. The socio-economic information include race, sex, age, duration of stay in their respective villages and number of generations staying in their respective villages. Apart from the above, information on marital status, household size, level of education, type of occupation, duration of occupation and income were also obtained. Knowledge or awareness of mangroves at different life stages was also inquired. Respondents were asked when they were aware of mangroves, i.e. during childhood, schooling period (primary, secondary, tertiary), working period or no knowledge about mangroves at all.

Table 4.21: Summary of Socio-economic Background of Respondents from the Local Coastal Community

Parameter	Category					
Race	Chinese	Malay	Indian	Others		
% of total sample	40.2	59.30	0.51	0.00		
Sex	Male		Female			
% of total sample	90.45		9.55			
Age (yr)	< 20	20 - 30	30 - 40	40 - 50	50 - 55	> 55
% of total sample	6.03	8.54	25.13	35.68	17.39	7.04
Duration of stay (yr)	< 1	1- 5	5 - 10	> 10		
% of total sample	0	2.01	4.52	93.47		
No. of generations	1	2	3	4		
% of total sample	9.05	19.60	26.77	44.72		
Marital status	Married		Unmarried			
% of total sample	86.93		13.07			
Household size (no. of people)	< 3	3 - 6	> 6			
% of total sample	11.06	45.23	43.72			
Level of education	None	Primary	Secondary	Tertiary	Others	
% of total sample	8.04	58.79	30.15	2.01	1.01	
Occupation	Fisherman	Aquacul	Government	H/wife	Unemp	Others
% of total sample	67.30	5.21	5.69	2.37	3.79	15.64
Duration of occupation (yr)	< 10	10 - 15	15 - 20	> 20		
% of total sample	18.75	19.27	17.71	44.27		
Income (RM/mth)	< 300	300-500	500-1000	1000-3000	3000-5000	> 5000
% of total sample	7.77	19.17	37.31	26.94	7.77	1.04
Knowledge of mangrove (awareness)	Childhood	Primary	Secondary	Working	None	
% of total sample	50.25	37.69	2.01	7.04	3.02	

Note: some percentage did not add up to 100 due to rounding error.
Aquacul. = aquaculturist
H/wife = housewife
Unemp = unemployed

(a) Race

In terms of race, 80 Chinese respondents were interviewed compared to 118 Malays and only 1 Indian. Generally, Malays and Chinese are more active in fishing compared to Indians. Figure 4.3 shows the distribution of respondents in terms of race.

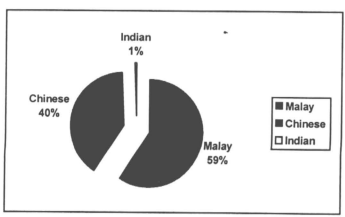

Figure 4.3: Distribution of Respondents by Race

(b) Sex

More than 90% of the respondents were male while female only made up 9.55%.

(c) Age

Majority of the respondents were in the 40-50 years age range (35.68%) followed by those between 30-40 years (25.13%), 50-55 years (17.39%), 20-30 years (8.54%) and less than 20 years old (6.03%). Figure 4.4 shows the distribution of respondents by age.

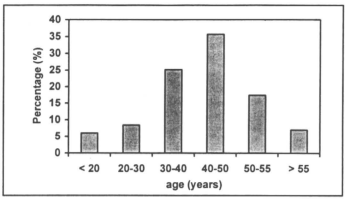

Figure 4.4: Distribution of Respondents by Age

(d) Duration of Stay and Generation

Most of the respondents have been living in their respective villages for more than 10 years. None have lived there for less than a year. In terms of generations, close to 45% of the families have been living for 4 generations while 26.77% have been living in Kuala Selangor for 3 generations in the area. Figure 4.5 shows the distribution of respondents by duration of stay in Kuala Selangor district.

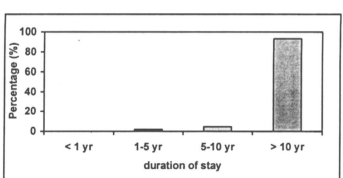

Figure 4.5: Distribution of Respondents by Duration of Stay in their Respective Villages

(e) Marital Status

A total of 173 of the respondents were married (87%) and only 26 (13%) were unmarried.

(f) Household Size

The main household size was medium to big with 45.23% having household size of 3-6 people and 43.72% having more than 6 people per household. Figure 4.6 shows the distribution of respondents by household size.

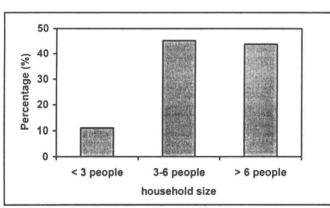

Figure 4.6: Distribution of Respondents by Household Size

(g) Level of Education

Majority of the respondents received only primary school education (58.79%) while 30.15% received secondary education. Primary education in Malaysia started at the age of 7 years to 12 years old. Secondary education started at age 13 years and the schooling period was 7-11 years. Tertiary education means university education or

any higher education than secondary education. Figure 4.7 shows the respondents' distribution by level of education.

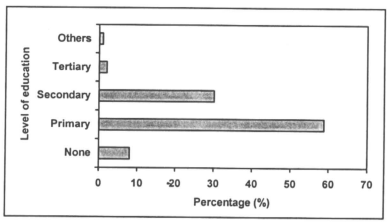

Figure 4.7: Distribution of Respondents by Level of Education

(h) Occupation

Although the respondents stayed in fishing villages, not all were fisherman. A total of 67.30% worked as fisherman and 15.64% worked in sectors such as agriculture and in more than 2 sectors. The number of respondents in each category of duration of occupation was distributed quite fairly. Between 17.7% - 44.3% of respondents were in each of the time period category. Figure 4.8 shows the respondents' distribution based on type of occupation.

(i) Income Level

Most of the local people (more than 60%) earned between RM500-3,000 of income per month. However, the number of people earning less than RM500 per month was found to be substantial, totaling about 27%. Only less than 10% of the respondents

earned more than RM3000 per month. Figure 4.9 shows the respondents' distribution by income level.

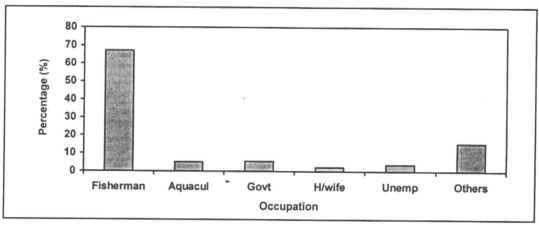

Figure 4.8: Distribution of Respondents by Occupation

Key: Aquacul: aquaculturist Govt: government servant
H/wife: housewife Unemp: unemployed

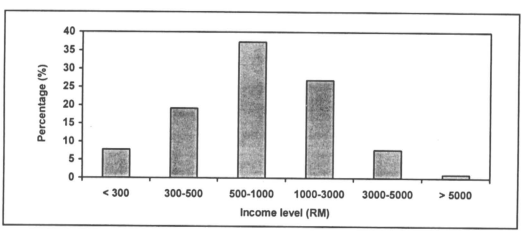

Figure 4.9: Distribution of Respondents by Income Level

(j) Knowledge on Mangroves

More than 50% of the respondents knew how mangrove plants look like since childhood, while only 37.69% knew about mangrove during their primary school.

Figure 4.10 shows the distribution of respondents based on the time when they first know about mangroves.

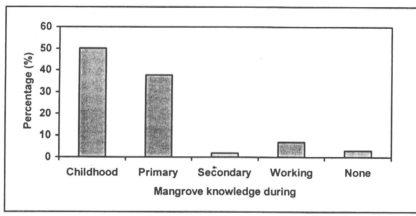

Figure 4.10: Distribution of Respondents by Knowledge on Mangroves

Note: Childhood = afterborn to 6 years
Primary school = 6 years of schooling starting at the age of 7
Secondary school = 7 - 11 years of schooling after completing primary school

4.9 Perception Study of the Respondents from the Local Coastal Community

A perception study was carried out as part of the socio-economic survey during July to September 1998. The perception study was aimed only at the local coastal community as they are the group that will be directly affected by any development involving mangrove forest. Respondents were asked whether they agreed, disagreed or had no opinion on future developments that might result in further mangrove clearance in their area.

The result of the perception study of the local community is shown in Figure 4.11. Almost 90% of the respondents objected to development of mangrove forest. A

small group (3.5%) however agreed while 5.0% did not give any opinion. Four of the total respondents did not reveal their stand.

Majority of those who objected to any proposed development on mangrove land viewed both economic loss and environmental pollution as the main factors. A total of 33.7% objected because of possible economic loss, while 18.5% objected based on environmental reasons. Objections due to economic reason were expected as most of the respondents were fishermen.

Only 7 respondents agreed to development on mangrove areas, citing better infrastructure, jobs and business opportunities as their reasons. Asked on whether respondents will encourage the future generation to continue their profession as fisherman, more than 50% opted to discourage while 42.7% thought the profession is still suitable for their children.

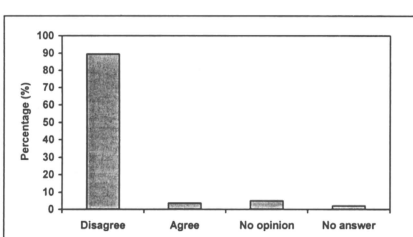

Figure 4.11: Perception of Respondents from the Local Coastal Community on Development that will affect the existing Mangrove Forest in Kuala Selangor District, Malaysia

4.10 Relation between Type of Respondents and Willingness To Pay

All respondents were asked on their willingness to pay to help conserve and manage the remaining 379 ha of mangrove forest in Kuala Selangor district. A starting bid of RM20.00 was suggested. The bid was increased if the respondent agreed to pay more and decreased if they were not willing to pay the starting bid price of RM20.00. The willingness to pay based on respondent's group is shown in Figure 4.12. The WTP of Malaysians was found to be generally higher. Of all the groups interviewed, about 85% of the respondents from the local community, local tourist and Malaysian public group expressed their willingness to pay. The foreign tourist group however recorded a total of 68.4% of not willing to pay.

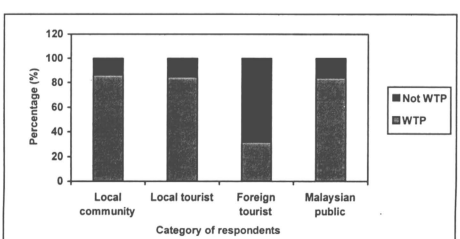

Figure 4.12: Willingness To Pay based on Category of Respondents