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ORIGINAL RESEARCH PAPER

Assessment of the local communities' knowledge on mangrove ecology

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ABSTRACT: The Kuala Selangor mangrove forest are facing massive reclamation for economic development but the conservation aspect and fisheries values of mangroves have been ignored in the decision-making process. The local community support and awareness of the mangrove forest conservation are still doubtful. The aim of the study is to analyses the local community perception on the mangrove forest conservation and management by the current and future development factor. Statistical data was generated using the SPSS software version 22 to develop a descriptive analysis and cross tabulation chi- square for data analysis and interpretation. The results reveal that knowledge and perception towards the mangrove forest are influenced by the socio-demographic factors such as age, level of education, occupation, living duration and distance from the mangrove forest. The data analyzed showed that the distance of living from mangrove forest had a positive relationship towards mangrove conservation followed by age and education. Education plays a role in increasing the community awareness and appreciation of the mangrove ecology. The outcome of the study could be utilized by the policy maker and local authority by taking into account the community perception of mangrove forest development, encouraging the community participation in the decision-making process and selecting a sustainable livelihood option for the mangrove forest.

KEYWORDS: *Community perception; Mangrove development; Mangrove forest*

INTRODUCTION

Mangrove forest is a complex assemblages of microscopic and macroscopic fauna and flora species (Feka, 2015) in nature. The mangroves reflect a multiple-use ecosystem providing a wide range of products and services (Kwan *et al*., 2005) for the environment and community for sustainable well-being. Mangrove is a highly valuable ecosystem and provides essential goods and services which contribute to the livelihoods, well-being, and security of the coastal communities (Duke and Bochove, 2014).

Mangrove forest also plays an important role to sustain the human and environment well-being for several reasons (Badola *et al*., 2012). Besides being a major source of supply especially marine products such as fish, shrimp, crab, and cockles, it also has an important role in the hydrological cycle and mitigation sector as a natural protector for our environment from natural disasters such as the monsoon wind, tsunami and erosion (Othman and Shalwahid, 1990).

The total economic values of mangrove forest estimated around the world are ranging from USD 2000 to USD 9000 per hectare per year (Kathiresan, 2012). The total area of mangrove forest on the west coast of peninsular Malaysia is estimated 78,395 ha (Sasekumar and Then, 2005) and the Kuala Selangor Nature park (KSNP) or South Banjar forest covers around 111 ha (Kwan *et al.*, 2005).

Although mangrove is an important natural heritage and supports local communities for their food supply, safety, and health, the mangrove area development and

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land conversion to other sectors still continue. The importance of the mangrove ecology was denied and the rapid development took over the place by time with the focus for housing and aquaculture development, especially (Latiff, 2012). Lots of researches have been conducted and published about the importance and function of the mangrove forest for our environment (Feka, 2015; Duke and Bochove, 2014; Latiff, 2012). However, the land conversion of mangrove forest is still being approved and continues (Latiff, 2012) even though it was clearly stated in the Malaysian Law under the 'National Forestry Act 1984' (Jusoh *et al.*, 2010) that the mangrove forest is fully protected.

Even though the mangrove forest is supporting the local community's economy and social wellness (Latiff, 2012), it is still being viewed as wasteland and converted to other land use pattern (Kwan *et al.*, 2005). The South Banjar Reserve Forest covered an area of 1,139 ha in 1963 but decreased to 257 ha in 1979 and now only covers 111 ha which remains as KSNP (Kwan *et al.*, 2005). It clearly shows the decreasing area of mangrove forest covered at the South Banjar forest; the land conversion for agriculture, aquaculture, resettlement and pollution is the main factor for the shrinking of the South Banjar forest (Latiff, 2012).The local communities adjacent to the KSNP rely on the mangrove forest for their daily socio-economy factor (Singh and Rengasamy, 2010) but period in-between the land conversion also grow rapidly (Latiff, 2012).

Due to the uncertainties of the mangrove ecosystem future, there is an urgent need to measure the importance of the mangrove ecology to the local communities and their understanding and perception of the mangrove forest development because community support is the main key to the effectiveness and success of the marine protected area like mangrove forest conservation and protection (Beger *et al*., 2004). There is a need to identify the awareness level of the local community towards mangrove conservation and appreciation and it is essential to develop a community-based ecosystem management and development based on the community opinion (Badola *et al*., 2012).
This study has been carried out in Kuala Selangor Nature Park in 2016. The main objective of this study is to determine the value of mangrove forest, and community attitudes towards the conservation of mangroves.The specific objectives are:

1. To determine the depth of knowledge of the local communities towards the value of the mangrove forest

2. To assess the perception and understanding of mangrove forest by local communities via socio-economic and education factor.

3. To analyse the local community perception on mangrove forest development and their support on the mangrove conservation

MATERIALS AND METHODS

Location – Kuala Selangor

This study was conducted at the Kuala Selangor District and mainly focused on the importance of retaining the mangrove forest at the Kuala Selangor Nature Park. Kuala Selangor is one of the nine districts located in the Selangor state (Yusof Hasan, 1981), situated on the west coast of peninsular Malaysia (3°19'N, 101°15'E) in Selangor (Khaironizam and Rashid, 2012). The Kuala Selangor district is under the Kuala Selangor district council (MDKS), established in 1978 under the Selangor act 18/78 (Portal Rasmi Majlis Daerah Kuala Selangor (MDKS), 2015).

The Kuala Selangor district is a combination of five small zones namely Ijok, Jeram, Tanjung Karang, Batang Berjuntai and Kuala Selangor (Portal Rasmi Majlis Daerah Kuala Selangor (MDKS), 2015) in a land area covering 117,844 hectares (MDKS, 2015). The total population of the Kuala Selangor old town adjacent to the KSNP is 11,649 (Kualaselangor.selangor.gov.my, 2015). The Kuala Selangor Nature Park (KSNP) is located in the south of Sungai Selangor near to the west coast of Kuala Selangor town in the Selangor State (Kwan *et al.*, 2005) as shown in Figure 1. The park is currently gazetted as a town park under the Local Government Act 1976 (Sharp, 1987). The KSNP mangrove forest site is approximately 324 hectares (Singh and Rengasamy, 2010) and comprises three main habitats including the secondary and mangrove forests and brackish lake. The coastal mangrove forest covers 104 hectares, secondary forest 200 hectares and the lake system in 20 acres (Singh and Rengasamy, 2010).The KSNP was established on 27th of September 1987 under the Malaysian Nature Society (MNS) to manage and conserve the mangrove forest as an important area for migratory birds (Singh and Rengasamy, 2010). The KSNP shelters over 156 species of birds, mammals, insects, molluscs, crabs, mudskipper, mud lobster, king crab, otters, leopard cat, and the threatened primate species (Singh and Rengasamy, 2010). The KSNP is also known as an ecotourism site in Kuala Selangor and this ecosystem serves as the

habitat, nursery and foraging area for many marine animals including acting as buffer zone to protect the economically important cockle and fishing which account for 90% of the Selangor state cockle production (Sharp, 1987) and support the local community socio-economy (Sasekumar *et al*., 2005). Considering its ecological and social value, the KSNP was identified and recognized as an Important Bird Area (IBA – MY11) under the Birdlife International.

Conservation Issues

The mangrove ecosystem is both dynamic and fragile that is very sensitive to either the natural stochastic events or human activities (Latiff, 2012). Between 1980 and 1990, 12% of the existing mangroves, which atone to about 59,500 ha, were lost in Malaysia and it included the Kuala Selangor district (Sasekumar and Then, 2005). The decline was due to various activities such as reclamation for agriculture, housing, aquaculture, infrastructure and tourism as shown in Fig. 1. The primary and most extensive threat to mangroves is the conversion of land-use (Latiff, 2012).

The Banjar South mangrove forest 'Kuala Selangor Nature Park' (KSNP) is one such area of where vast areas are currently being massively reclaimed (Sasekumar and Then, 2005) for activities such as aquaculture farm and housing development. The bund built in the early 70s reclaimed around 300 m of the mangrove shore at the Banjar South Forest which was converted to oil palm holdings and poultry farms (Sasekumar and Then, 2005). Mangroves are constantly undervalued and do not figure in decision-making, resulting to massive loss (Duke and Bochove, 2014).

The community participation in the mangrove conservation is important for the harmonious relationships between forest and human (Walters, 2004). Mangrove ecology plays a critical role in supporting the human well-being through the food supply, poverty reduction, and climate regulation (Duke and Bochove, 2014). Even though the important value of mangrove ecology is well explained and the widespread attention is allocated, the lack of conservation effort, loss and degradation remain a

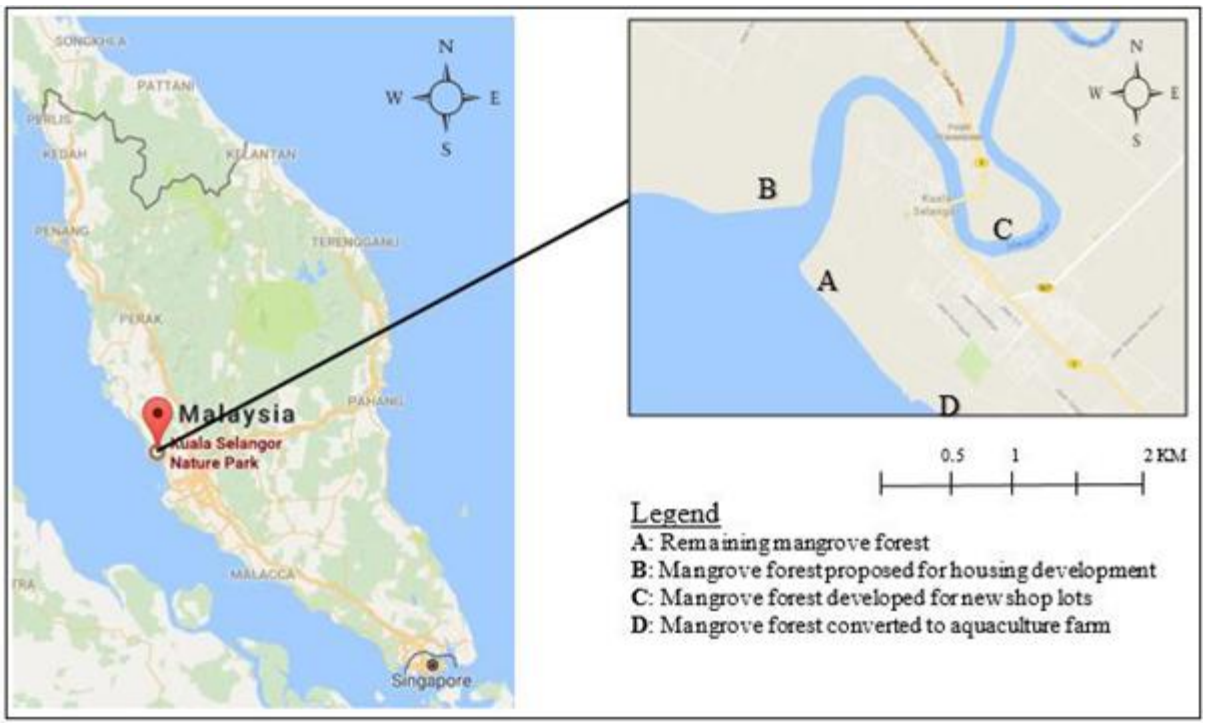

Fig. 1: Kuala Selangor (Anon, 2016)

matter of concern (Badola *et al*., 2012) and the community participation is still unclear.

Mangroves provide a natural defence from natural disaster and reduce property loss and vulnerability of the local communities (Duke and Bochove, 2014; Singh and Rengasamy, 2010). It is clear that mangrove and human have a positive relationship but the community participation on mangrove conservation is still low and it is suggested that people's participation will determine the success or failure of any conservation project (Badola *et al*., 2012). The community participation in the conservation effort is extremely important and without greater public awareness, conservation effort would normally fail (Latiff, 2012). Local government and various environment NGO had been continuously conduct environmental campaign and event for local community to increase community participant and conservation effort in mangrove conservation (Melati, 2010).

Data Collection

This assessment was conducted to survey the local communities' level of knowledge on the mangrove forest and their perception towards the existing mangrove forest development. The information and data were collected at the Kuala Selangor district adjacent to the Kuala Selangor Nature Park (KSNP). There were four nearest villages located surrounding the KSNP namely Tanjung Keramat, Sungai Buloh, Taman Melawati and Desiran Melawati and a new housing area with the total population of 11,649 in 2011 (Kualaselangor.selangor.gov.my, 2015).

The primary data in the research was collected through questionnaire randomly. The eligible respondents for the questionnaire survey were the local communities staying near or adjacent to the Kuala Selangor Nature Park boundaries, precisely at coordinates 3°23'51"N 101°10'07"E.

The questionnaire was divided into three parts; demographic, knowledge and perception. 31 questions and statements were included in the questionnaire. In the demographic section, the respondents were requested to state their socio-economy factor; the knowledge section tested the respondents on mangrove forest, which is important and finally, the respondents need to verify their acceptance level on the types of current and future development planned, which include their need. The total sample size of the respondent is 370 (Krejcie and Morgan, 1970) out of the total population adjacent to the KSNP area, which is 11,649 (Kualaselangor.selangor.gov.my, 2015). The questionnaires were distributed from January to April 2016.

Statistical Analysis

The collected data was analysed using the SPSS software version 22. The respondents' demographic, knowledge and perception data were analysed using the descriptive statistics to summarize the categorical variables as numbers and percentages. Whereby, in the frequency analysis, the cross tabulation and chi-square tests were carried out to determine the association between the perception factor of the people with knowledge and demographic variables such as the gender, educational level, occupation and distance of living from mangrove area.

RESULTS AND DISCUSSION

Socio-economic profile

The socio-economic profile of the respondents is shown in Table 1. The total number of respondents is 371 and 198 respondents (53.4%) were females and the other 173 are males (46.6%). The age of the respondents is higher for the range of 20-25 years old (29.9%) followed by 26-31 years old (27.8%) and it can be assumed that most of the respondents were youths with the lowest age group was above 43 years old (9.4%). Most of the respondents' education level was secondary school (39.6%) followed by diploma and certification level by 29.6%, while1.9% (7 persons) did not have proper education. Based on occupation, government servants were 29.6%, private sector workers 43.1% and 11.9% of them are students.

The basic salary of the respondents was shown to be between RM 801.00 and RM 1600.00 (38.8%), 18.6% earned between RM 1601.00 and RM 2400.00 whereas 16.7% had income below RM 800.00. 50% of the respondents' distance from the Kuala Selangor Mangrove forest was below 5KM and 79% of the respondents stated that they have stayed in Kuala Selangor for more than six years. 7.8% the respondents were unwilling to share the information of their income resulting in the missing value.

Knowledge and awareness regarding the mangrove forest

Fig. 2 presents the result of the learning place about mangrove by respondents and Fig. 3 presents the total

mangrove species can be identified by respondents. 55% of the respondents learnt about the mangrove forest from their school followed by mass media 15.9%, awareness campaign 13.2%, social-network 7.3%, through family or friends 6.2%, and from their work requirement 1.9%. Only 42.6% of the respondents knew more than four species of mangrove trees and 55.3% of the respondents knew below three species, and 2.1% of missing value was due to the unknown of the mangrove trees.

Table 1 Socio-economic profile of the respondents

Characteristics		Frequency	Percentage (%)
Gender			
	Male	173	46.6
	Female	198	53.4
Age			
	<20 years	49	13.2
	20-25 years	111	29.9
	26-31 years	103	27.8
	32-37 years	46	12.4
	38-43 years	27	7.3
	>43 years	35	9.4
Education			
	None	7	1.9
	Primary School	24	6.5
	Secondary school	147	39.6
	Diploma & certificate	110	29.6
	Degree	78	21.0
	Postgraduate	5	1.3
Occupation			
	Fisherman	4	1.1
	Farmer & estate worker	9	2.4
	Cockles & mussels industry	14	3.8
	Government servant	110	29.6
	Private sector	160	43.1
	Student	44	11.9
	NGO	6	1.6
	Housewife	2	0.5
	Own business	8	2.2
	Not working	5	1.3
	Missing	9	2.4
Income			
	=RM800	62	16.7
	RM801 – RM1600	144	38.8
	RM1601 – RM2400	69	18.6
	RM2401 – RM3200	27	7.3
	>RM3200	40	10.8
	Missing	29	7.8
Duration of Living period			
	= 5 years	74	19.9
	6 – 10 years	112	30.2
	11 – 20 years	82	22.1
	= 21 years	99	26.7
	Missing	4	1.1
Distance from nearest KSNP			
	= 1 km	44	11.9
	2 - 4 km	153	41.2
	5 – 7 km	54	14.6
	8 – 10 km	45	12.1
	= 11 km	71	19.1
	Missing	4	1.1

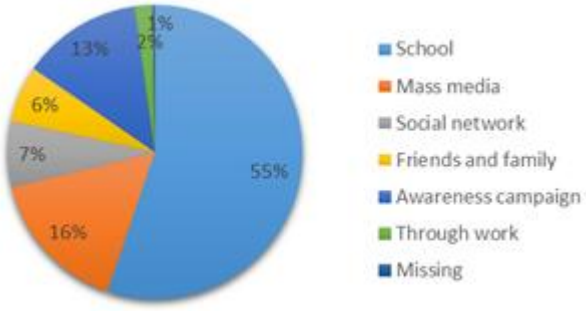

Fig. 2: Statements on respondents' learning place about mangrove

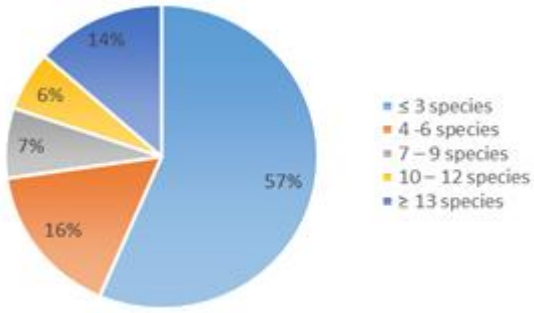

Fig. 3: Total mangrove tree species that can be identified by respondents

The respondents' awareness and knowledge about mangrove forest were examined and are presented in Table 2 while Table 3 presents the variation in the respondents' answers based on their age, education, occupation, duration and distance of living for the knowledge-related questions. A total of 20.5% (76 out of 371) of the total respondents clarified as not knowing the existence of the mangrove forest at Kuala Selangor. This is also supported by the cross table chi-square test (X^2=9.560, for p-value 0.023) of the chi-square respondent awareness on the existence of mangrove forests near Kuala Selangor (Table 2). It shows that the local communities still need more awareness about the existing mangrove forests. Hence, it is concluded that greater public awareness is important for the community knowledge and success of the conservation effort (Latiff, 2012).

For the community knowledge on the importance of mangrove forests for fisherman economy and income statement, 86.3% of the respondents were aware and 12.9% of the respondents did not know about it. The distance from the respondents' house or workplace to the Kuala Selangor Mangrove Forest influenced the respondents' knowledge about mangrove. This is also supported by the cross table chi-square test with X^2=22.138 and p-value p<0.001 (Table 3), where the respondents who work or stay near the Kuala Selangor Nature Park understand more about the mangrove. The closer people stay to the forest the more they depend on and understand the importance of it (Badola *et al*., 2012). The awareness and knowledge of the mangrove forest also show a strong relationship and significance on the demographic factor like age and education (Age: X^2= 17.124, p-value 0.004) (Education: X^2=13.239, p-value 0.021).

Eighty-nine per cent of the respondents were aware of the function of the mangrove forest and protection on the land which shows the significance of age, education, income and distance from the Kuala Selangor Nature Park. The distance and income level indicate a strong relation with the statement (Distance: X^2=16.110, p-value 0.003), (Income: X^2= 13.598, p-value 0.009). The respondents who stay near the mangrove area well understood the importance of the mangrove forest and the need to protect it (Badola *et al*., 2012).

For the statement on whether the knowledge of mangrove forest habitat was informed very clearly, it was significant for education, distance from the park and age where 87.1% of the respondents know the function while 11.9% were not aware. The most significant factor is education and it is also supported by the cross table chi-square X^2= 16.391 and p-value 0.006 (Table 3). Most of the respondents learn about the mangrove forest and living things inside the forest via education system (Latiff, 2012).

Interestingly, 87.9% of the respondents agreed that the mangrove forest is important for human sustainability and only 11.3% did not agree on the statement, especially respondent who stay far from mangrove forest. The awareness of the importance of the mangrove forest increased with the increasing in age and distance of staying from the mangrove forest (Age: X^2= 18.372, p-value 0.003), (Distance: X^2= 11.029, p-value 0.026). This is also supported by Badola *et al*. (2012) as younger age and educated person understand more about the mangrove forest. Because the new education curriculum includes the importance of education on the mangrove forest in school and continuous awareness campaign for school students

compared to the previous education system (Shanmugaraj, 2015).

Perception towards mangrove forest development

Among the respondents, 79.2% of them agreed that the mangrove forest in Kuala Selangor is critically endangered and 73.9% of the respondents did not agree for the mangrove forest conversion into other land use patterns like housing area or aquaculture farming. Table 4 shows the respondents' perception on the mangrove forest development and critical level. There is a significant relationship between educations and respondents' perception on the level of acceptances on the mangrove forest condition level with significant p-value 0.006. The perception of mangrove forest development shows a strong relationship where occupation and distance draw the significances (Occupation: p-value 0.001) (Distance: p-value 0.028).

Table 2: Statements on the respondents' knowledge and awareness about mangrove forest

Statements	Yes (%)	No (%)	Missing (%)	Significance (p-value)				
				Age	Education	Occupation	Duration	Distance
Q13-existance of mangrove forest near Kuala Selangor	79.2	20.5	0.3	0.093	0.791	0.611	0.023*	0.077
Q15- Do you agree, mangrove is important for fisherman economy & income	86.3	12.9	0.8	0.004*	0.021*	0.119	0.866	p<0.001*
Q16- Mangrove protects land from wind, wave and erosion	89.5	9.7	0.8	0.039*	0.041*	0.089	0.304	0.003*
Q17- Mangrove is nursery for small fishes, mollusc, shrimp & crabs	87.1	11.9	1.1	0.029*	0.006*	0.509	0.691	0.016*
Q18- Do you agree, mangrove is important for human sustainable	87.9	11.3	0.8	0.003*	0.059	0.560	0.454	0.026*

Table 3: Chi-square analysis variations in the respondents' answer based on their age, education level, occupation, income, duration of living period and distance for knowledge-related question

Statements	Variables	Chi-square	p-value
Q13-existance of mangrove forest near Kuala Selangor	Duration of living period	9.560	0.023
Q15- Do you agree, mangrove is important for fisherman economy & income	Age	17.124	0.004
	Education	13.239	0.021
	Distance from nearest KSNP	22.138	p<0.001
Q16- Mangrove protects land from wind, wave and erosion	Age	11.686	0.039
	Education	11.562	0.041
	Income	13.598	0.009
	Distance from nearest KSNP	16.110	0.003
Q17- Mangrove is a nursery for small fishes, mollusc, shrimp & crabs	Age	12.466	0.029
	Education	16.391	0.006
	Distance from nearest KSNP	12.173	0.016
Q18- Do you agree that mangrove is important for human sustainable	Age	18.372	0.003
	Distance from nearest KSNP	11.029	0.026

Table 4: Statement on respondent perception on Mangrove

Statements	Yes (%)	No (%)	Missing (%)	Significance (p-value)				
				Age	Education	Occupation	Duration	Distance
Q19- Mangrove forest is critically threatened	79.2	19.9	0.8	0.360	0.006*	0.207	0.103	0.151
Q20- Do you agree mangrove forest being developed to other land use pattern (housing)	25.1	73.9	0.8	0.284	0.983	0.001*	0.169	0.028*

*P significant at P-value is less or equal to 0.05 (Pd"0.05)

Table 5 shows the analysis of the perception on mangrove forest development and conservation and Table 6 is the variation based on their demographic factor. The result shows that 79% of the respondents agreed and suggested to stop the mangrove forest encroachment and 11.9% of the respondents disagreed with the statement while 8.4% of the respondents were not sure whether the mangrove forest encroachment should be stopped. The cross tabulation chi-square analysis was used to examine the relationship and significance of age, education, work, duration of living period and distance on the perception questions. The results in Table 5 indicate that there was strong relationship with age, education, occupation, duration and distance (Age: X^2= 21.917, p-value 0.016) (Education: X^2= 22.765, p-value 0.012) (Occupation: X^2= 34.277, p-value 0.012) (Duration of living period: X^2= 37.653, p-value 0.049) (Distance: X^2= 15.595, p-value 0.049). This outcome suggested that there is a solid relationship between the duration of living period near the mangrove forest with positive perception and suggestion for mangrove conservation.

From the responses obtained, 84.4% of the respondents agreed to gazette the mangrove forest as protected forest and only 3.2% of the respondents disagreed. Moreover, 11.9% of the respondents were not sure about this statement. The P-value and chi-square reflect a high significance relationship (Age: p-value 0.005, X^2= 25.261, Distance: P-value 0.036, X^2= 16.490). This is because the respondents staying near the mangrove forest have a positive perception of the area and its surroundings. This is similar to the annotations found by Badola *et al.* (2012).

The statement on conservation-based management factor was agreed by 79.5% of the respondents and supported by a very high significance p-value = 0.001, X^2= 28.624 with age, p-value = 0.026, X^2= 20.336 with education and p-value = 0.043, X^2= 29.431 for occupation. Education factor and age encourage the conservation-based management for the mangrove forest. The distance of living from the mangrove forest and age also have high significance with the statement to stop mangrove forest logging (Age: X^2= 26.189, p-value 0.003 and Distance: X^2= 21.009, p-value 0.007), its show respondent who stay near mangrove forest more focus on mangrove forest conservation and stop logging.

Other land use patterns like the aquaculture farming and oil palm cultivation were agreed by 56.1% of the respondents and only 21% of the respondents disagreed for this type of the land use while 22.6% of the respondents were not sure on this matter because some of the respondents still did not understand the difference between the agricultural vegetation and natural mangrove trees. More awareness and education are needed to inform the community (Latiff, 2012). 72.5% of the respondents agreed to encourage tourism activities at the mangrove forest. There is a significant relationship between the distance of living and p-value 0.001, X^2= 25.340. It was supported by Singh (2010) as the local community surrounding the Kuala Selangor Nature Park rely on the mangrove forest for their socio-economy factor (Singh, 2010).

The success of previous awareness campaign in increasing the motivation and participation on mangrove ecology was agreed positively by 81.1% of the respondents and only 4.9% respondent disagreed on the statement while 13.2% of the respondents were not sure of the success rate on them. The respondents' occupation and distance of living from the mangrove forest were significant (Occupation: X^2= 32.025, p-value 0.022) (Distance: X^2= 17.586, p-value 0.025). The government staff,

NGO members and fisherman were among those who agreed of the success of previous awareness campaign conducted. 83.6% of the respondents agreed for increasing and having continuous awareness campaigns for the community. The p-value and chi-square is highly significance for education factor, where the p-value was 0.037, X^2= 19.269. The local community perception in the development of the mangrove forest is based on high acceptance level influenced by their distance of living to the Kuala Selangor Nature Park, indicated by the high significant relation (Distance: X^2= 20.392, p-value 0.009). The local community is more prepared to decide the type of development at their area and they are also looking forward for the acceptance of their perception in the decision-making. Badola *et al.* (2012) stated that all the mangrove developments should be based on the community opinion.

Table 5: Perception on mangrove forest development and conservation

C24- Should stop mangrove logging	8.6	7.3	83.6	0.5	0.003*	0.307	0.130	0.295	0.007*
C25- Other land use patterns like aquaculture farming and oil palm cultivation should be approved	21.0	22.6	56.1	0.3	0.052	0.161	0.004*	0.815	0.007*
C27- Encourage tourism activity	8.6	14.3	72.5	4.6	0.324	0.360	0.061	0.227	0.001*
C28- Previous awareness campaign have increased motivation and appreciation on mangrove	4.9	13.2	81.1	0.8	0.266	0.741	0.022*	0.564	0.025*
C29- Awareness campaign need to be increased	5.7	8.9	83.6	1.9	0.214	0.037*	0.195	0.060	0.050
C30- Mangrove forest development need to be based on local community acceptance	8.4	16.2	75.2	0.3	0.111	0.787	0.171	0.759	0.009*
C24- Should stop mangrove logging	8.6	7.3	83.6	0.5	0.003*	0.307	0.130	0.295	0.007*
C25- Other land use patterns like aquaculture farming and oil palm cultivation should be approved	21.0	22.6	56.1	0.3	0.052	0.161	0.004*	0.815	0.007*
C27- Encourage tourism activity	8.6	14.3	72.5	4.6	0.324	0.360	0.061	0.227	0.001*
C28- Previous awareness campaign have increased motivation and appreciation on mangrove	4.9	13.2	81.1	0.8	0.266	0.741	0.022*	0.564	0.025*
C29- Awareness campaign need to be increased	5.7	8.9	83.6	1.9	0.214	0.037*	0.195	0.060	0.050
C30- Mangrove forest development need to be based on local community acceptance	8.4	16.2	75.2	0.3	0.111	0.787	0.171	0.759	0.009*

Table 6: Chi-square analysis variations in the respondents' answer based on their age, education, occupation, duration of living period and distance for the perception on mangrove forest development and conservation

Statements	Variables		Disagree (%)	Not Sure (%)	Agree (%)	Chi-square	p-value
C21- Encroachment of mangrove forest should be stopped	Age					21.917	0.016
		<20 years	6.1	12.2	81.6		
		20-25 years	10.8	11.7	77.5		
		26-31 years	19.4	10.7	69.9		
		32-37 years	13.0	2.2	84.8		
		38-43 years	4.2	0	95.8		
		>43 years	5.7	0	94.3		
	Education					22.765	0.012
		None	9.0	2.6	88.5		
		Primary School	20.0	0	80.0		
		Secondary school					
		Diploma & certificate	0	0	100.0		
		Degree					
		Postgraduate	11.1	11.1	77.8		
	Occupation					34.277	0.012
		Fisherman	7.1	0	92.9		
		Farmer & estate worker					
		Cockles & mussels	8.2	2.7	89.1		
		industry	17.2	15.3	67.5		
		Government servant	6.8	2.3	90.9		
		Private sector	0	0	100.0		
		Student	0	0	100.0		
		NGO	0	0	100.0		
		Housewife	20.0	20.0	60.0		
		Own business					
		Not working					
	Living period					37.653	0.001
		= 5 years	5.5	4.1	90.4		
		6 – 10 years	21.6	8.1	70.3		
		11 – 20 years	4.9	14.6	80.5		
		= 21 years	10.2	6.1	83.7		
	Distance from nearest KSNP					15.595	0.049
		= 1 km	16.3	7.0	76.7		
		2 - 4 km	15.7	11.8	72.5		
		5 – 7 km	7.4	5.6	87.0		
		8 – 10 km	11.6	7.0	81.4		
		= 11 km	4.2	2.8	93.0		
C22- Mangrove forest should have been gazetted as protected areas	Age					25.261	0.005
		<20 years	4.1	12.2	83.7		
		20-25 years	5.4	16.2	78.4		
		26-31 years	0	18.4	81.6		
		32-37 years	2.2	2.2	95.7		
		38-43 years	8.0	0	92.0		
		>43 years	2.9	0	97.1		
	Distance from nearest KSNP					16.490	0.036
		= 1 km	6.8	6.8	86.4		
		2 - 4 km	2.0	17.0	81.0		
		5 – 7 km	3.7	9.3	87.0		
		8 – 10 km	4.7	16.3	79.1		
		= 11 km	2.8	1.4	95.8		

Table 6 Continued: Chi-square analysis variations in the respondents' answer based on their age, education, occupation, duration of living period and distance for the perception on mangrove forest development and conservation

Statements	Variables	Disagree (%)	Not Sure (%)	Agree (%)	Chi-square	p-value
C23- Conservation-based management needs to be applied	Age				28.624	0.001
	<20 years	0	26.5	73.5		
	20-25 years	6.3	22.5	71.2		
	26-31 years	3.9	18.4	77.7		
	32-37 years	2.2	4.3	93.5		
	38-43 years	4.2	0	95.8		
	>43 years	2.9	0	97.1		
	Education				20.336	0.026
	None	14.3	14.3	71.4		
	Primary School	4.3	8.7	87.0		
	Secondary school	2.8	22.1	75.2		
	Diploma & certificate	7.3	16.4	76.4		
	Degree	0	6.4	93.6		
	Postgraduate	0	20.0	80.0		
	Occupation				29.431	0.043
	Fisherman	25.0	0	75.0		
	Farmer & estate worker	0	11.1	88.9		
	Cockles & mussels	7.1	14.3	78.6		
	industry	0.9	7.3	91.8		
	Government servant	5.7	23.6	70.7		
	Private sector	2.3	11.4	86.4		
	Student	0	0	100.0		
	NGO	0	0	100.0		
	Housewife	0	12.5	87.5		
	Own business	0	20.0	80.0		
	Not working					
C24- Should stop mangrove logging	Age				26.189	0.003
	<20 years	2.0	4.1	93.9		
	20-25 years	15.3	9.0	75.7		
	26-31 years	6.9	13.7	79.4		
	32-37 years	6.5	0	93.5		
	38-43 years	11.5	0	88.5		
	>43 years	2.9	2.9	94.3		
	Distance from nearest KSNP				21.009	0.007
	= 1 km	7.0	9.3	83.7		
	2 - 4 km	9.2	9.9	80.9		
	5 – 7 km	7.4	3.7	88.9		
	8 – 10 km	22.2	6.7	71.1		
	= 11 km	1.4	2.8	95.8		
C25- Other land use patterns like aquaculture farming and oil palm cultivation should be approved	Occupation				37.857	0.004
	Fisherman	25.0	0	75.0		
	Farmer & estate worker	11.1	0	88.9		
	Cockles & mussels	14.3	7.1	78.6		
	industry	18.2	17.3	64.5		
	Government servant	19.5	25.8	54.7		
	Private sector	22.7	34.1	43.2		
	Student	50.0	16.7	33.3		
	NGO	100.0	0	0		
	Housewife	62.5	12.5	25.0		
	Own business	40.0	40.0	20.0		
	Not working				20.983	0.007
	Distance from nearest KSNP	32.6	27.9	39.5		
	= 1 km	21.6	28.8	49.7		
	2 - 4 km	16.7	11.1	72.2		
	5 – 7 km	17.8	11.1	71.2		
	8 – 10 km	19.7	18.3	62.0		
	= 11 km					

Table 6 Continued: Chi-square analysis variations in the respondents' answer based on their age, education, occupation, duration of living period and distance for the perception on mangrove forest development and conservation

Statements	Variables	Disagree (%)	Not Sure (%)	Agree (%)	Chi-square	p-value
C27- Encourage tourism activity	Education				23.153	0.010
	None	0	14.3	85.7		
	Primary School	17.4	21.7	60.9		
	Secondary school	10.9	7.2	81.9		
	Diploma & certificate	11.4	21.9	66.7		
	Degree	1.3	18.4	80.3		
	Postgraduate	0	0	100.0		
	Distance from nearest KSNP				25.340	0.001
	= 1 km	4.7	18.6	76.7		
	2 - 4 km	6.2	17.9	75.9		
	5 – 7 km	5.7	9.4	84.9		
	8 – 10 km	27.9	11.6	60.5		
	= 11 km	9.0	10.4	80.6		
C28- Previous awareness campaigns have increased the motivation and appreciation on mangrove	Occupation				32.052	0.022
	Fisherman	0	0	100.0		
	Farmer & estate	11.1	0	88.9		
	worker	7.1	7.1	85.7		
	Cockles & mussels	1.9	3.7	94.4		
	industry	8.1	20.0	71.9		
	Government servant	2.3	13.6	84.1		
	Private sector	0	0	100.0		
	Student	0	0	100.0		
	NGO	0	12.5	87.5		
	Housewife	0	40.0	60.0		
	Own business				17.586	0.025
	Not working	11.4	13.6	75.0		
	Distance from nearest KSNP	4.0	16.6	79.5		
	= 1 km	1.9	9.3	88.9		
	2 - 4 km	11.4	13.6	75.0		
	5 – 7 km	1.4	5.6	93.0		
	8 – 10 km					
	= 11 km					
C29- Awareness campaign needs to be increased	Education				19.269	0.037
	None	0	14.3	85.7		
	Primary School	4.2	12.5	83.3		
	Secondary school	3.5	7.7	88.7		
	Diploma & certificate	11.1	14.8	74.1		
	Degree	3.8	2.6	93.6		
	Postgraduate	0	0	100.0		
C30- Mangrove forest development needs to be based on the local community acceptance	Distance from nearest KSNP				20.392	0.009
	= 1 km	18.6	20.9	60.5		
	2 - 4 km	5.9	21.6	72.5		
	5 – 7 km	5.6	9.3	85.2		
	8 – 10 km	8.9	13.3	77.8		
	= 11 km	9.9	5.6	84.5		

CONCLUSIONS

The Kuala Selangor community strongly supported the conservation of mangrove forests in the district based on their ecological knowledge. This study showed that the local community is well aware of the function of the mangroves in the coastal environment. According to the data analysis, it were concluded that the educated person and people who living closely to mangrove forest fully need the mangrove forest and support for the conservation. Local government or developer need to approach local community before any planning and development of the mangrove forest, and the planning should be based on their acceptance and participation.

Education is main factor in determine the communities understanding and create positive perception on mangrove forest among local communities. Based on the result, more conservation effort and awareness campaigns need to be conducted to support the mangrove conservation and continuously strengthen the enforcement and environment activities to increase public awareness in protecting the mangrove forest and creating appreciation among the local community and 83.6% of the respondents supported to increase the awareness campaigns. The current development of the mangrove forests at Kuala Selangor was piloted with low local community participation but in future the stakeholders need to more focus on their perception in the decision-making procedure to get more positive output.

Most of the respondents have a positive perception about mangrove forest conservation but their practice and action for conservation are still low according to the analysed result, for successful conservation effort needs an active participation from the local community. Any conservation effort without support from the local community will be failed.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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