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## Assessment of Social Adaptation Capacity of Malaysian Fishermen to Climate Change

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**Abstract:** Climate change has a tremendous impact on the livelihood of fishermen as it is poised to affect the sustainability of the fisheries industry. Thus, there is a need for the fisherfolk to possess adequate adaptation capacity to lessen the negative impact due to climate change. The main purpose of this study is to assess the level of social adaptation capacity of Malaysian fishermen to climate change and to seek the association between social adaptation capacity and selected socio-demographic factors. This is a quantitative study whereby data was collected from 300 registered fishermen in Malaysia. The sampling technique used was stratified random sampling and data was obtained through a face-to-face interview. Based on the results gained, it showed that the respondents were having a very high level of social adaptation capacity. In terms of association, the study found that there is a significant difference between social adaptation capacity and the factors of age groups and income. The study recommends that the local fishermen need to be given adequate training and financial support so that they will be mentally and financially prepared to face the calamities of climate change.

**Key words:** Climate change, social adaptation capacity, fishermen, livelihood

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### INTRODUCTION

Many countries have recognized on the importance of agriculture (Bahaman *et al.*, 2010) and much hope has been placed on the relevance of the fishery segment as an enigma of growth for the agriculture sector and in providing food security. As a rapidly developing nation, Malaysia too has always emphasized on the development of the agriculture sector including the fishery sector that is recognized as one of the main industries in Malaysia (Shaffril *et al.*, 2011a). In the 2012, Budget announced by the Malaysian Prime Minister a huge portion of RM29.8 billion has been set aside for agriculture and rural development. This shows the commitment the government has placed on the development of the agriculture sector and the community that is directly involved particularly the farmers and fishermen.

Of late, the term sustainability has been given much prominence among policy makers as a guide towards utilizing the available resources in a more appropriate manner (D'Silva *et al.*, 2011). As resources worldwide become scarce as a result of human greed, good sustainable practices are emphasized so as to ensure that the future generations will not be deprived of their food and living conditions. On top of it, the consequence of human greed has also contributed to global climate

change and this resulted many nations to experience negative economic impacts (Vaghefi *et al.*, 2011), food shortages (Akinbile and Yusoff, 2011) and variability in environmental conditions in the aquatic ecosystems especially due to rising sea temperatures, intensifying storms and acidification of oceans. This has a wide impact on the animal production systems (Anyu and Ayuk, 2011) and the livelihoods of the fishermen community that to a very great extent depend on fisheries and aquaculture as their source of income. Climate change all over the world has affected the community of fishermen in various ways such as productivity, fishing practices and areas available for fishing. Thus, the impact of climate change will for sure make the communities in particular the fishermen to make major social adaptation (Shaffril *et al.*, 2011b) and to possess the necessary adaptive capacity so as to overcome the upheaval as a result of climate change.

What is actually adaptation and how can it be essential in helping local fishermen to overcome obstacles due to global climate change? According to Sofoluwe *et al.* (2011), climate change adaptation is referred to ways and means individuals can make adjustments in natural or human systems to offset the actual or expected impact of climate change or its effects that moderates harm or exploits beneficial opportunities. Thus, by understanding the adaptation capacity of

fishermen and the factors associated with their social adaptation capacity will enable policy makers, in particular, to come up with adept programs for the fishermen to overcome the challenges of climate change.

A number of studies have been carried out to determine the indicators of social adaptation and individual adaptive capacity. In general, these indicators are based on three main domains and they are the individual itself, his/her community and the environment. It was identified that basically these indicators are as follows: perception of risks, individual's ability to cope with change in terms of stress, depression, anxiety and anger, level of interests shown to make changes, ability to plan, learn and reorganize, attachment to occupation, employability, influence of family characteristics, attachment to community, business size and approach, financial status, income diversity, possession of local environment knowledge, access to technology climate information and skills, networking and the occurrence of inequitable distribution of resource access among resource users (Marshall *et al.*, 2010).

Undoubtedly in Malaysia the fishery industry is one of the expanding units in the agriculture sector and as a result has contributed vastly to the economic growth of the nation besides providing the important protein for the consumption of the local market. However, the recent statistics showed that a significant difference did not exist for the fish production in Malaysia whereby in the year 2010 it only amounted to 1,854,000 metric tons with a value of RM8, 613.33 million compared to the year 2005 the amount was 1,416,702 metric tons with a value of RM5, 213.53 (Shaffril *et al.*, 2011a).

A number of factors could be associated with the above finding and one of the likely factors will be the impact of climate change that forced production not to increase tremendously. Hence, there is a need for fishermen in Malaysia to possess adaptation capacity particularly in the social context so that they will be able to withstand the downcast of global warming and climate change. A search of the existing literature showed that not many studies were carried out to determine the social adaptation of Malaysian fishermen with regards to the impact of climate change. Thus, this study is designed to identify the association between selected socio-demographic factors and the social adaptation of Malaysian fishermen in the main fishery states in Malaysia.

## MATERIALS AND METHODS

This study used a survey research methodology whereby a cross-sectional survey was implemented to

obtain information from fishermen concerning their social adaptation as a result of climate change. Items for the instrument were derived from previous literature and they were validated by a panel of researchers to ensure its construct and content validity. The dependent variable was social adaptation of fishermen toward climate change while the independent variables constituted the socio-demographic factors of age, monthly income, catchment areas and working experience.

The population of this study is the registered fishermen at east coast zone of Malaysia as in Table 1.

In this study, the sampling techniques employed was stratified sampling and a total of 300 fishermen were selected as respondents of the study. A pre-test was conducted prior to the actual study and the overall Cronbach's alpha of all constructs were above the threshold of .7, indicating that the instrument was sound in terms of its reliability.

The data collection took about four months to be completed whereby the data was obtained through a face-to-face interview with the selected respondents. SPSS software was used to analyse the data using both descriptive and inferential statistics.

Prior to conducting the inferential statistics, the exploratory data analysis was implemented to check on outliers and to ensure that the assumptions for parametric tests were fulfilled. By using normality tests found in SPSS, it was identified that the distribution of the data was normal and the assumption of homogeneity of variance was fulfilled. To describe the general data of the study, descriptive statistics in the form of frequency, percentage, mean and standard deviation were executed. On the other hand, inferential statistics in the form of

Table 1: Number of registered fishermen at east coast zone of Malaysia

States/Districts	Number of registered fishermen (2009)
<b>Kelantan</b>	
Bachok and Pasir Puteh	6430
Tumpat	1744
Kota Baharu	1450
<b>Terengganu</b>	
Besut	2356
South Kuala Terengganu	2135
Kemaman	1874
Marang	1224
Dungun	1196
North Kuala Terengganu	876
Setiu	760
<b>Pahang</b>	
Kuantan	3720
Rompin	1987
Pekan	1317
<b>Johor (East)</b>	
Mersing	3041
South Kota Tinggi	1321
North Kota Tinggi	1134
Overall total	32565

independent t-test and one-way ANOVA were performed to seek any significant differences between the dependent and independent variables.

**RESULTS**

Table 2 depicts the socio-demographic profile of the respondents. It clearly showed that in terms of age, the bulk of Malaysian fishermen are in the senior category and the mean age of 42.21 years of age among the fishermen of this study displayed that when it comes to agriculture as exposed in previous studies the majority of them are the older citizens. It seems that in the Malaysian context the senior citizens dominate the agriculture sector whether they are crops, poultry or fisheries. On top of it, in terms of the level of education, many of the fishermen did not have a high level of education as more than half of the respondents had only primary education. Looking at their level of income, the data displayed that the mean income of the fishermen of this study was RM669.62 indicating that many of the fishermen were not enjoying a high income and thus they need to be given much support so that they will be continue with their career. As had been mentioned earlier that the vast majority of the fishermen in this study were of the senior category, thus it was not surprising to note that in terms of working experience as fishermen, the mean score was 25.1 years displaying that many of them had joined the fisheries sector once they left schooling. This also indicates that these fishermen are very experienced when it comes to matters pertaining to fishing and the fishing environment that they are exposed to since they have spent most of the time doing fishing. With regards to the category of fishermen, almost three quarter of them obtain their fisheries resources from the coastal environment.

Next, the focus is on the main objective of the study that is to determine the level of social adaptation of fishermen in withstanding the impact of climate change. The histogram diagram as in Fig. 1 showed that the distribution has the rough shape of a normal distribution.

In Table 3, the descriptive statistics expressed that the mean scores obtained pertaining to the social adaptation of the respondents of this study was 3.4530 (SD = 0.30997) and this was at a high level. This is indeed an encouraging result as it showed that the fishermen in Malaysia, in general, were having the opinion that they will be able to adapt socially against all the calamities as a result of climate change.

Next, to further understand on the significant difference that exists between social adaptation and selected demographic factors inferential statistics was carried out. Table 4 showed the comparison between

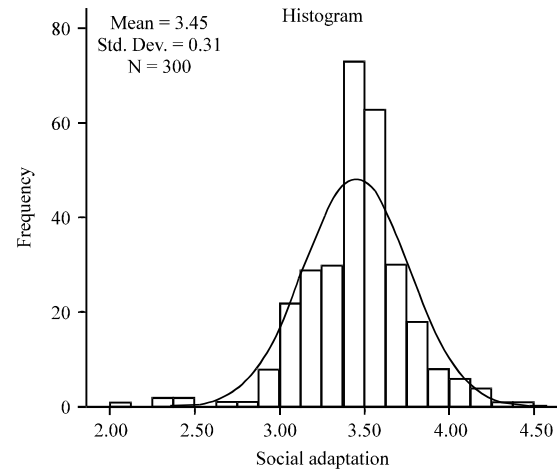


Fig. 1: Distribution of scores obtained on the social adaptation of fishermen

Table 2: Socio-demographic profile of respondents

Variables	Frequency	Percentage	Mean	SD
<b>Age (years)</b>			42.21	12.96
<30	42	14.0		
31-40	57	19.0		
41-50	79	26.3		
51-60	75	25.0		
>61	47	15.7		
<b>Level of education</b>				
Never been to school	21	7.0		
Primary school	154	51.3		
PMR/SRP	55	18.3		
SPM/SPMV	66	22.0		
Skill certificates	3	1.0		
Degree/Masters/PhD	1	0.3		
<b>Income per month (RM)</b>			669.62	724.71
<500	136	45.3		
501-750	99	33.0		
>750	65	21.7		
<b>Number of household</b>	5.77	2.53		
<5 members	156	52.0		
>5 members	144	48.0		
<b>Experience as a fishermen (years)</b>			25.1	14.29
<10	61	20.3		
11-20	82	27.3		
21-30	58	19.3		
31-40	56	18.7		
>41	43	14.3		
<b>Average (days) going out to sea</b>			18.9	4.86
<15	93	31.0		
16-20	118	39.3		
>21	89	29.7		
<b>Category of fishermen</b>				
Coastal area	213	71.0		
Deep sea	87	29.0		

Table 3: Level of social adaptation of fisher man

	N	Minimum	Maximum	Mean	Std. deviation
Social adaptation	300	2.02	4.38	3.4530	0.30997
Valid N (listwise)	300				

social adaptation and age. Since age was categorized into more than group groups, One-way analysis of variance was carried out. The data as in Table 3 displayed that

Table 4: ANOVA table to show significant differences between social adaptation and age

Social adaptation	Sum of squares	df	Mean square	F	Sig.
Between groups	1.241	2	0.620	6.703	0.001
Within groups	27.488	297	0.093		
Total	28.728	299			

Table 5: Multiple comparison table between social adaptation and age

Social adaptation Tukey's HSD					95% confidence interval	
(I) age category	(J) age category	Mean difference (I-J)	Std. error	Sig.	Lower bound	Upper bound
20-40	41-60	-0.04355	0.03902	0.505	-0.1355	0.0484
	>60	14506*	0.05461	0.023	0.0164	0.2737
41-60	20-40	-0.04355	0.03902	0.505	-0.0484	0.1355
	>60	0.18861*	0.05151	0.001	0.0673	0.3100
>60	20-40	-0.14506*	0.05461	0.023	-0.2737	0.0164
	41-60	0.18861*	0.05151	0.001	0.3100	-0.0673

\*The mean difference is significant at the 0.05 level

Table 6: Comparison between social adaptation and income

Social adaptation	Sum of squares	df	Mean square	F	Sig.
Between groups	1.532	4	0.383	4.154	0.003
Within groups	27.197	295	0.092		
Total	28.728	299			

Table 7: Multiple comparison table between social adaptation and income

Social adaptation Tukey HSD					95% confidence interval	
(I) age category	(J) age category	Mean difference (I-J)	Std. error	Sig.	Lower bound	Upper bound
100-500	501-1000	-0.87320	0.03604	-0.112	-0.1862	0.0116
	1001-1500	-0.34856	0.10444	0.008	-0.6352	-0.0619
	1501-2000	-0.04732	0.13821	0.997	-0.4267	0.3320
	>2000	-0.35843	0.21624	0.462	-0.9519	0.2351
501-1000	100-500	-0.87320	0.03604	0.112	-0.0116	0.1862
	1001-1500	-0.26123	0.10430	0.092	-0.5475	-0.0251
	1501-2000	-0.04000	0.13811	0.998	-0.3391	0.4191
	>2000	-0.27111	0.21618	0.719	-0.8645	0.3222
1001-1500	100-500	0.34856	0.10444	0.008	-0.0619	0.6352
	501-1000	0.26123	0.10430	0.092	-0.0251	0.5175
	1501-2000	0.30123	0.16936	0.338	-0.1636	0.7661
	>2000	-0.00988	0.23736	1.000	-0.6614	0.6416
1501-2000	100-500	0.04732	0.13821	0.997	-0.3320	0.4267
	501-1000	-0.04000	0.13811	0.998	-0.4191	0.3391
	1501-1500	-0.30123	0.16936	0.388	-0.7661	0.1636
	>2000	-0.31111	0.25404	0.737	-1.0084	0.3861
>2000	100-500	0.35843	0.13821	0.997	-0.3320	0.4267
	501-1000	0.27111	0.13811	0.998	-0.4191	0.3391
	1501-1500	0.00988	0.23736	1.000	-0.6416	-0.6616
	1501-2000	0.31111	0.25404	0.737	-0.3861	1.0084

since .001 is less than  $\alpha = .05$ , we can reject the null hypothesis and conclude that there is a significant difference in social adaptation between the age groups.

Having obtained a significant result, a post-hoc test was carried out to see where the significant lies. The multiple comparison (Table 5) showed that there is a significant difference only between the age category of “20-40” and “>60” and “41-60” and “>60”.

Meanwhile, Table 6 showed the comparison between social adaptation and income. The ANOVA table showed that there is a significant difference between social adaptation and the level of income.

Further test using the Tukey's Honestly Significant Difference test (HSD) was implemented to compare all

pairs of group means and the results are shown in the ‘Multiple Comparisons’ in Table 7.

The multiple comparison (Table 7) showed that there is a significant difference only between the category of “100-500” and “1001-1500”.

Next, the test of one-way analysis of variance was carried out to seek for any difference between social adaptation and work experience. As being displayed in Table 8, since the sig. value was .463 which is greater than the alpha value of .06, thus the null hypothesis is not rejected. The conclusion is that there is no significant difference in social adaptation between the various income groups.

Table 8: Comparison between social adaptation and work experience

Social adaptation	Sum of squares	df	Mean square	F	Sig.
Between groups	0.248	3	0.083	0.859	0.463
Within groups	28.480	296	0.096		
Total	2.8728	299			

Table 9: Mean values on social adaptation for the two different catchment areas

Social adaptation	Catchment area	N	Mean	Std. deviation	Std. error mean
Social adaptation	Shore	213	3.4431	0.29365	0.02012
	Deep sea	87	3.4771	0.34735	0.03724

Table 10: Levene's test of equality variances

Social adaptation	Levene's test for equality of variances				Sig. (2-tailed)	t-test for equality of means		95% Confidence interval of the difference	
	F	Sig.	t	df		Mean difference	Std. error difference	Lower	Upper
Equal variances assumed	2.190	0.140	-0.863	298	0.389	-0.03405	0.03946	-0.11170	0.04360
Equal variances not assumed			-0.804	138.742	0.423	-0.03405	0.04233	-0.11774	0.04964

Another interesting finding will be to see whether there exists any difference in social adaptation between the catchment areas of shore and deep sea. The group statistics in Table 9 reports that the mean values on the variable social adaptation is not the same for the two different groups. The mean scores obtained by the respondents from the “deep sea” were slightly higher compared to the respondents from the “shore”. However, is this sample difference in social adaptation large enough to convince that there is a real significant difference in social adaptation between the population of “shore” and the population of “deep sea”? Table 10 showed that the sig. value was .389 is bigger than the alpha level of .05 meaning that the null hypothesis is not rejected. Thus, the observed difference between the samples is statistically not significant.

### DISCUSSION

The main objective of this study is to identify the level of social adaptation among Malaysian fishermen and the influence of socio-demographic factors towards this level of social adaptation. It was revealed from the study that in general fishermen in Malaysia were experiencing a high level of social adaptation capacity to withstand the impact of climate change similar to fishermen in the North Sea as was identified by MacNeil *et al.* (2010). This perhaps is not surprising because according to Badjeck *et al.* (2010) those who are involved in the fisheries sector have historically had to adapt to the vagaries of weather and climate. Thus, these fishermen might have adequate knowledge and experience and know how to adapt due to global climate changes.

On top of it, the study too revealed that the socio-demographic factors that were statistically different with social adaptation capacity were the factors of age groups

and income. On the other hand, there was no significant difference between social adaptation capacity and the factors of work experience and catchment areas.

The differences that occurred for the factor of age could be due to the fact that the senior respondents might feel that they possess enough knowledge and skills to overcome the entire catastrophe brought about by climate change compared to the young fishermen who perhaps were having more anxiety and this might have an impact for them to look for solutions to overcome changes as a result of climate change. Moreover, the significant difference pertaining to age is also in line with another current finding obtained by Zhang *et al.* (2011) that identified that the senior fishermen perceived temperature change as cyclical while on the other hand young fishermen seem to be more open to emerging scientific consensus due to climate change and this perhaps might have an impact on their social adaptation capacity.

It was not surprising to find that the element of income as an important indicator that will exhibit significant difference in relation to social adaptation capacity. Past literature as expressed by Marshall *et al.* (2010) and WorldFish Center (2007) had indicated that those with steady income and diverse livelihood will be able to adapt socially to the changes that might occur as a consequences of climate change compared to those who are struggling to live with their meager income. The current study further supports on the notion of having adequate income as a vital driver to further strengthen the social adaptation process due to climate change.

The study also showed that the catchment areas are not an important indicator towards social adaptation capacity. It is undeniable that the impact of climate change will be experienced by all fishermen (MacNeil *et al.*, 2010) no matter in which catchment areas they are in, whether it is offshore or deep sea. This could

be the reason the study showed that there was no significant difference in social adaptation capacity between various catchment areas.

### CONCLUSION

Social adaptation capacity is pertinent for the sustainability of the fishermen community to overcome the disaster of climate change that might affect them ecologically, economically and socially. The current study was able to picture some light for the relevant authorities on the fishermen's perception on the social adaptation capacity in the midst of facing the crisis of climate change. Even though the level of social adaptation capacity of Malaysian fishermen is seemed to be at a commendable level, the outcome of this study showed that there is a need to train our young fishermen so that they will be mentally prepared to face the changes as a result of climate change. Another important finding is that the level of income of fishermen needs to be further enhanced so that they will be economically furnished to withstand the pressures of climate changes. If these steps are taken, it will set the direction for the fishermen to focus on their career with a calmer thought and enhance on their resilience level and in the process of doing so they will be able to enhance on their productivity and provide enough food for the consumption of mankind.

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