INFLUENCE OF SOCIO-DEMOGRAPHIC CHARACTERISTICS ON PERCEPTION ON CLIMATE CHANGE BY FISHER'S ALONG LAKE VICTORIA BEACHES IN SIAYA COUNTY, KENYA

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Abstract

Perception on climate change is increasing globally with increase on knowledge and its effects to individuals. The aim of this study was to evaluate the influence of socio-demographic characteristics on climate change by fishers along Lake Victoria beaches in Siaya County. A sample of 385 household heads (proportionately selected) was used. Primary data was collected and analyzed quantitatively by the help of a logistic regression model. With a logistic regression model having coefficients which provided the relationship between the probability (sociodemographic characteristics) and influences on predictors (perception on climate change), the R^2 (Nagelkerke) of 0.704 showed that there was a strong relationship between socio-demographic characteristics and perception on climate change. There is need to know how relationship between socio-demographic characteristics and perception on climate change as such information help in identifying problems, solutions and challenges on how climate change resilience can be achieved.

Key Words: Perception, Fisher's, Lake, Victoria, Beaches, Siaya, County, Kenya.

1.0 Introduction

Climate change has have several definitions by different individuals, bodies and institutions. Holdren (2006) defines climate change as any measurable trend in global climate towards extreme, which is in addition to rising global temperatures. It is a long term measurable change in the elements of climate tending towards extreme. United Nation Framework Convention on Climate Change (1992) defines climate change as all change in climate, directly or indirectly attributed to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over comparable time period with human activities being at the heart of climatic change issues. The Intergovernmental Panel on Climate Change (2007) on the other hand, defines climate change as all evolution of the climate in the time that is due to the natural variability or to the human activities. The variation in defining climate change is an indication that perception about climate change is not universal hence may vary from region to region or even within a specific region depending on who is defining it and for what reasons it is being defined.

Perception of climate change as a threat across the world has been increasing over the years thanks to the severity and increased frequency of climate change impacts (United Nations Development Programme, 2007), but it is still not considered a priority environmental issue especially in the developed countries (Leiserowitz, Kates & Parris, 2005; Leiserowitz, 2006; Pew Research Centre, 2013). Various studies show that people in developing countries are more likely to perceive climate change as a threat (Pew Research Centre, 2006; Godfrey, Le Roux-Rutledge, Cooke & Burton, 2009). Contrary results were, however, reported by Pugliese & Ray (2009) who states that climate change is more likely to be perceived as a serious problem in the developed world than in developing countries, despite developing countries being the most vulnerable to climate change impacts.

Global attention on climate change was sort for the first time by the Brundtland Report, Our Common Future, which stated that the unsustainable development practices of humankind have pushed the world's climate to a warming trend (United Nation World Commission on Environment and Development, 1987). On the contrary, the public concern on climate change was not triggered by the Brundtland's report, but by the unusual northern hemisphere heat wave and drought of the summer 1988 (Christianson, 1999). Consequently, the

IPCC was established in 1989 to carry out periodic assessments on the global climate system and later the UNFCCC was adopted in 1992 to provide a framework for global action against climate change. Numerous studies conducted since then reveal that the vast majority of people across the world, especially in developing countries, are unaware of climate change despite their high vulnerability to the impacts of climate change, (Bostrom, Morgan, Fischhoff& Read, 1994; Bord, Fisher, & O'Conner, 1998; Pew Research Centre, 2006; Pugliese & Ray, 2009; Godfrey, Le Roux-Rutledge, Cooke & Burton, 2009).

Despite their awareness of changing weather patterns, people in Africa, are particularly misinformed about global climate change (Godfrey et al., 2009; Taderera, 2010). The low level of awareness on climate change across sub-Saharan African countries is attributed to limited awareness campaigns on one hand and the fact that African countries have got too many problems ranging from poverty to political conflicts on the other hand (United Nations Framework Convention on Climate Change, 2007; United Nation Development Programme, 2007) making climate change not to be a priority issue.

Majority of Kenya's population is unaware of climate change, but are concerned about food insecurity and the recurrent droughts and floods in the country (Otieno, Pauker&Maina, 2009; Government of Kenya, 2010). However, the Kenyan government is aware of and concerned about climate change as a development issue. In this regard, the government has developed the National
Climate Change Response Strategy (NCCRS) – 2010 and its implementation plan, the National Climate Change Action Plan (NCCAP) 2013-2017, which outlines actions to be taken to mitigate and build resilience to the impacts of climate change.

In Siaya County for example, different categories of stakeholders possess different types of climate change knowledge as farmers identify changes in weather patterns in terms of erratic rainfall, poor rainfall distribution and little rainfall while traditional authorities (chiefs, sub-chiefs, village elders) are knowledgeable of the changes on weather patterns described by regular farmers but with less detailed insight on specific changes (Marin, 2015). This knowledge is important as response to climate change by adaptation needs recognition that it is occurring (Downing, 1996). Whereas attempts have been made to assess the level of climate change awareness among Kenyans in general as documented in Otieno, Pauker&Maina (2009), Government of Kenya (2010), Government of Kenya (2013), there was still a gap on what fishers' perception is on climate change. This study was designed to fill this gap by evaluating fishers' perception on climate change along the Lake Victoria beaches in Siaya County, Kenya.

2.0 Materials and Methods

Materials and methods constitutes the study area; types of data; sample, sample size and sampling techniques; data collection methods and tools, data analysis and presentation.

2.1 Study Area

This study was carried out along the Lake Victoria beaches in Siaya County. Siaya County is one of the six counties in the Nyanza region. It has a land surface area of 2,530 km² with a water surface area of 1,005 km^2. It is bordered by Busia County to the North West, Vihiga and Kakamega counties to the North East, Kisumu County to the South East and Homa Bay County across the Winam Gulf to the South (Figure 1). The water surface area forms part of Lake Victoria. It approximately lies between latitude 0º 26´South to 0º 18´ North and longitude 33º 58´ and 34º 33´ (Government of Kenya, 2015).

Siaya County has three major geomorphologic areas namely: Dissected Uplands, Moderate Lowlands and Yala Swamp. These have different relief, soils and land use patterns. The altitude of the County rises from 1,140m on the shores of Lake Victoria to 1,400m above sea level on the North. There are few hills found in the County namely; Mbaga, Odiado, Akala, Regea, Nyambare, Usenge, Ramogi hills, Rambugu, Abiero, Sirafuongo and Naya hills. River Nzoia and Yalatraverse the County and enter Lake Victoria through the Yala Swamp (Government of Kenya, 2013). The physical features have a bearing on the overall development potential of the County. The high altitude areas that form the Ugenya and Ugunja areas have higher rainfall hence suitable for agriculture and livestock keeping. Rivers Nzoia, Yala and Lake Kanyaboli have a great potential for irrigation. The low altitude areas of Boro, Uranga, Uyoma and Wagai receive less rainfall and thus are suitable for cotton growing and drought resistant crop varieties (ibid.).

Agriculture is the backbone of the economy of the county, providing employment to about 80% of the county population and contributing a few acres of arable land and a small number of cattle, sheep, goats, pigs and chicken. The main crops grown include maize, sorghum, beans, cowpeas, groundnuts, cassava, sweet potatoes, kales and bananas. However, a few people are turning to be contracted out grower farming, growing sugarcane factories (Evans, 2012). In Siaya County, the main activities in the fisheries sub-sector are capture fisheries in Lake Victoria. The major fish species from the capture fisheries are: *Latesniloticus* Nile Perch (Mbuta), R*astrineobolaargentea* Silver Cyprinid-Dagaa (Omena), *Protopterusaethiopus* Lungfish (Kamongo), *Haplochromini* Haplochromines (fulu/wiu), *Oreochroromisniloticus* Nile Tilapia (Ngege), and *Clariasgariepinus* African Catfish (Mumi) (Government of Kenya, 2013). The capture fisheries resource users land their fish at fish beaches of which there are a total of 79 along the shores of Lake Victoria with the major ones being Luanda Kotieno, WichlumUhanya, Usenge, Kamariga and Osindo

(ibid.)

The fishing however, is not mechanized though cases of overfishing are reported consequently; the activity has been adversely affected by the invasion of water hyacinth and the collapse of fish cooperatives (Department of Information Siaya County, 2012). Some effort has been made to bring the fish landing sites to the quality assurance standard required but a lot of work remains towards this direction. In the year 2012, fish production from the capture fisheries totaled 28,149 metric tonnes while fish farming realized 71.3 metric tonnes (Government of Kenya, 2013).

2.2 Sources and Types of Data Collected for the Study

In this study, primary data were collected. Primary data refers to the information gathered directly from respondents and that which involves the creation of 'new' data (Kombo & Tromp, 2006). This study obtains data from primary sources such as the household survey. It included fishers' perceptions on climate change.

2.3 Sample, Sample Size and Sampling Techniques

According to the Munyoki & Mulwa (2012) there has been no agreement as how large a sample a researcher should choose, since sample size is just an indicator of representativeness. They continue by saying that many researchers have relied on what others have done before to justify the size of the sample. It is often claimed that the sample chosen should bear some proportional relationship to the size of the population from which it is drawn. Emory (1985) on the other hand says that a sample should be a function of the variation in the

population parameters under study, and the estimating precision needed by the researcher. In order to attain the sample size of this study, the researcher considered a similar study done by the Lake Victoria Fisheries Organization (2014) where a proportion of 50% of picking a choice was detected. In computing the minimal sample size the researcher adopted the formula in Creative Research Systems (2013) where to compute a minimal sample size a researcher uses a confidence limit of 95% accepting a difference of up to 5% of the true population bringing the formula:

$$n = \frac{Z^2 \, p \, (1 - p)}{d^2}$$

Where:
n = sample size
Z = confidence limit at 95% which is 1.96
d = level of significance or error/ precision of +0.05 or -0.05
p = proportion for picking a choice detected from the previous study or the proportion in the target population estimated to have characteristics being measured- 50% which is 0.5

$$n = \frac{1.96^2 \times 0.5 \, (1-0.5)}{(0.05)^2} = 384.16 \text{ which is approximately } 385$$

The sample size for the household survey was the 385 household heads.

Due to the need to do a detailed study, it was not possible for the researcher to involve the entire population of the 79 beaches found in Siaya County therefore the researcher purposively selected
8 beaches. This was a criterial selection by considering; the geographical location (Wagusu, Uyawi, Gul Min Ougo, Nyamnwa and Wichlum beaches neighboring each other); and number of households within a beach (Wichlum, Misori, Usenge and LwandaKotieno) registering high numbers of households. Proportionate random sampling was used to get the number of household heads to be sampled from the selected beaches (Table 1).

2.4 Data collection Methods and Tools

A household survey was used to collect data from the household heads. Fishing-based livelihoods information was based on fishers' perceptions of climate change. A semi-structured questionnaire was used in collecting data for the household survey.

2.5 Data Analysis and Presentation

In evaluating fishers 'perception on climate change. A logistic regression model (computed with the help of XLSTAT version 2016) was used to examine the influence of some of the sociodemographic information (gender, age, household size, marital status, years lived in the beach, highest level of education, type of household, main occupation, main source of income, belonging to a social group, and type of house) as predictor variables on perception on climate change. A dummy dependent variable was created and it took the

value of one if the fishers' opinion is influenced by the socio-demographic information and zero if it does not. The model between DV and the demographic characteristics was as follows: DV= $\beta_0 + \beta_1 + \beta_2 + \beta_3 + \ldots + \beta_n$ where = $\beta_0$wasthe intercept; β_1, β_2, β_3,… were coefficients associated with each of the following socio-demographic information: gender, age, household size, marital status, highest level of education, type of household, main occupation, years lived in the beach, main source of income, belonging to a social group, type of house and β_n indicated that there can be multiple (n) demographic characteristics. A description of the predictors and how they were expected to influence diversification are briefly summarized in Table 2.

3.0 Results and Discussions

A logistic regression model was used to evaluate the extent to which socio-demographic characteristics of fishers' perception on climate change using characteristics as predictors. A dummy dependent variable (DV) which tool the value of one (1) if a household had perception and zero (0) if not was created (Table 3). Majority of respondents (81.04%) had knowledge and perception on climate change with only 18.96% having no perception. A logistic regression model was established. It had coefficients that provided the relationship between the probability (sociodemographic characteristics) influences on predictors (perception on climate change). If it was zero (0) then there was no relationship and if it was not zero (0), then the predictor variables played roles in predicting the influence. The significance values identified the predictors which predicted influence or not and the odds ratios showed changes in odds for influence for each unit change in the predictors. A description of the predictors and how they were expected to influence perception on climate change are briefly summarized as shown in Table 4.

The model of relationship between the variable and the predictors was as follows: DV (Perception on climate change overtime-1986 to 2015) = 1/ (1 + exp (-(-1.7292753934252 + 0.129027956091497* Age + 0.278083755446447 * Household size-1.6620918 9138492E-02*years lived in beach +6.65303458956851E-02* Female-1.19437462 204689* Married-1.34475924166303* Divorced-0.171582644821967* Seperated-2.10467353152147* Widow/er-4.5523054461478E-02* Incomplete Primary +0.33 0581341411323* Complete Primary-0.044956207244305* Incomplete Secondary +0.4876688 84208856* Complete Secondary +0.341819127331621* Higher Level of Education -6.58763762700741E-02* Female Headed Household-3.01981052494818* Crew-2.25755729399271* Fish Trader +1.75981702202261* Net Maker -2.10384494903835* Business Person-0.60825968 1198471* Transport Provider-0.951133767183498* Ice Provider+0.462722453431142* Farmer+0.683612882663351* Money Lender -1.21155579792999* Teacher +0.61604961816143* Dress Maker -0.895374829912878* Petrol Vender-2.198350 56213683* Equipment Seller+1.78889202820329* Fish Trading +2.08895041072587* Small Business Enterprise+3.2710502525607* Fishing +1.08818398272374* Salary +0.613919904689376* Not Belonging to a Social Group-1.21637540844151* Having Semi- Permanent with Iron Sheet-1.33381248996499*)))

The R^2 (Nagelkerke) of 0.704 showed that there was a strong relationship between the predictors and the probability of the influence of socio-demographic characteristics on perception on climate change (Table 4). The coefficient values (B) showed that influence was enhanced by age, household size, females, incomplete primary, complete primary, complete secondary, higher education, net maker, farmer, money lender, dress maker, fish trading, small business enterprise, fishing, salary and not belonging to a social group with positive significant while years lived at the beach, married, divorced, separated, widow/er, incomplete secondary,

female headed, crew, fish trader, business person, transport provider, ice provider, teacher, petrol vender, equipment seller, semi-permanent with iron sheet and permanent with stones/bricks had negative significant relationships, indicating that they limited the influence of perception on climate change (Table 4).

Some of the variables like: being male, single, having a male headed household, boat maker, farming, bot making, net making, ice provision, money lending, having mad wall grass thatched house and no schooling exhibited none significant relationships, indicating that they did not have influence on perception on climate change (Table 4). The odds ratios [Exp (B)] showed that fishing (26.339), having a small business enterprise (8.076) and fish trading (5.983) had the highest chances of influencing fishers' perception on climate change and a unit increase in each could increase influence by 26.34, 8.08 and 5.98 times respectively (Table 4).

The influence of socio-demographic characteristics on perception on climate change may not be easily visible but is important as it influences the people's vulnerability, adaptation and mitigation measures to climate change which in general is all about achieving the resilience levels (transformability, adaptability and persistence) to climate change by fishing-based livelihoods.

4.0 Conclusions and Recommendation

With a logistic regression model that has coefficients which provided the relationship between the probability (socio-demographic characteristics) influences on predictors (perception on climate change), fisher's perception on climate change should be documented and made available as their perceptions play a greater role in identifying the problems, challenges and solution finding to climate change. This is because such information would determine their vulnerability and adaptive levels to climate change.

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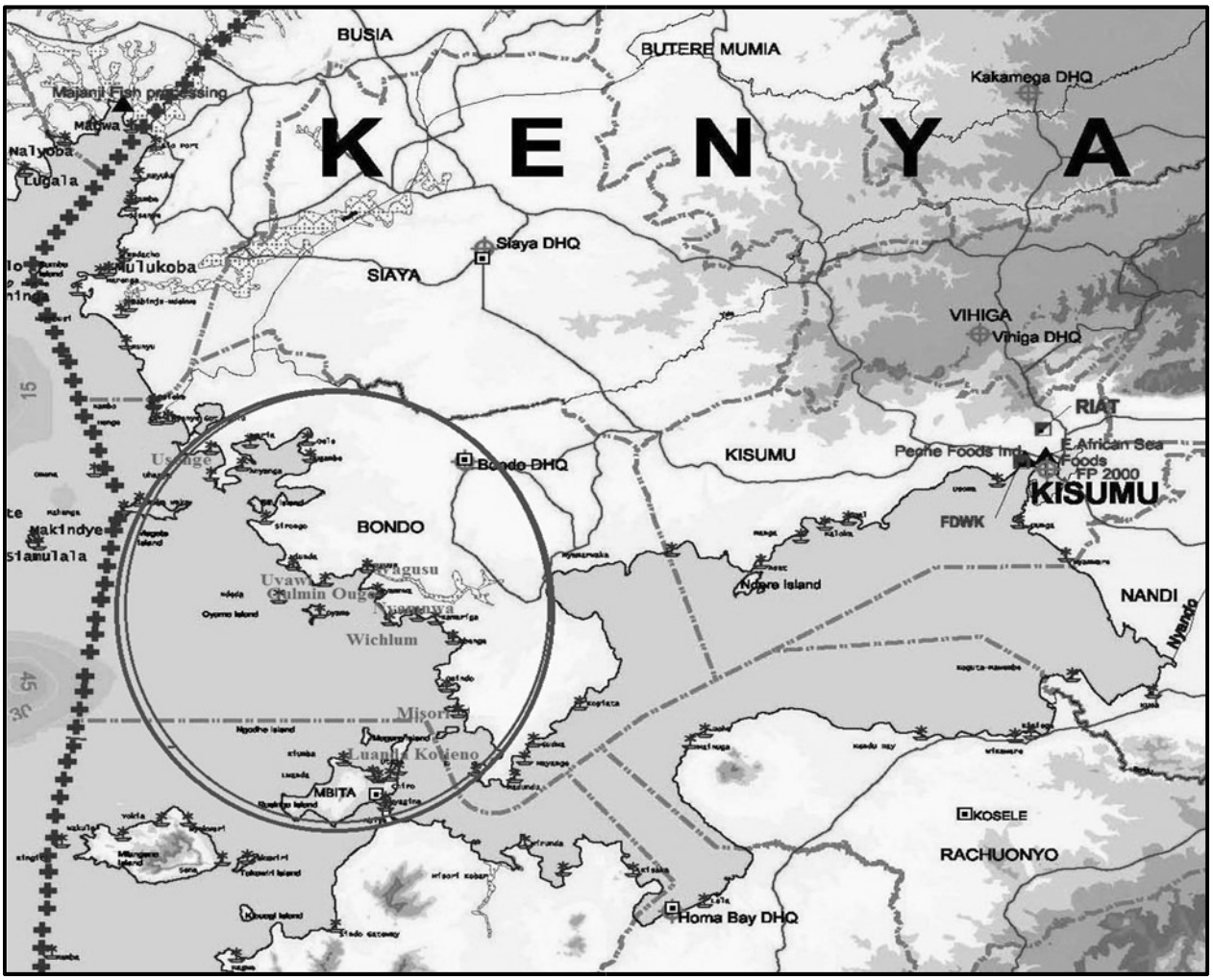

Legend

- Beaches -Study area Wichlum- Name of Selected Beach for the Study

Figure 1: Lake Victoria with Selected beaches for the Study

Table 1: Population and Number of Households in selected Beaches

Beach Name	Households in the beach	Number of household heads in the sample
1. Gul Min Ougo	79	5
2. Nyamnwa	181	12
3. Uyawi	311	20
4. Wagusu	298	20
5. Wichlum	1793	118
6. LwandaKotieno	1140	75
7. Usenge	578	38
8.Misori	1475	97
Total	**5855**	**385**

Table 2: Descriptions of Predictors and how they were expected to Influence Perception on Climate Change

Variable/ predictor	Influence of the predictors
Age	It was the total head of household head. It had a positive or negative relationship on influencing their perception on climate change and having influence on their resilience strategies (adaptation and mitigation measures).
Marital status	It was whether one was married, single, widowed, separated or divorced. It would create the level of dependency on the natural resources (fish, water, trees and land) for meeting individual needs making them to find ways of ensuring that their needs are provided even with changes on climate change.

Household size	It was the total number of members in a household. Large households divert labor to various activities to provide for their needs (Yirga, 2007). It was expected to increase dependency level as income from fishing-based livelihood activities may not be able to ensure that their needs are met.
Highest level of education	It was whether the household head had attained a certain level of formal education or not. Education is associated with the ability to access and utilize information and adaptation of technology (Daberkow& Mc Brides, 2003) and was expected to influence the perception of individuals to climate change as well as resilience strategies.
Belonging to social group	It determined whether the household head belonged to social groups like credit, religious, fisheries, agricultural and social groups which would provide the fisher communities with a sense and purpose to adopt to climate change or even perception on climate change
Type of house	It was whether one lived in a grass thatched house, semi-permanent with iron sheet or permanent with stones/bricks. It would indicate the bell-being of the household determining their possibility to deal with climate shocks (rain/drought or even deaths).
Years lived in the beach	This was the actual years the household head had spent as a residence at the beach. It was to help in identifying with the possibility of having migrating fishing communities and residential ones which would determine a strategy of dealing with climate change.

Gender	It was whether one was a male or a female. This would influence the dependency level to natural resources (water, fish, trees and land) and identification of the most vulnerable groups to climate change.
Household head type	It was when a household was male or female headed. The head of the household was expected to be the one making the most important decisions about the household hence would influence their perception on climate change.
Main occupation	This was what the household head practiced as a source of livelihood. It would determine their income hence adaptation strategies to climate change.
Main source of income	This was what the household head has a source of income that is used to meet their daily needs. It would influence the ability to diversify the means of production if what is received from the main source of income is not enough to meet the household needs

Table 3: Category of Variables as Used in the Logistic Regression Calculation.

Category of the variable	**Frequency**	**Percentage (%)**
Having perception on climate change (1)	312	81.04
Not having perception on climate change (0)	73	18.96

Table 4: Logistic Regression Coefficients of the Socio-Demographic Characteristics that Influence Perception of Fishers along Lake Victoria Beaches in Siaya County on Climate Change.

Source	B	Standard error	Wald Chi-Square	Pr> Chi² (significance)	Exp (B)
Intercept	-1.730	1.285	1.813	0.178	
Age	0.129	0.039	11.148	0.001	1.138
HH Size	0.278	0.125	4.972	0.026	1.321
years lived in beach	-0.017	0.020	0.672	0.412	0.984
Gender-1	0.000	0.000			
Gender-2	0.067	0.716	0.009	0.926	1.069
Marital Status-1	0.000	0.000			
Marital Status-2	-1.194	0.582	4.205	0.040	0.303
Marital Status-3	-1.345	2.421	0.309	0.579	0.261
Marital Status-4	-0.172	2.184	0.006	0.937	0.842
Marital Status-5	-2.105	1.065	3.908	0.048	0.122
HL of Education-1	0.000	0.000			
HL of Education-2	0.046	0.583	0.006	0.938	1.047
HL of Education-3	0.331	0.602	0.302	0.583	1.392
HL of Education-4	-0.045	0.676	0.004	0.947	0.956
HL of Education-5	0.488	0.695	0.492	0.483	1.629
HL of Education-6	0.342	0.824	0.172	0.678	1.408
HH Type-1	0.000	0.000			

HH Type-2	-0.066	0.992	0.004	0.947	0.936
Main Occupation-1	0.000	0.000	3.9		
Main Occupation-2	-3.020	2.650	1.299	0.254	0.049
Main Occupation-3	-2.258	2.007	1.266	0.261	0.105
Main Occupation-4	1.760	2.359	0.557	0.456	5.811
Main Occupation-5	-2.104	2.789	0.569	0.451	0.122
Main Occupation-6	-0.608	1.799	0.114	0.735	0.544
Main Occupation-7	-0.951	1.362	0.488	0.485	0.386
Main Occupation-8	0.463	1.257	0.136	0.713	1.588
Main Occupation-9	0.684	2.030	0.113	0.736	1.981
Main Occupation-10	-1.212	3.407	0.126	0.722	0.298
Main Occupation-11	0.616	2.059	0.089	0.765	1.852
Main Occupation-12	-0.895	2.490	0.129	0.719	0.408
Main Occupation-13	-2.198	1.902	1.336	0.248	0.111
Main Source of income-1	0.000	0.000			
Main Source of income-2	0.000	0.000			
Main Source of income-3	0.000	0.000			
Main Source of income-4	1.789	1.831	0.954	0.329	5.983
Main Source of income-5	2.089	2.583	0.654	0.419	8.076
Main Source of income-6	3.271	2.610	1.570	0.210	26.339
Main Source of income-7	1.088	3.164	0.118	0.731	2.969

Main Source of income-8	0.000	0.000			
Main Source of income-9	0.000	0.000			
Belonging to social group-1	0.000	0.000			
Belonging to social group-2	0.614	0.447	1.883	0.170	1.848
Type of House-1	0.000	0.000			
Type of House-2	-1.216	0.777	2.450	0.117	0.296
Type of House-3	-1.334	0.888	2.258	0.133	0.263
Nagelkerke R Square (R^2)				**0.704)**	

Legend

Gender-1(Male); Gender-2 (Female).

Marital Status-1(Single); Marital Status-2 (Married); Marital Status-3 (Divorced); Marital Status -4 (Separated); Marital Status-5 (Widow/er);

Highest Level (HL) of Education-1 (No Schooling); HL of Education-2 (Incomplete Primary); HL of Education-3 (Complete Primary); HL of Education-4 (Incomplete Secondary); HL of Education-5 (Complete Secondary); HL of Education-6 (Higher).

House Hold (HH) Type-1 (Male Headed); HH Type-2 (Female Headed).

Main Occupation-1 (Boat Maker); Main Occupation-2 (Fisherman or crew); Main Occupation-3 (Fish Trader); Main Occupation-4 (Net Maker); Main Occupation-5 (Business Person); Main Occupation-6 (Transport Provider); Main Occupation-7 (Ice Provider); Main Occupation-8 (Farmer); Main Occupation-9 (Money Lender); Main Occupation-10 (Teacher); Main Occupation-11 (Dress Maker); Main Occupation-12 (Petrol Vender); Main Occupation-13 (Equipment seller).

Main Source of income-1 (Farming); Main Source of income-2 (Boat Making); Main Source of income-3 (Net Making); Main Source of income-4 (Fish Trading); Main Source of income-5 (Small Business Enterprise); Main Source of income-6 (Fishing); Main Source of income-7 (Salary); Main Source of income-8 (Ice Provision); Main Source of income-9 (Money Lending).

Belonging to social group-1 (Yes); Belonging to social group-2 (No).

Type of House-1 (Mad Wall Grass Thatched); Type of House-2 (Semi-Permanent with Iron sheet); and Type of House-3 (Permanent with stones/bricks).

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