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DIVERSIFYING INCOME SOURCES: THE MOVE FROM FISHING NETS TO SEAWEED FARMING IN COASTAL KENYA

Keiko Yamada Naomi
Monitoring and Evaluation, Research and Learning Manager, Plan International Kenya, Nairobi.
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Abstract
The coastal marine fishing communities of Kenya have historically relied on fishing as their primary source of income, supporting livelihoods for generations. However, recent declines in fish catches have raised concerns, attributed to various factors including mangrove degradation and destructive fishing practices. This study explores the importance of diversifying livelihoods within these fishing communities to enhance resilience and economic security. Household diversification, characterized by the pursuit of new income sources while maintaining existing ones, is considered vital for household economic stability. This diversification concept is particularly relevant in the context of natural resource governance and has implications for fisheries management and policy. Understanding how households engage in multiple occupations can inform decisions related to resource utilization and the sustainability of declining fisheries. This research sheds light on the role of livelihood diversification in the face of evolving challenges in coastal fishing communities.

Keywords: Coastal fishing communities, Livelihood diversification, Fisheries sustainability, Resource governance, Economic resilience

1.1 Background

For generations upon generations, the coastal marine fisher communities of Kenya have depended on fishing as their economic mainstay inheriting the traditional occupation across generations (Mangi *et al.,* 2008). Fisheries provide employment to thousands of small-scale fishermen, and to thousands more people involved in a variety of fishing-related activities. These include fish traders, processors, transporters, net-makers and boat builders. Recent trends have however seen decline in fish catches (AU-AIBAR (2016) occasioned by degradation of mangrove areas, coupled with other factors such as destructive fishing methods (GOK, 2017). Other factors include uncontrolled harvesting, the destruction of coral reefs (which is caused by pollution from inadequate sewage systems) and the use of destructive fishing equipment, fish drugging and overfishing (Spalding *et al*., 2010).

Diverse livelihood portfolios are frequently viewed as a critical component of household economies in developing countries. Households that have multiplicity of livelihood sources are seen to be more secure than specialized households. Diversification occurs "when a household unit produces a new product or renders a paid service without ceasing to produce any of the existing ones" (Fabusoro, 2010; Ashley *et al*., 2003; Eliss, 2001; Chambers and Conway, 1992, Ventkesh, 2006). Within the context of natural resources governance in particular, the capacity of individual households to engage in multiple occupations has been

shown to influence important issues such as whether fishers would exit a declining fishery, how people react to policy, the types of resource management systems that may be applicable, and other decisions about natural resource use (Cinner *et al.,* 2010).

However, the open access nature of the fishery and lack of opportunities for livelihood diversification is contributing to growing pressure on marine resources and fish-based livelihoods. Thus, growing numbers of fishers‟ livelihoods are being increasingly squeezed in a vicious circle that signals an urgent need for livelihood diversification in fishing communities (Gordon and Pulis, 2010).

The diminishing fish catch increases the vulnerabilities that fisher communities are exposed to (particularly illness) and a lack of access to basic social services including health, education and sources of affordable credit (Okeyo, 2010). Understanding the relationship between fishing and livelihood diversification is important because fishing is an important component of rural livelihoods of households in the coastal areas. Diversification potentially increases the adaptive options of households and therefore places households in good position during periods of livelihood stress ensuring further that fishers who diversify reduce fishing pressure, which may contribute to long-term sustainability of the social-ecological system (Blythe *et al.*, 2014).

This study sought to provide an understanding of the key determinants of livelihood diversification with the following specific objectives: a) explore the determinants of livelihood diversification among marine fisher communities, b) determine the various typologies of diversification, and c) assess potential viability and adoption of emerging alternative livelihood sources.

1.2 Statement of the problem

Livelihood diversification studies have primarily focused on farm households and pastoralists but with little attention to fisher households (Hoowerg *et al.,* 2009) and much less focus to its effect and influence on marine fisher coastal communities yet it has been identified as one goal of sustainable fisheries and coastal sustainability initiatives, with both ecosystem and social benefits (Alden, 2011). Livelihood diversification in fisher communities is also viewed as a plausible solution for fishermen to cope with new constraints as it is a „away to resist in front of a real or perceived degrading economic and environmental context‟ (Henichart *et al,* 2010).

Dwindling fish stocks in the coastal waters and signs of overfishing of high value species in the territorial waters may already be predisposing the communities to deprivation occasioned by degradation of marine resources and declining fish catches (Luc, 2017; Hoorweg *et al.,* 2009). Of interest, is the fact that fishers have stuck to the traditional forms of livelihood strategies yet alternative livelihood options and diverse income opportunities allow communities to be flexible to adapt to social, political, and economic changes (McLeod *et al.,* 2006). Accordingly, the determinants of livelihood diversification among fisher communities is less understood including how diversification strategies influence fishing activities and, ultimately, pressure on fisheries resources (Brugère *et al*., 2008). This study thus, examined the various

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forms and typologies of livelihood diversification, the determinants of diversification and potential for diversification of alternative livelihood options for the fisher folk.

2.0 Materials, methods and theoretical framework

2.1 Theoretical framework

The study adopted the sustainable livelihood framework (UK Department for International Development). The framework identifies five integrated and interrelated asset types. The five assets encompass the financial, physical, social, human, and natural. An individual actor, in our case a fisher, may own or acquire access to a particular set of assets. The combination of assets is determined by the context in which the fisher lives (Parkinson and Ramirez, 2006; Bennet, 2010). The three key components to the livelihood framework are capabilities, assets and activities (De Satge, 2002). The framework (Figure 1) has been shown to give a comprehensive and practically focused understanding of fishers‟ realities, which can then subsequently inform development initiatives and policy documentation (Baumann, 2002).

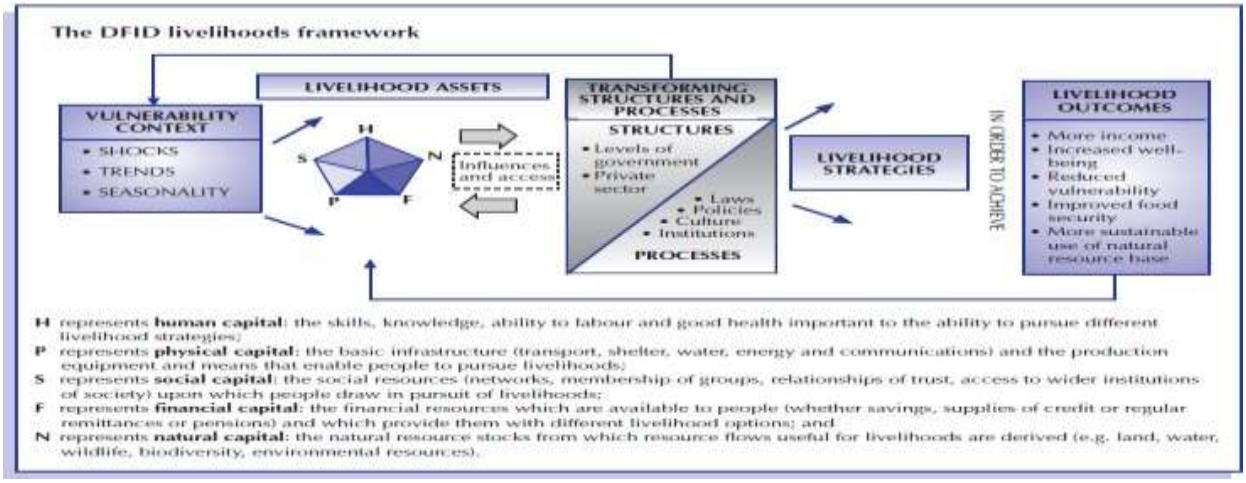

Figure 1 The sustainable Livelihoods Framework, DFID, 1999

2.2 Materials and methods

The study adopted a descriptive and analytical cross-sectional survey design based on mixed methods. The design has been hailed for its effectiveness in ensuring internal reliability and corroboration of facts and opinions (Brannen, 2005; Graff, 2017) and triangulation of sources. A multi-stage stratified cluster sampling was adopted. Quantitative data was collected from randomly sampled 346 households using a structured survey questionnaire while qualitative data was collected from fifteen (15) purposively selected key informants and nine (9) focused group discussion sessions that reached 714 males and 50 female respondents.

The extent of diversification of the households was measured using Simpson Index of Diversification (SID) preferred because of its computational simplicity, robustness and wider applicability (Khatun, 2012) and also for the fact that it takes into consideration both the number of income sources as well how evenly the distributions of the income between the different sources are (Minot *et al.,* 2006; Joshi *et al*., 2003).

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Inferential statistics was undertaken using Analysis of variance (ANOVA), regression and correlation analysis as well as student T-test at a significance level of 95%. Qualitative analysis was performed using content/thematic analysis an analytic process that uses a theory-driven approach where the analysis categories are determined a priori based on the study objectives and identifying the common themes around which the analysis should be carried out.

2.3 The study sites

Kwale County is one of the six counties in the coastal region of Kenya. It borders Taita Taveta County to the North West, Kilifi County to the North and North East, Mombasa County and Indian Ocean to the East and South East and the United Republic of Tanzania to the South West. The County is located in the Southern tip of Kenya, lying between Latitudes
30.05º to40.75º South and Longitudes 38.52º to 39.51º East. Kwale County covers an area of about 8,270.2 Square Kilometres, of which 62 is water surface.
The County covers a total surface
area of 8,270.2 square km and accounts for 1.42 per cent of Kenya's total surface area. It has a population of 866820 persons 425,121M and 441,681F, 18 Intersex]. Administratively, Kwale County is divided into five sub-counties being Msambweni, Lunga, Kinango, Matuga and
Samburu-Kwale. The study was conducted in Msambweni and Lungalunga sub-counties. Msambweni has a total population of 177,690 [Male: 89,208, Female: 88,482] while Lungalunga has 198,425 [Male: 97,174, Female: 101,247]. The average temperature of the county is 24.2°C and rainfall amounts range between 400 mm and 1,680 mm per year. Kwale has abundant fisheries reserves along the coastline. Major fish

reserves include: Shimoni, Vanga, Msambweni, Diani, and Tiwi. There are 20 beach management units (BMUs) and 54 landing sites.

The main types of fish include Rabbit Fish, scavengers, snappers, parrot fish, octopus, squids and variety of ornamental fish. In addition, there are 338 fish ponds in the county (Government of Kwale, 2018).

3.0 Results and discussion

3.1The extent of livelihood diversification

This study employed the Simpsons Index of Diversity (SID) to determine the degree of income diversification among the coastal marine communities of Kwale in Kenya. The preference for this index was based on the advantages it portends as realized by those researchers that have used it (Shaha *et al*., 2010; Babatunde *et al*., 2009 and Joshi *et al*., 2003) and for its „computational simplicity, robustness and wider applicability" (Ahmed *et al*., 2018). The index takes into consideration both the number of income sources as well how evenly the distributions of the income between the different sources are (Minot *et al*., 2006; Joshi *et al*., 2003). The formula for Simpson index is given as:

$$S.I. = 1 - \sum_{i=1}^{N} P_i^2$$

Where:

N is the total number of income sources

P_i represents income proportion of the i-th income source.

The index value lies between 0 and 1. The value of the index is zero when there is a complete specialization and approaches one as the level of diversification increases. The more the SID value is closer to one, the more diversified the household income is. The index's value is zero if there is just one source of income. As the number of sources increase, the shares (P_i) decline, as does the sum of the squared shares, so that SID approaches to 1. Households with most diversified income sources have the largest SID value, and the least diversified income sources have the smallest SID value. SID gets better with evenness of income sources.

The index was computed for all the households and comparison made against household characteristics including education level, household size etc. The levels of diversification as a result of the SID adopted the categorization by (Ahmed *et al*., 2018) which categorizes livelihood diversification as follows:

1. No diversification (SID < = 01)
2. Low level of diversification (SID = 01 - 0.25)
3. Medium level of diversification (SID = 0.26 - 0.50)
4. High level of diversification (SID = 0.51 - 0.75)
5. Very high level of diversification (SID > 0.75)

To identify the major drivers of livelihood diversification, multiple regression analysis was carried out using Equation:

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$D = \beta 0 + \beta i\ Xi + \mu$

Where, D is the dependent variable, representing Livelihood Diversification Index, explained by βi which represents a vector of parameters, and Xi is a vector of exogenous explanatory variables. The explanatory variables for analysis were selected based on a literature review (Mathewos and Nigatu, 2016; Sahal and Bahal, 2014; Saha and Bahal, 2010 and Ahmed *et al.*, 2018) which includes the sex of the household head, age, marital status, education level of the household head, household size, land size, total asset value of the household, access to credit and family borrowings, involvement in social safety nets among others.

The study identified 15 possible livelihood sources that were available for adoption in the marine communities of Kwale County. The households were subsequently asked which livelihood options they practiced and estimated share contribution for each source of livelihood documented. The total number of livelihood sources practiced by the household and the share contribution or each source of livelihood to the household income was used to compute the Simpson Diversification index (SDI) for the household.

Of the fifteen livelihood sources selected by the 346 respondents (see Table 1), agriculture sector received the highest number of cases at 147, followed by fish and shell fish sector (136), followed by small businesses (74) and salaries and wages at 30 to complete the top five most preferred sources of income for the residents of Kwale. The least preferred was mariculture reporting only one case followed by mining and quarrying (5 cases). Among the emerging sources of livelihood, sea weed farming received the highest cases at 18 indicating its steady rise and acceptance by the coastal marine communities. The transport, storage and communication sector with 27 cases is also steadily on the rise mainly as a result of the use of motorbikes popularly known as the *boda* to the locals.

Table 1:Sources of livelihood for the marine communities of Kwale and number of practicing household

No	Source of livelihood by category	**No of HH**
1	Fish and shell fish sector (Fish processing, Fish trading, fish distribution including selling marine products (gleaning))	136
2	Fish based livelihoods (all types & all gears, fishing equipment, boat renting, gear renting, boat crew)	27
3	Sea weed farming	18
4	Mariculture/aquaculture (rearing of aquatic fish/ plants)	1
5	Forestry sector (mangrove exploitation, including selling of wood & wood products)	8
6	Agriculture sector (cash crops, livestock & commercial agriculture)	147
7	Agro-coconut related (All production related to coconuts including palm wine)	34
8	Tourism sector (eco-tourism activities, tour guiding, beach boys, hotels, crafts and carvings, jewelry etc.)	11
9	Service and manufacturing & cottage industry (Bicycle repairers, Black smiths, Builders, Dress making, Mechanics).	24
10	Mining and quarrying Sector including coral reefs collection	5

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11 Salaries and wages (National Government/private/county government) 30
12 Tradesman work (plumber, machinery, painter, masonry etc.) 12
13 Business (shop keeping, sales of cereals, grocery, fruits etc.) 74
14 Transport, Storage and Communication (boda, bus conductor, telephone accessories, 27 electronic hardwares)
15 Wholesale & Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and 8 Household Goods

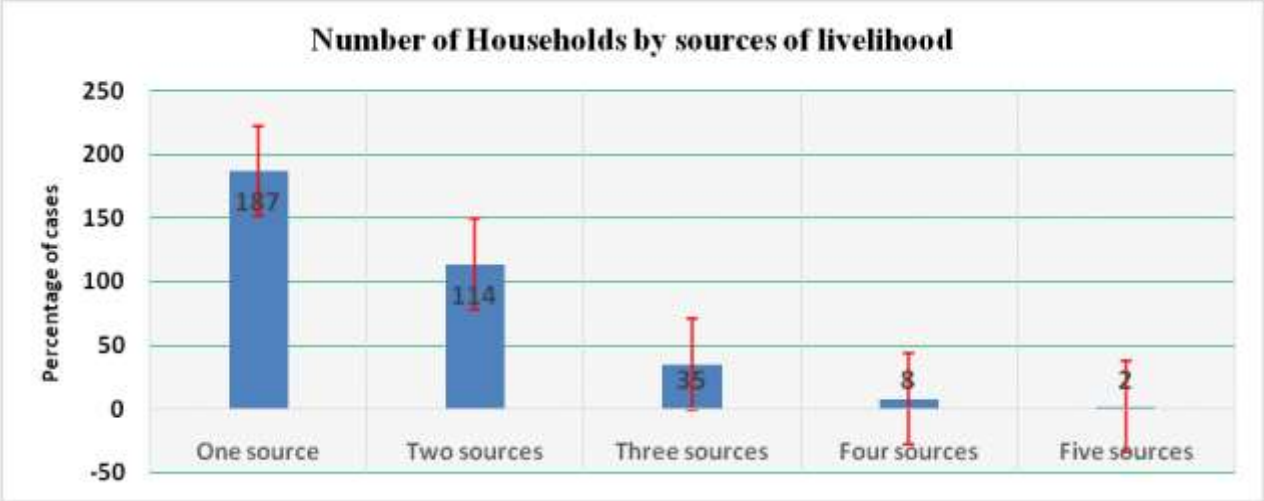

Figure 2: Percentage cases of households and sources of livelihood

The average number of income-generating activities or sources per household for the 346 households was 1.62 (SD=0.804). The minimum number of sources identified was one and the maximum was five. In total, more than half of the households, 187 corresponding to 54%, were engaged only in one source of livelihood; 114 (32.9%) were engaged in two sources; 35 (10.1%) were engaged in three sources; 8 (2.3%) were engaged in four sources; and only 2 (0.6%) were engaged in five sources of livelihood. Using Ahmed *et al*., (2018) classification, the number of livelihood sources was determined to be significantly correlated with the level of diversification with 99.5% of the respondents reported at the level of „No diversification" engaged in only one source of income and those with high level of diversification were engaged 100% in five different sources of income as shown in Table 2. It was established that women were more specialized than men in the extent of diversification.

Table 2: Extent of diversification and number of sources of livelihoods

Extent of diversification	Number of sources					Total
	1	2	3	4	5	
No diversification	99.5%	1.8%				54.3%

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Low diversification		32.5%	5.7%	12.5%		11.6%
Medium level of diversification		65.8%	51.4%	25%		27.5%
High level of diversification	0.5%		42.9%	62.5%	100%	6.6%
	100%	100%	100%	100%	100%	100%

Source: Survey data

Table 3: Number of livelihood activities by gender

Gender of HH Head		Livelihood numbers					Total
		One source	Two sources	Three sources	Four sources	Five sources	
Male	Count	69 (36.9%)	55 (48.2%)	16 (45.7%)	4 (50%)	1 (50%)	145 41.9%
Female	Count	118 (63.1%)	59 (51.8%)	19 (54.3%)	4 (50%)	1 (50%)	201 (58.1%)
Total	Count	187 (100%)	114 (100%)	35 (100%)	8 (100%)	2 (100%)	346 (100%)

Source: Survey data

The study showed that only 52.6% indicated that they did not make extra income from other sources apart from their current main source while 47.4% diversified their income sources.

3.2Extent of diversification based on SID values

Table 4: Extent of diversification as classified by SID values

level of diversification					
SID Value	Diversification level	Frequency	Percent		Cumulative Percent
>01	No diversification	188	54.3		54.3
01 - 0.25	Low diversification	40	11.6		65.9
0.26 - 0.50	Medium level of diversification	95	27.5		93.4
0.51 - 0.75	High level of diversification	23	6.6		100
	Total	346	100		

Based on the calculated SID values (See Table 4) and the categorization adopted by Ahmed *et al*., (2018), the study established that more than half of the respondents (54.3%) of the 346 households interviewed

had no diversification. In addition, 11.6% had low level of diversification, 27.5% had medium level of diversification, and a paltry 6.6% had a high level of diversification. These results showed that most of the households are still stuck to the traditional sources of livelihood, mainly fishing and agriculture and small businesses. Only a very small fraction of the households is presently engaged in multiple livelihood sources, and even then, those that have diversified livelihoods have a large contribution share by one major source mainly agriculture and fishing.

It was established that upstream communities were mainly engaged in mixed farming while the shoreline communities were predominantly engaged in fishing and fish-based livelihoods. In the fishing communities, men were mainly engaged in fish harvesting while women were in fish processing. In the upstream communities both men and women were engaged in farming but with diversified livelihoods in small businesses and other activities in mining, motor bike riding etc. Discussions with fishermen and adult men and women in the communities showed that in recent times there have been new sources of livelihood such as seaweed farming, apiculture and carbon trading championed by other agencies such as Plan International and German donor organizations managed by Kenya Marine and Fisheries Research Institute (KEMFRI).

Linear regression model was used to identify factors which influence or condition household's livelihood diversification strategies. These factors were theorized and modelled from various variables based on literature review to try and understand how they predict livelihood diversification. Thirteen explanatory variables were identified, and regression analysis conducted with the level of diversification (computed as SID) being the dependent variable.

A total of 16 explanatory variables were included in the model to establish the determinants of diversification among the marine communities of Kwale County. The variables included: Number of HH working members; Gender of Household Head; Age of HH head in years; Marital status of respondent; Household Size; Access to credit (loans and borrowings); Training on livelihood; Land unit held in Ha; HH dependency ratio;

Social Assets Value Index; Physical assets value Index; Public assets index value; Financial Assets Value Index; Human Assets Value Index; Membership to social organization and Fishermen attitude and identity. Table 5 explains the explanatory variables.

Table 5: Description of explanatory variables included in the regression model

Explanatory Variable	**Description**
Number of HH working members	Total members of the household engaged in an economic activity that brings income to the household
Gender of Household Head	Sex of household head (1 = Male and 2= Female)
Age of HH head in years	A continuous variable measured in years

Marital status of respondent	A nominal variable in which 1= Single 2=Married, 3=Divorced, 4=Widowed, 5=Separated and 6=Not applicable
Education of the Household	Average year of schooling for head of household and spouse
Household Size	A continuous variable computed from the total number of persons living and staying in the HH as at the time of study
Access to and credit (loans borrowings)	Refers to HH that have received borrowings or loans from financial institutions in the three months preceding the study
Training on livelihood	Households that have received a formal training on the livelihood source they are engaged in or wish to engage in with 1=received training and 2= did not receive training
Land unit holding in Ha	A continuous variable measured in hectares of land owned
Household dependency ratio	Dependency ratio of the household (ratio of economically inactive persons (younger than 18 and older than 59) over the economically active persons (ages 18-59 years) expressed in percentage
Social Assets value Index	An index computed by measuring 4 important elements of social capital (networks, membership to groups, relationships)
Physical assets value Index	An index computed by measuring 8 elements of physical capital (infrastructure and production equipment)
Public assets value	An index measured by HH access to basic water and sanitation services
Financial Assets value Index	Index computed from 6 elements (savings, access to credit services, borrowings and remittances)
Human Assets value Index	Index computed from 14 elements of human capital (skills, knowledge, labour, health and ability to pursue different livelihood strategies.
Membership to social organization	Nominal variable where 1= Yes and 2=No
Fishermen attitude and identity index	A single value derived from a set of 12, 5point Likert scale questions in which

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	1= Strongly Disagree, 2=Disagree, 3=Neither Agree nor disagree, 4=Agree and 5=Strongly Agree

Upon putting through the 16 explanatory variables into the model, the results showed that the overall summary F-Test for the model was significant (P≤0.05) and that the R-squared value of 0.180 was recorded. This means that 18% variation in the dependent variable (extent of livelihood diversification) was explained by the explanatory variables modelled in the study. Following the results derived from the model, it was established that some factors were significantly associated with the extent of diversification of livelihoods while other had no significant association. The results of the coefficients tallied in Table 6 showed that out of the 16 explanatory predictor variables put in the model, six (6) were found to be significantly and strongly associated with the dependent variable (extent of livelihood diversification). They included: (Gender of Household Head, Training on livelihood, HH dependency ratio, Social Assets Value Index, Financial Assets Value Index, Membership to social organization and Fishermen attitude and identity). The other 10 variables were not significantly different from the dependent variable (extent of diversification).

Table 6: Coefficient of determinants of livelihood diversification

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.162	.345		3.367	01
Number of HH working members	.177	54	.178	3.290	01
Gender of Household Head	-.212	.109	-.101	-1.937	04
Age of HH head in years	06	04	72	1.323	.175
Marital status of respondent	-32	68	-25	-.464	.643
Household Size	11	17	36	.673	.502
Access to credit (loans and borrowings)	39	.131	16	.295	.768
Training on livelihood	-.273	.165	-.114	-1.660	08
Land unit held in Ha	-03	04	-44	-.851	.396
HH dependency ratio	02	03	49	.912	04

Social Assets value Index	05	02	.149	2.168	31
Physical assets value Index	01	03	28	.472	.637
Public assets value	-05	02	-.157	-2.465	798
Financial Assets value Index	05	03	.162	2.197	29
Human Assets value Index	05	04	.114	1.328	.185
Membership to social organization	88	.120	41	.729	06
Fishermen attitude and identity	0.10	05	0.193	2.122	036
a. Dependent Variable: Level of diversification					

The regression output indicated that there are certain household level variables (demographic and socioeconomic) affecting the extent of livelihood diversification among marine communities. The size of household, access credit (loans and borrowings) and marital status was not significantly associated with diversification. The finding on the household size contrasts that of Mphande (2016) that a big family needs more resources for sustenance than a small family and hence „people with big families will venture into as many ways as possible to gain the required resources to support their families." These results are however consistent with related findings by Naznin *et al.,* (2015) that concluded that household size, access to loan and marital status do not affect income diversification. The findings on household size however differs with other findings (Tizale, 2007; Bryceson, 2002) that found household size to affect significantly diversification of households. They argued that the chance of a household diversifying would increase with the size of the household. These variations can however be seen to vary from marine to agrarian based communities whose primary focus is on water resource and not land based resources.

The household size which measured the total number of people in the household was thought to have a positive significant association with diversification such as findings by Mentamo and Geda (2016) that showed that „A unit change in households" size brings about 0. 009 units and 0.07 unit change in the dependent variable (livelihood diversification)" but this turned out not to be a significant factor in influencing livelihood diversification.

3.2.1 Extent of diversification and gender

The study considered the influence of gender of the household head on diversification and established it was positively associated with the livelihood diversification of marine communities. The male headed households were hypothesized to be positively related to higher levels of diversification compared to female headed households who suffer gender-based restriction and unequal power balances especially in fishing communities where men control fishing resources. The findings are consistent with similar related studies such as Dirribsa and Tassew, 2015; Debele and Desta, 2016) who for instance noted that gender

significantly influenced livelihoods with a difference at 1% level, between the mean number of livelihood activities engaged in by men and women.

A cross tabulation between the gender of the household head and the level of diversification reported a significant level of difference between the males and females X^2 (p≥05=013). Comparatively, 47.6% of the females reported „No diversification" compared to 59.2% of the females with the results suggesting that females were most likely to be specialized in sources of income than the men who are more diversified.

3.2.2 Extent of diversification and age of the household head

A further analysis on age as an explanatory variable showed that it was not significantly associated with the level of diversification. This is despite the studies such as that of Mariotti *et al*., (2014) that showed that as age increases, and the household heads cross the turning point of approximately 60 years, it is less likely that the households would choose to have diversified livelihoods. It is however in consonance with FAO (2016) study that showed that young people migrating outside the communities, have possibilities of diversification than the ageing indicating that *„Young men also tend to be more mobile, which may enhance their opportunities for income diversification*" and still is counter findings that suggested that household head's age is the prime force towards livelihood diversification (Khatun and Roy, 2012; Ellis, 2005).

In the focus group discussion with fishermen they indicated that some level of diversification is only possible with a certain age. One participant observed,

"We know of very few people who have stopped fishing and completely shifted into other forms of livelihood e.g. herbalists, small businesses, Base Titanium Factory as drivers and wage and salaried employment; but it changes with age and time; so that while one is still young he would prefer being a fisherman while with age one prefers being a fish monger or get alternative livelihood to fishing." (Male Participant FGD, Gazi)

3.2.3 Education of household and extent of diversification

Contrary to findings by Yizengaw *et al. (*2015) and Khatun & Roy (2012) that showed that educated household heads are, more likely to have diversified activities with an escalated probability of engagement in livelihood diversification, this study established no significant association. The finding is possibly due to education levels of the coastal communities in Kenya remaining relatively low and even lower among the fisher folk. The findings contrast those of agrarian communities where education is invariably associated to diversification as farmers that acquire new knowledge on agricultural techniques get more likely to diversify (with Oluwatayo, 2009; Ng"ang"a *et al*., 2011). Debele and Desta (2016) observed in their study in Ethiopia that „that an increase in education level of head will increase the likelihood of being in highly and moderately diversified compared to the probability of being in less diversified strategy." Presumably, education is the key to literacy. If an individual is able to read and write, they have a higher chance of choosing an appropriate field of work or further skills training in order to advance their livelihoods. The Ministry of education official exemplified the role of education during the interview, *"education standards determine level of knowledge and skills as well as attitudes, which together translate to livelihoods activities;*

In addition, proper livelihoods give good support to education e.g. farming and fishing in the county which has a direct influence on education standards."

3.2.4 Extent of diversification and marital status

There was also no statistically significant association established between household extent of diversification and the marital status of the household head. This finding differs with similar findings in farm based livelihoods that have established a significant positive association between marital status and extent of diversification (Olale *et al*.,2010).

3.2.5 Social assets, memberships and extent of diversification

The study established a positive association between diversification and assets especially the social assets and financial assets all which were established as significantly affecting livelihood diversification. The findings mirror closely those of Mariotti *et al.,* (2014) who found that „assets owned have a positive impact on whether households diversified their livelihoods to earn more income. " Separately but related to this, was the positive association reported between the level of diversification and membership to social organization. It has been noted that social networks seem to enable household members to extend their participation to new activities (Stefan and Manfred, 2005) and that „these networks are beneficial in obtaining knowledge that can be used to further livelihoods" (Mphande, 2016).

Further to this, participation in social groups outside the fishing sector can lead to learning and acquisition of new knowledge on emerging livelihood strategies and provide a great sense of security to try out new livelihood strategies (Rhona and Susana (2011). A cross tabulation of household membership to a social organization in the community such as village savings and loaning associations, resource conservation groups among others and extent of diversification showed a positive significant correlation (X^2=00). Of the 346 households, 61.9% of those who were not members of any group had „no diversification" compared to 40.7% of those who were members. Additionally, more households (42.3%) reported either medium or high level of diversification compared to 29.6% of those who were not members. Conclusively, being in a group is associated with significant positive association with diversification with those who are in a social grouping likely to diversify than those who are not.

Further analysis showed a cross tabulation of the extent of diversification and the number of times a household was able to meet other household's members in the community and interact with them in the three months preceding the study reported a significant positive correlation (X^2 =013). Based on the findings, households that never had any social interactions had 69.6% „No diversification", compared to 49.3% for those who had interactions more than three times, 45.5% for three times, 53.8% for two times and 50% for once. Medium level of diversification and high level of diversification is reported as number of times of interaction in the community increases clearly showing the importance of social assets as a factor in the marine community livelihood diversification. The findings are shown in Table 7. Table 7: Social interaction and extent of diversification

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		A20. Thinking back over the past three months, how many times in a normal week did you meet other people in the community socially?					Total
		Once	Twice	Thrice	>3times	Never	
Level of diversification	No diversification	50%	53.8%	45.5%	49.3%	69.6%	54.3%
	Low diversification	16.7%	2.6%	22.7%	14.2%	3.8%	11.6%
	Medium level of diversification	30.6%	41%	22.7%	27.6%	19%	27.5%
	High level of diversification	2.8%	2.6%	9.1%	9%	7.6%	6.6%
Total		100%	100%	100%	100%	100%	100%

3.2.6 Extent of diversification and total household asset value

Even though some of the asset elements like human assets and public assets did not report significant positive association, collectively as a measure of Total asset index they strongly positively affected the level of diversification indicating that assets are an important factor in diversification of livelihoods among marine communities. The attitude and identity of the fishermen equally played an important role with those fishermen with a negative attitude and identity more likely to report diversification than those with a positive attitude. Fishermen who considered their quality of life as poor and status as low were more likely to diversify.

3.2.7 Extent of diversification and household dependency ratio

The other explanatory variable examined was the dependency ratio which measures the ability of the household to sustain and meet their needs. It was observed that increase in the dependency ratio puts more pressure on the household and decreases the ability of the household to meet their needs. An increased dependency ratio arguably pushes the household into diversifying into other activities that can bring more income to the household (Khatun and Roy, 2012). Contrary to this finding, the study established no positive significant association between livelihood diversification and dependency ratio of the households which nonetheless was established to be very high among marine communities. Separately, access to credit and borrowings was equally not found to have a significant influence on diversification. This is so with farm-based study by Ahmed (2018) that showed that „households having more amount of credit are likely to be more diversified in their livelihood activates" as well as other related studies (Babatunde, 2009; Asmah, 2011 and Saha *et al*., 2010; Oluwatayo,2009).

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3.2.8 Extent of diversification and household training skills on new livelihood sources

The other positively associated explanatory variable was training which enabled the communities to be adequately empowered to make deliberate choices to diversify their livelihoods. According to Mphande (2016), „the more the skills in a household, the more they can venture into different markets thereby widening their ability to make money and support their family."

Additionally, there was no positive significant association between diversification and land holding despite the fact that significant proportion being farmers (P=0.95). A cross tabulation of occupation practiced by the respondents and levels of diversification was not significant. However, there were variations reported for instance 55.70% of those engaged in agriculture had no diversification compared to 58% of those engaged in fishing. The highest level of specialization was reported among those undertaking merchant and trade business (66.7%) and with the religious leaders reporting the highest level of diversification.

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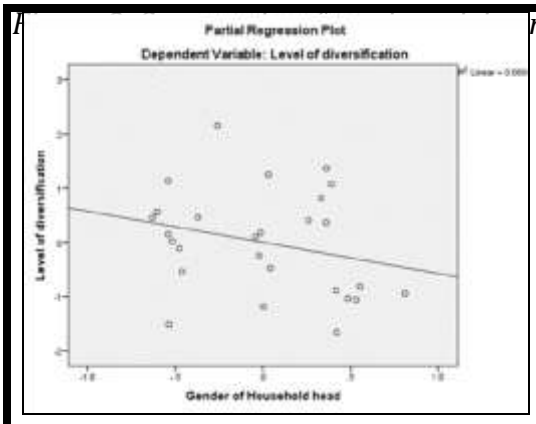

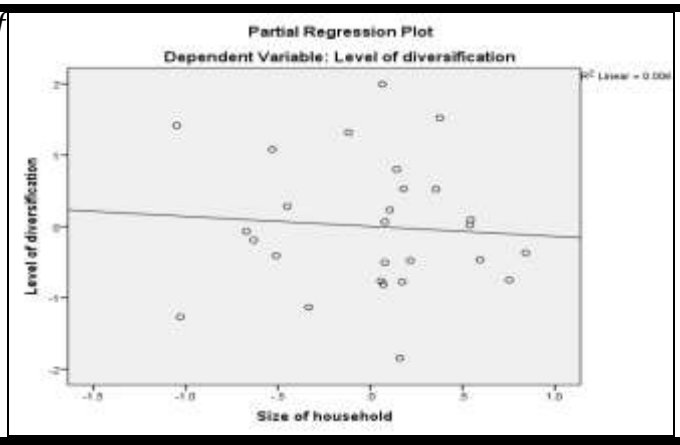

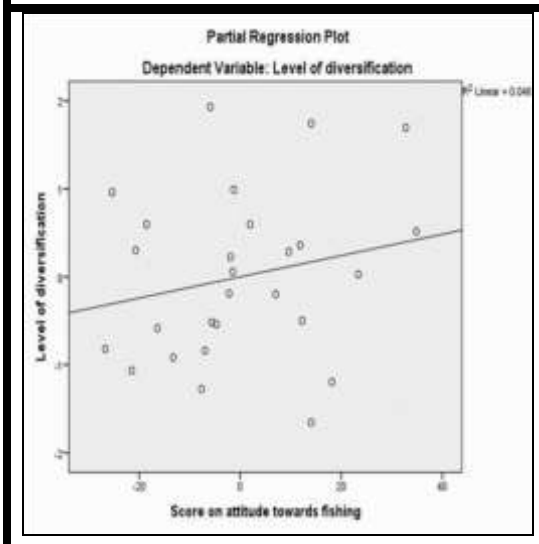

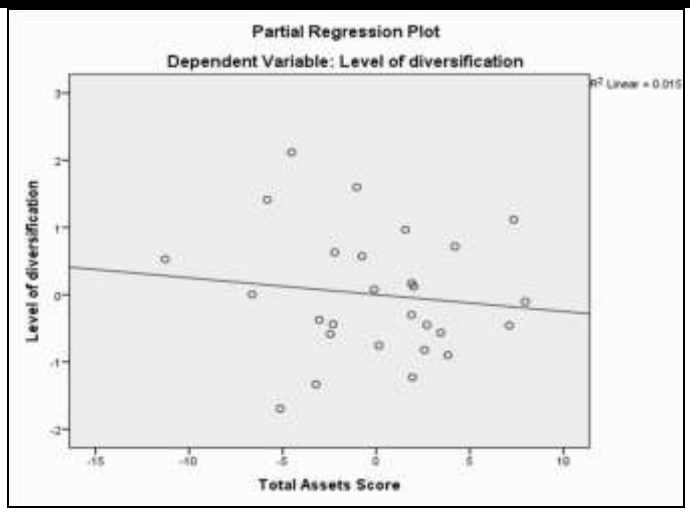

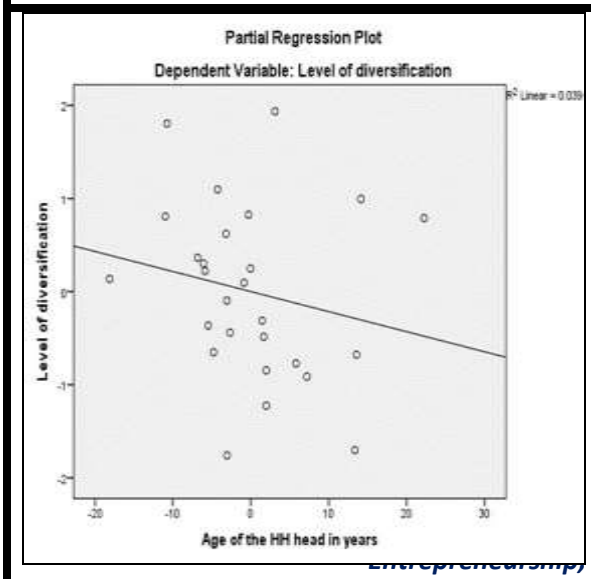

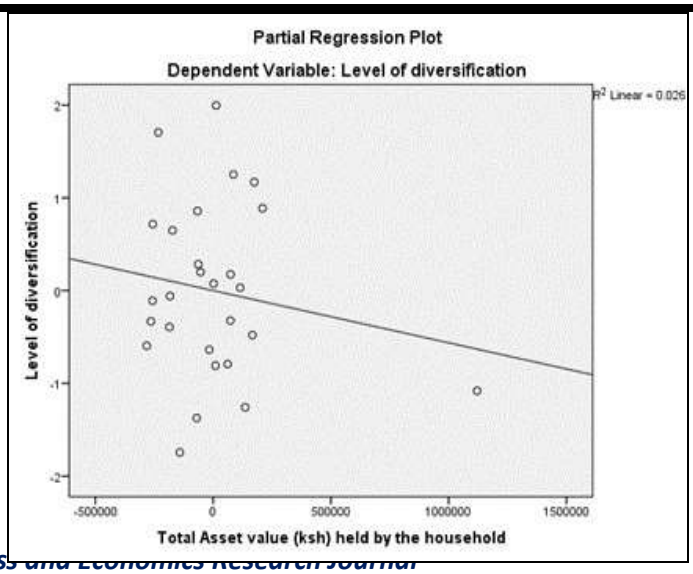

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3.3 The barriers to livelihood diversification

It was established in the study that the main reason why the communities are still sticking to their current main source of livelihood despite their dwindling fortunes is because of lack of viable alternatives for which they have capacity to undertake (58.4%), followed by lack of adequate skills to engage in the emerging livelihoods sources thus limiting them to what they are used to doing with skills transferred to them from one generation to the other (30.6%), deep seated belief that the livelihood source was bequeathed to them by their previous ancestral generation and that they are morally obligated to stick to it (13.4%), unfavorable and changing climatic patterns that causes seasonality in some livelihood sources such as agriculture which relies on the rain (10.5%) and unpredictability of the income sources (6.2%). (See Table 8).

Table 8: Reasons for relying on one income source

Reasons for relying on one income source	**Responses**		
	N	Percent	Percentage of Cases (%)
Is a heritage that was given to me by my grandparents/ father	28	11%	13.4
There is no other alternative available that I can resort to	122	48%	58.4
This is the only source of income which I have the technical skills required	64	25.2%	30.6
The climate is not favorable for other livelihood options such as farming.	22	8.7%	10.5
The returns from fishing are predictable unlike the other income sources	5	2%	2.4
Other specify	13	5.1%	6.2
Total	254	100%	121.5

In the focus group discussion with adult fishermen at Gazi, participants noted that whereas they saw the need to get out of fishing because of its dwindling returns, they were yet to get alternatives and even so they also lack adequate skills and knowledge on what to do with emerging livelihoods like sea weed farming and aquaculture. The fishermen were of the opinion that fishing should be enhanced by providing them with recommended gears that are environmentally sustainable and which will not put them through legal conflicts with law enforcement authorities as they presently do. They also indicated the alternatives need be those that they have technical capacity to undertake.

3.4 Typologies of diversification

Having established that there are emerging alternative livelihoods apart from the mainstream traditional livelihoods of farming and fishing, the study sought to determine if the alternatives were culturally

acceptable, economically viable, socially viable and environmentally sustainable. The study sought to determine the level of acceptability of the emerging livelihoods and whether the communities were willing to trade them off for their current livelihood strategies or continue doing them alongside their mainstream livelihoods. The importance of these emerging livelihoods has been recognized by 42.2% of the respondents. Apart from the mainstream livelihood sources the other emerging sources include *boda,* small scale businesses, charcoal burning, mangrove farming, sea weed farming and quarrying.

In trying to understand if the fisher folk would leave their fish-based livelihood for the emerging livelihood strategies, the study established that 69.5% (N=118) of respondents were willing to leave fishing and turn to other sources of livelihood if any case there arise an opportunity. The findings are concomitant to those of Versleijen (2001) that found out that more than half of the fishermen whose fathers were fishers (54.6%) were willing to stop fishing if another job was offered to them with the rest (45.5%) not willing to stop.

Despite the willingness to diversify, 30.5% would still hold on fishing even if there emerged another source of livelihood. The choice over fishing instead of other alternatives was discussed in the focus group discussions where it was observed that fishing still remained a favourite because of lack of alternatives. At Gazi, a woman in adult FGD observed thus, *"…We don"t like fishing but there are no alternatives. It is also cultural, fishing is a lifestyle so we shall leave but finally go back to it or do it as part time job."* This is what Nayak, (2017) called a "mental block" in reference to fisher households who consider fishing as a caste or cultural activity, a way of life, rather than an economic pursuit which he argued complicates livelihood choices further in terms of people moving out of fishing to non-fishing activities. The discussions however revealed that there are new livelihoods such as sea weed farming that are increasingly getting embraced by the marine communities.

The study equally sought to establish some of the reasons why the communities would continue sticking to their main source of livelihood even with the knowledge that the returns on fishing are declining and may not be sustainable to the families.

The analysis showed that 26.2% (N=168) prefer the identified livelihood due to its economical nature while 19%% of the respondents are expert in the identified areas so they would rather stick with what they know how to do best. In addition, 4.2% hold that the identified are not capital intensive and so easy to start. Other reasons mentioned for preference of the main source of livelihood over the others are; climatic factors, gender based factors, promotion by the government and agencies among other reasons. These are shown in Figure 4. The study also established that some of the factors that push families towards diversification are increased family

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demands, decline in productivity and climatic changes. These are reported in Figure 5.

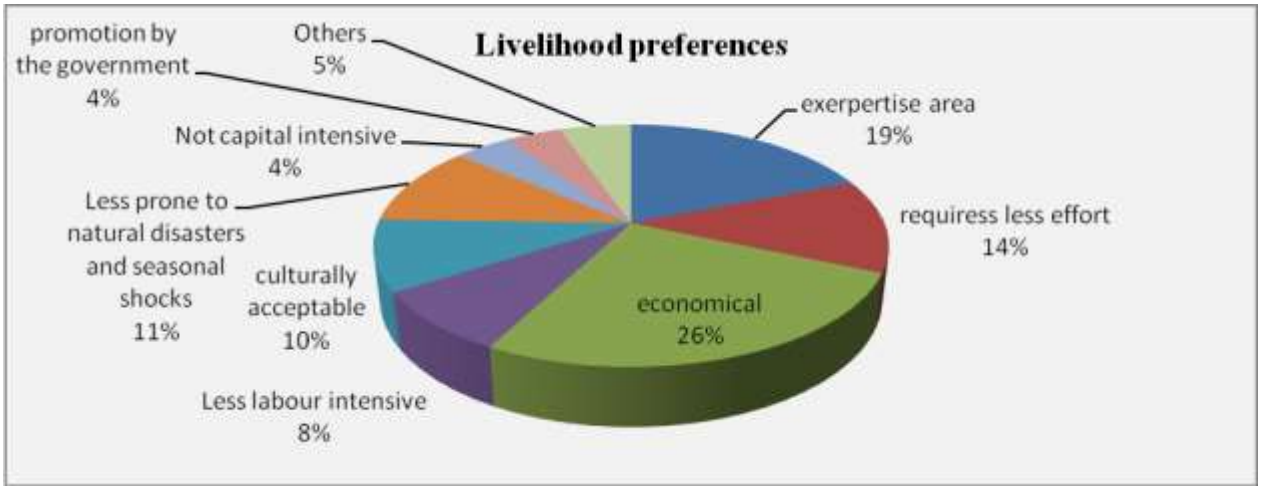

Figure 4: Factors determining preference of main livelihood source against alternatives

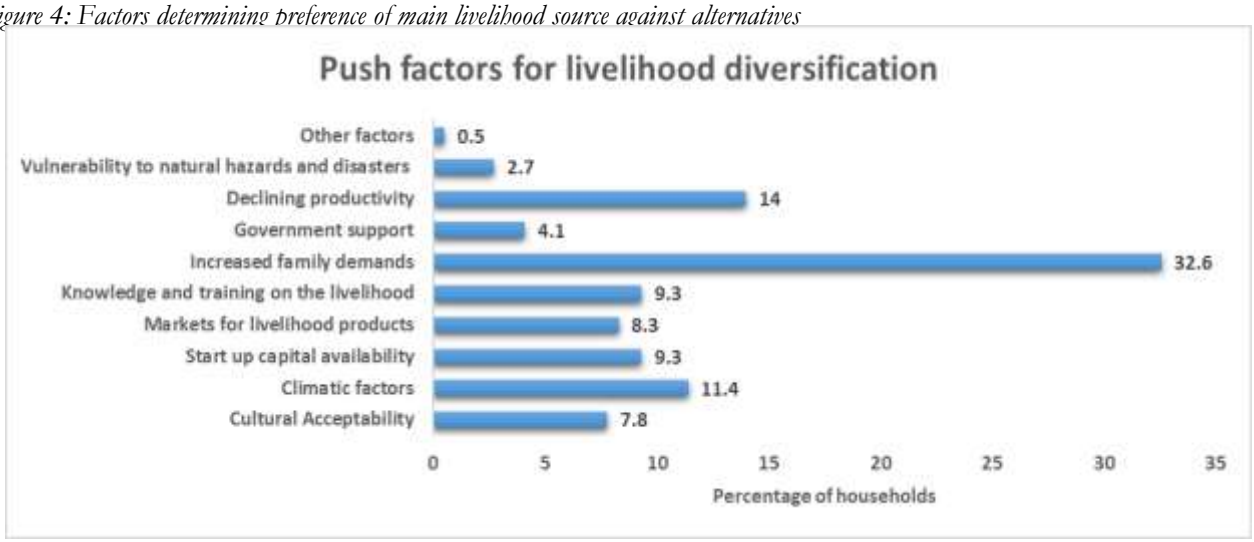

Figure 5: Push factors for livelihood diversification

Three sets of livelihood types were investigated, that is e*nhanced livelihoods* in which the household decides to add value to ongoing traditional or historically associated mainstream livelihood, diversified/Supplemental livelihood which includes elements of enhancing existing livelihoods and adopting "supplemental" strategies (making current practices more sustainable) and alternative livelihoods that involves completely changing occupations and is often for those involved (Pomeroy *et al.*, 2005). Based on this dichotomy, the study established that 29.7% cases indicated having switched completely to an alternative source of livelihood, and 69.5% kept doing their main source of livelihood even as they engaged in the other alternative source (supplemental livelihood). These findings were corroborated in focus group discussion with beach management members who indicated that supplemental livelihoods were their most preferred. A member observed thus:

We know that fishing as a livelihood has a lot of challenges and we are not happy engaging in it as our main source of
livelihood. However, we do know there is no alternative job and or employment for us; it is an easier way of starting up and a gateway to other alternative forms of livelihoods. If there are other sustainable sources we would be willing to take them up as supplementary livelihoods— Adult Male FGD, Beach Management Unit, Gazi

Further, 22.9% engaged in their main livelihood but on seasons when it became unsustainable either due to seasonal changes such as climate factors or declined productivity they switched to an alternative source but returned soon after the main source stabilized (enhanced livelihood). Supporting this view, is an observation in the focus group discussion where the fishermen observed that, fishing has declined because of too many fishermen, poor equipment,

Inferior fishing gears, and lack of equipment for deep sea fishing restricting them to shallow waters with less fish catches. They indicated that their current fishing livelihood requires enhancement with better fishing gears that are recommended and licensed and which are environmentally friendly.

The fishermen continued to explain that they are sticking to fishing only because they lack alternatives. They also recognize fishing as an old-time cultural inheritance which they would find difficult to completely shift from. One male participant in the Gazi FGD explained, *"Fishing is a cultural part of us and a lifestyle, it is not just a source of livelihood so we shall leave it but finally we shall go back to it or do it as part time job."*

Conclusively thus, the majority of the fishing community would rather continue engaging in fishing or their main source of livelihood supplementing it with other sources. This supports the view of Campbell (2008), that opines that a change from one livelihood to another is not always the only way forward and that enhancing existing livelihoods also has a role to play and can facilitate a more profitable livelihood and reduce the need to engage in destructive activities. It also confirms the position of Pollnac *et al*., (2001) that „providing or facilitating uptake of alternative livelihood activities may not necessarily cause fishers to leave a fishery", and that „addition rather than substitution of activities may take place." It also gives credence to the doubts cast by Hoof and Nathalie (2017) that fishers would be least likely to abandon fishing completely if they found other employment and were more likely to combine the two.

3.5Readiness for diversification

The study sought to determine how willing the households were to consider an alternative livelihood source. It was realized that 38.4% were strongly willing to consider other sources of livelihood, while 49.1% were willing with only 13% not willing to diversify and instead stick to their current source of livelihood. The study therefore established that majority of the community members are willing to consider other sources of livelihoods if well addressed thus will be able to progress economically and socially.

4.0 Conclusion and recommendation

A low level of diversification is reported among the fisher communities in Kwale County. Six (6) variables are found to be significantly and strongly associated with the dependent variable, (extent of livelihood diversification). They include: (Gender of Household Head, Training on livelihood, Household dependency ratio, Social Assets Value Index, Financial Assets Value Index, Membership to social organization and Fisher folk attitude and identity). The study finds no significant association between age and level of diversification. The level of education is equally found not significantly associated with level of diversification contrary to related studies in farm-based livelihoods. In line with this finding, it is advised that programs that encourage diversification among fisher households need to focus on the identified determinants and tailor make their programs while considering these key determinants if they are to succeed in influencing the fisher households towards livelihood diversification. There is also high willingness to turn to alternative livelihoods by the fisher folk with much focus on supplemental livelihoods as opposed to alternative livelihoods.

Given that most fisher households combine fishing and non-fishing strategies; livelihood intervention programmes should prioritize improvement of the non-fishing activities. Understandably, this will take away some pressure from the fish stock by allowing the fish stock to regenerate. In consideration of these findings, the study recommends prioritization of non-fishing livelihood sources such as seaweed farming, apiculture, mangrove planting, small business enterprises among others. To be successful, however, support in the form of credit and training must go together if alternative income sources of the house-holds are to be relied upon.

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