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LIVELIHOOD DIMENSIONS OF THE IMPACT OF AQUATIC PLANTS INVASION OF WATERWAYS ALONG THE RIVER NUN IN SOUTHERN NIGERIA

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ABSTRACT

The marine ecosystem is a valuable resource characterized by a variety of aquatic plants and animals; which help to provide vital ecosystem services. However, the issue of water plant menace along waterways in Nigeria has generated much concerns and debates in recent years, especially in Southern Nigeria where a great number of communities are in the coastal areas with a large rural population who depend basically on fishing, farming and forestry activities. This study evaluates the livelihood dimensions of water plants invasion of the River Nun in Southern Nigeria. The River Nun is an important economic water route in Southern Nigeria, and with various adjoining creeks, the river strongly supports local water transportation and other economic activities. The river is constantly under serious threat by invasive water plants which most times form plant colonies that either float or encroach on the waterways. The study involved 120 respondents randomly selected from coastal communities along the Southern Ijaw area of the River Nun in Bayelsa State. The ordinal regression analysis carried out suggests that water transportation, fishing and farming are among the impacted economic activities; with boat drivers, fishermen and farmers respectively possibly being the most affected by the negative impacts of water plants invasion of waterways along the River Nun. The study encourages the government and relevant stakeholders in the maritime sector; to undertake urgent remedial measures to routinely prevent or control invasive aquatic plants on waterways along the River and other affected waterways across the country; to minimize the impact on the livelihood of people living in the coastal areas. Also, the government and corporate organizations should collaborate with researchers and academic institutions to promote increased in-depth research and scientific experiments to identify various ways to use potentially invasive plant species for economic purposes. More so, the maritime sector should provide adequate training to water transport workers and boat drivers, while extension officers should be equipped to provide necessary assistance to coastal farmers and fishermen whose livelihoods seem to be mostly affected by the daily impacts of the menace.

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INTRODUCTION

The marine ecosystem is a valuable natural resource that helps to provide vital ecosystem services. In fact, the survival of the planet; Earth also strongly depends on the relentless ecosystem services provided by most natural resources, such as the marine ecosystem; characterized by various water resources with a variety of aquatic (or water) plants and animals. In particular, the river is an economic wealth to coastal rural communities across the globe, including Nigeria; as it provides a long coastline that provides rural population the access to valuable economic resources (Udom *et al*., 2019). Besides a serene environment, the rural people, including farmers have a strong desire for wealth (Tang, 2019), and engage largely in various economic activities such as farming, fishing, lumbering, hunting and gathering of valuable wild resources (Ekpebu & Ukpong, 2013). Amidst these economic benefits are notable associated problems arising from changes in the marine ecosystem, climate change challenges and unsustainable or poorly-managed human exploitative activities; this view is also confirmed by Udom *et al*. (2019) and Ukpong (2012).

Looking at the ecological perspective, water plant colonies can form a massive mat of floating plant matter (biomass) on the water surface, blocking off sunlight and depleting oxygen in the marine ecosystem, thus hindering bioactivity in the marine environment, and capable of depriving submerged flora species the energy for biological processes such as photosynthesis (Chamier *et al*., 2012). Also, decaying biomass from floating plant colonies may result in the water having an unpleasant taste and odour (Jones, 2001).

Many invasive alien plants have higher evaporation rates than indigenous species do and therefore, use more water than the vegetation they replace (Malan & Day, 2002). Cullis *et al.* (2007), also confirms loss of usable water due to invasive plant species. The invasion and rapid spread of aquatic plants are indicators of declining water quality and have also been linked to increases in water-borne, water-based and water-related diseases (Masifwa *et al*., 2001; Chamier *et al*., 2012). Beside the ecological impacts as observed in different parts of the world, this study specifically seeks to evaluate the statistical dimensions of the livelihood implications of invasive water plants along the Nun River, which serves as a major economic and transportation route to many coastal communities in Southern Nigeria. In particular, the coastal communities in Southern Ijaw Local Government Area of Bayelsa State; where this

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study was carried out, have a majority of the rural people who are almost exclusively dependent on fishing, agriculture (coastal farming), forestry activities and water transportation for their livelihood.

Besides the ecological and economic implications of the aquatic plants, it is obvious that free-floating plants or invasive plant colonies also pose a threat to traditional sources of human livelihood in the area; as they frequently invade or encroach waterways along the river.

According to Ukpong *et al*. (2020), there is no doubt that floating plant colonies potentially affects economic activities of people in the coastal areas; impede on fishing activities along waterways, and could affect boat engines; which is a potential safety risk on a busy water route such as the River Nun. In fact, as further emphasized by Ukpong *et al*. (2020), free floating water plant colonies constitute one of the most critical maritime problems along the coastline of the River Nun; while the River faces increasing menace of fast growing plant species encroaching into its waterways from various locations of its coastal banks. These facts incite serious concerns about the implications on livelihood of the rural people and safety of water transport users, against which this study was carried out to evaluate.

MATERIALS AND METHODS

This study was carried out in Southern Ijaw Local Government Area of Bayelsa State particularly coastal communities located along the coast of the popular River Nun. The river has a long coastline, with daily incidence of free-floating invasive water plant colonies and observable prominent water plant encroachment locations.

The study involved a total of 120 people selected from communities located along the Ayama and Ekowe communities axis of the River Nun; these include thirty (30) farmers, forty (40) boat drivers and fifty (50) fishermen who voluntarily participated in the questionnaire survey. The study employed the Descriptive Statistics to evaluate the livelihood implications of water plant invasion and encroachment of waterways along the River Nun; and the Ordinal Regression analysis to determine the statistical relationship between responses on negative impact thresholds and selected socioeconomic indices of the respondents such as gender and occupation. The results are presented in Figure 1 and Table 1.

RESULTS AND DISCUSSION

The Ordinal Regression, specifically enabled determination of the most vulnerable or most affected group of people or economic activities in the area; with regards to the negative impacts of water plant invasion of the River Nun. The result as indicated in Table 1, suggests

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that boat drivers, fishermen and farmers respectively are the most vulnerable groups to the negative impacts of water plant invasion of the River Nun. Also, the result suggests that female population in the study area might be comparatively most vulnerable to the negative impacts of water plant invasion of the River.

The assumptions of the regression analysis are further strengthened by the descriptive perspective indicated by a Histogram showing Cross-tabulations between Occupation/Gender variables and levels (or thresholds) of negative impact of water plant invasion of the River Nun. By observation, only farmers indicated a moderate viewpoint on the negative impact of plant invasion (Figure 1). Compared with farmers, fishermen and boat drivers did not indicate any of the low impact thresholds (*no impact and low impact*), with boat drivers indicating only higher impact thresholds (*serious impact and very serious impact*) beyond the midpoint (*moderate impact*). Another interesting observation as displayed on the Histogram is that; female respondents seemed to completely ignore the lower impact thresholds compared to male respondents whose responses spread across all levels of negative impact thresholds.

By inferences, it is obvious that free-floating water plants greatly interfere with economic activities along the waterways, and hamper navigation of boats including fishing boats and passenger boats, as well as canoes and vessels. Also, plant encroachment locations and detached colonies would interfere with fishing activities by obstructing fishing nets and making fish/seafood catch difficult; which have a significant impact on the livelihood of fishing households who are among the predominant population in the coastal areas.

The result also suggests that invasive plant menace pose a constraint to agricultural activities, perhaps by occasionally invading farmlands along the coastal areas following high water tides, thereby positioning as, or left to form a part of, weed population that would need to be removed. These would not only pose unnecessary stress on the farmers but also, the plant washed offshore on farms could settle on seed beds or young plant seedlings; causing delayed germination or death of seedlings, thus resulting in the need for replanting or reseeding. On the other hand, plant invasion of farmlands as a result of being washed offshore creates additional labour demands, economic loss and economic costs on coastal farmers.

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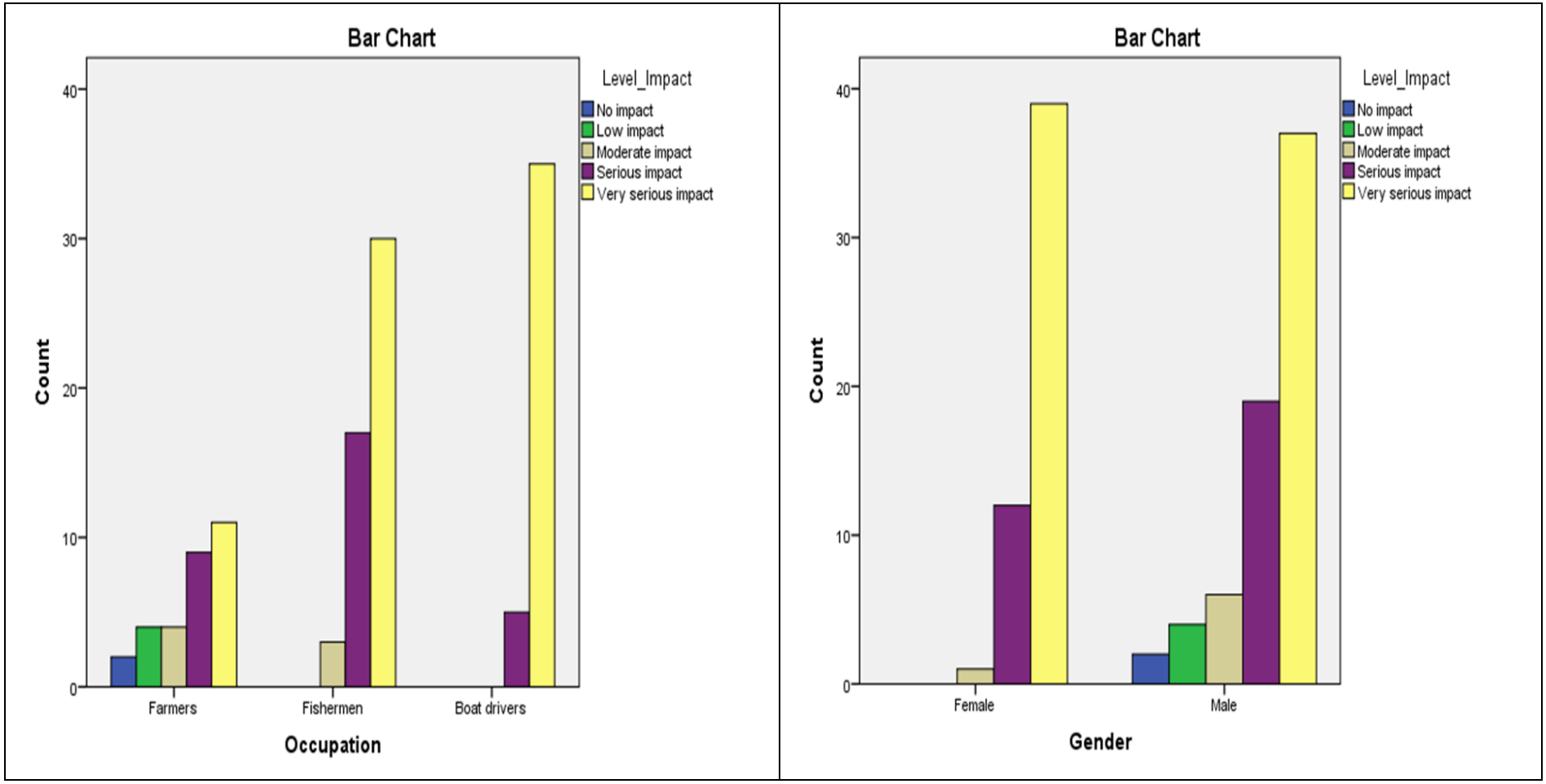

Figure 1. Histogram showing Cross-tabulations between Occupation/Gender variables and Levels of Negative Impact of Water plant invasion of the River Nun

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Ordinal Regression Results

Parameter Estimates

Variable		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[No_Impact = 1]	-6.361	.921	47.686	1	.000	-8.167	-4.556
	[Low_Impact = 2]	-5.048	.697	52.484	1	.000	-6.414	-3.682
	[Moderate_Impact = 3]	-3.930	.607	41.883	1	.000	-5.120	-2.739
	[Serious_Impact = 4]	-1.709	.488	12.247	1	.000	-2.667	-.752
Gender	[Female =0]	2.242	.496	20.421	1	.000	1.269	3.214
	[Male =1]	0[a]	.	.	0	.	.	.
Occupation	[Farmer =1]	-4.023	.688	34.172	1	.000	-5.372	-2.674
	[Fishermen =2]	-2.350	.617	14.493	1	.000	-3.560	-1.140
	[Boat driver =3]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero as a reference variable.

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CONCLUSION

The study among other findings has been able to statistically establish the relationship between the negative impact of water plant invasion and livelihood status of people in coastal rural areas along the River Nun in Southern Nigeria; with the highest negative impact suggested to be more on water transportation business, fishing and farming respectively.

In a wider perspective, an impact on water transportation could have an extensively resonant effect on the socioeconomic and livelihood status of people in the coastal areas. Thus, this study re-emphasizes the need for remedial measures to help enhance economic recovery and improved livelihood of people in the coastal areas.

The study also suggests the need for government and corporate support to coastal population; to enable them develop or promote indigenous methods of preventing or coping with the daily menace of water plant invasion. For instance, farmers might need extension services and training to enable them to protect their farms and crops from invasion by free-floating water plants. Again, fishermen and boat drivers would need to be given professional training to be able to cope with the daily risks and economic implications of plant invasion of the waterways.

More so, there is a need for multinational organizations, government and relevant agencies that are significant stakeholders in the maritime sector; to engage in or sponsor necessary routine preventive and control measures that would help minimize the impacts of the menace along the waterways. Above all, the study reemphasizes the need for increased research on the subject matter. Such research works should be supported or fully funded by relevant stakeholders; such as the government, multinational organizations, the Niger Delta Development Commission (NDDC), the Maritime related organizations, and international research funding agencies. In particular, funding should be provided for researchers and institutions in the area to help in further research on the biology, ecology and large-scale industrial and economic applications of valuable water plants in the area. This would help in harnessing the economic benefits of some of these aquatic plants.

Indeed, the River Nun is a uniquely valuable natural water resource which serves as an important water route that connects several coastal communities, farms and oil and gas installations in Southern Nigeria. Thus, a continuous maintenance of its waterways would promote ecological buoyancy, economic growth, maritime safety and improved livelihood of people in the coastal areas.

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