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ORIGINAL RESEARCH

THE BENEFITS AND CHALLENGES OF SARGASSUM SEAWEED TO THE LOCAL FISHING COMMUNITIES IN NIGERIA

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Abstract:

Introduction: The presence of Sargassum seaweed on the sea across the globe has been harmful and helpful to the economy. It has been a great threat, particularly to the survival of the fishing industry in coastal African countries where found.

Aims: This study examined the benefits and challenges of Sargassum seaweed to the local fishing communities in Nigeria.

Materials and Methods: This exploratory research used a Key Informant Interview (KII) approach to obtain relevant information from the key stakeholders in the fishing industry. The respondents were randomly selected along the fishing coastal communities in Nigeria.

Results: The findings showed that the occurrence of Sargassum seaweed on the sea is seasonal. The presence of Sargassum on the sea or waterways had prevented fishermen from going to the fishing grounds, leading to loss of catches, deaths of fish (e.g. barracuda, shiny nose), the clogging and tearing of fishing gears, thereby affecting their livelihoods and income. It has equally led to the release of offensive odour in the coastal communities and its mass has been a breeding ground for mosquitoes.

Conclusion: The occurrence of Sargassum seaweed has been of no direct benefit to the fisherfolks and coastal environments. It has, however, indirectly provided employment opportunities for young men who cleared its debris and provided a diversified source of income to the fishing households. Thus, it was recommended that in-depth research should be specially conducted on Sargassum through collaborative efforts by relevant institutions to explore the potential benefits of Sargassum seaweed as done in some Caribbean countries.

To Keywords: Sargassum seaweed, challenges, benefits, livelihoods, fishing communities

All co-authors agreed to have their names listed as authors.

1. INTRODUCTION

Globally, seaweeds are classified by appearance into green, brown, red, and blue-green [1]. Accordingly, by habitats, the green seaweeds are commonly found in the intertidal zone (e.g., sea lettuce), brown seaweeds commonly inhabit the tidal zone (e.g. Sargassum), red seaweeds are mostly found in subtidal waters (e.g. Gracilaria), and blue-green seaweeds (e.g. Lyngbya) are found in supra tidal regions [1]. Sargassum seaweed, also known as brown alga or gulfweed, belongs to the family Sargassaceae and order, Fucales [2]. It is of many species, but the two main species are the Sargassum fluitans and Sargassum natans [3]. According to [2], the nutrient constituents of Sargassum hystrix var. fluitans are high in carbohydrates (58.72%), ash (18.5%), fibre (17%), and moisture (14.33%) among others.

Although the causes of the recent blooms of Sargassum in coastal areas in Africa are yet unclear, sea surface temperature, sewage disposal, asexual reproduction, and free-floating features of this seaweed have enhanced its capabilities to spread and colonize new habitats quickly [4-5]. It grows faster with factors such as more nutrients of debris from flood, urbanization, and logging pollution [3]. Its invasive tendency is equally aided by its floating and asexual reproduction. This seaweed, although more prevalent in the Caribbean, is rapidly seen spreading between West Africa and Brazil, which is now called the Great Atlantic Sargassum Belt [3].

The presence of Sargassum seaweed globally has generated contrasting effects: harmful and helpful especially to the economy and fishing activities where found. In the Caribbean, Sargassum has smothered beaches and inhibited swimming (tourism), reduced access to gears and fish catches (fisheries), increased hydrogen sulfide, and killed wildlife such as turtles (health and environment), thereby resulting in loss of earnings in tourism and fisheries' harvest and post-harvest sectors [3]. At the same time, the presence of Sargassum in this region has brought opportunities to the coastal communities which cannot be underplayed [3].

According to [6], in a project being supported by the Blue-Chip Foundation in Trinidad and Tobago, the University of West Indies (UWI) is executing the project that will see vehicles running on a fuel made of Sargassum seaweed in combination with wastewater from rum factories. The aim is to have a quarter of Barbados' cars running on this fuel. This is expected to be achieved by facilitating a climate of innovation and entrepreneurship among the students and university staff. In another study by [7], Sargassum fulvellum has been invaluable to the pharmaceutical industry. They investigated the potential uses of sargassum seaweed and found that it has components that exhibit antipyretic, analgesic, antiedema, antimicrobial, antioxidant, antitumor, neuroprotective, anticoagulative, anti-inflammatory, hepatoprotective, immunomodulatory, antidiabetic, and anticancer effects. In addition, sargassum has been widely used as a food additive in East Asian countries, organic fertilizer/manure, animal and fish feed, biofuel, hair care products, building materials, and oriental medicine in treating lumps, dropsy, swelling, testicular pains, and urinary problems [3, 7-8].

In Nigeria, the coastline stretches from the boundary with the Benin Republic in the West to the Cameroon border in the East covering 853km [2]. In 2012, the Nigerian media reported the presence of an unknown seaweed floating massively on and off the coastal areas of some states (Ondo, Ogun, and Lagos) in South West. The two species of the plant-like brown macro-algae identified in the Nigerian coastal environment yearly during the wet season (April-July) are Sargassum natans and Sargassum fluitans [5]. They are alien to Nigeria's coastal ecology and have invasive tendencies that require prompt attention due to devastating effects on fishing activities and coastal communities [2]. Although Sargassum has the potential to provide materials for the development of other agricultural and non-agricultural products, it is still not (poorly) utilized [2].

In another dimension, the presence of Sargassum has negatively impacted the coastal communities and fisheries sectors in West Africa. For instance, Sargassum in coastal waterways in Nigeria has led to the clogging of fishing gears and entanglements of engine propellers [4, 9, 2]. This has prevented fishermen from going to their fishing grounds and a reduction in fish catch, fishing period, and income. Assessment of influxes of Sargassum has revealed that this seaweed can accumulate heavy metals such as arsenic and cadmium which may pose a risk to human health and the environment [10]. Thus, calling for more in-depth studies to be conducted. Although methods such as biological (herbivores), chemical (though restricted due to health and wildlife), and physical/mechanical (human efforts but laborious) have been employed in managing this seaweed in Nigeria [5], efforts towards turning it into economic advantage are still limited.

Despite the various uses of Sargassum seaweed globally, its use is limited in Nigeria. For instance, industrial use of Sargassum has not gained much attention in Nigeria as in some places across the globe. This is partly due to limited knowledge about the potential of this seaweed [5]. Against this background, the following research questions were raised: Have the challenges caused by Sargassum around coastal communities in Nigeria changed? Has the presence of Sargassum seaweed in the coastal communities brought any benefits? What efforts are being employed to manage the challenges posed by Sargassum seaweed? The specific objectives were to examine the changes in the challenges of Sargassum faced by fisherfolks in coastal communities in Nigeria; explore the possible benefits the occurrence of Sargassum seaweed has brought to the coastal communities in Nigeria, and identify efforts employed by fisherfolks in coastal communities in managing the challenges posed by Sargassum seaweed.

The demand for seaweed and its products has increased exponentially globally, over the last 25 years. Similarly, Africa and its offshore islands have remarkable potential for seaweed production to contribute to world demand [11]. Although the Sustainable Development Goals have been accepted in Africa, their adoption in the region has lagged behind the rest of the world. Minimal progress has been recorded with some countries recording complete stagnation [12]. Many sub-Saharan African countries are not progressing making significant progress towards achieving various Sustainable Development Goals. Achieving the conservation and sustainable use of the oceans, seas, and marine resources for sustainable development (Goal 14) is threatened by the presence of Sargassum. In addition, water resources are important to agriculture and diversification plans in Nigeria. Thus, the presence of Sargassum seaweed in Nigeria if not addressed, could hamper the economic development of water resources and lives around coastal communities.

Empirically, [13] worked on seaweeds in Nigeria with special attention to the potential of culture, exploitation, benefits, and utilization. [2] assessed the impacts of an invasive Sargassum seaweed on the fisheries and other economics in Nigerian coastal waters. [5] examined the invasion of pelagic Sargassum in West Africa. [9] related climate change effect and the perceptions of Nigeria's coastal communities on the presence of Sargassum species. [4] discussed the Sargassum impact in West Africa (Senegal to Nigeria). [14] worked on reporting the first occurrence of Sargassum seaweed in Nigeria calling for more research on it. However, this is an exploratory study that focused more on the challenges and benefits that the Sargassum seaweed has brought to the local coastal communities in Nigeria. Thus, contributing more to the frontier of knowledge in this niche, and revealing more where its potential can still be harnessed, and providing policy options in this regard.

2. MATERIAL AND METHODS

2.1 STUDY AREA

The study was conducted in coastal communities in Nigeria. Coastal communities in Nigeria span from the boundary of Benin Republic in the West to the border of Cameroon in the East [2]. The study area in Nigeria and the presence of Sargassum seaweed in West Africa are shown in Figure 1 and Figure 2, respectively.

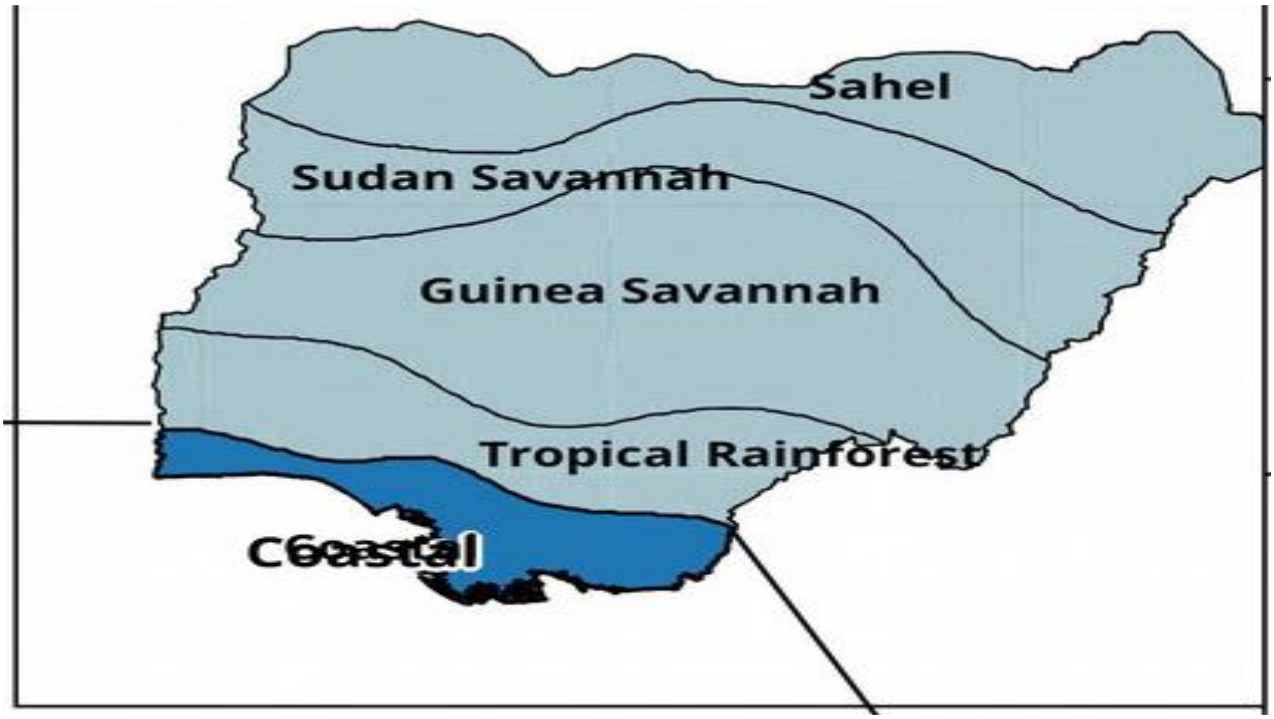

Figure 1: Map showing the coastal area (blue colour) in Nigeria. Source: Adapted from [15].

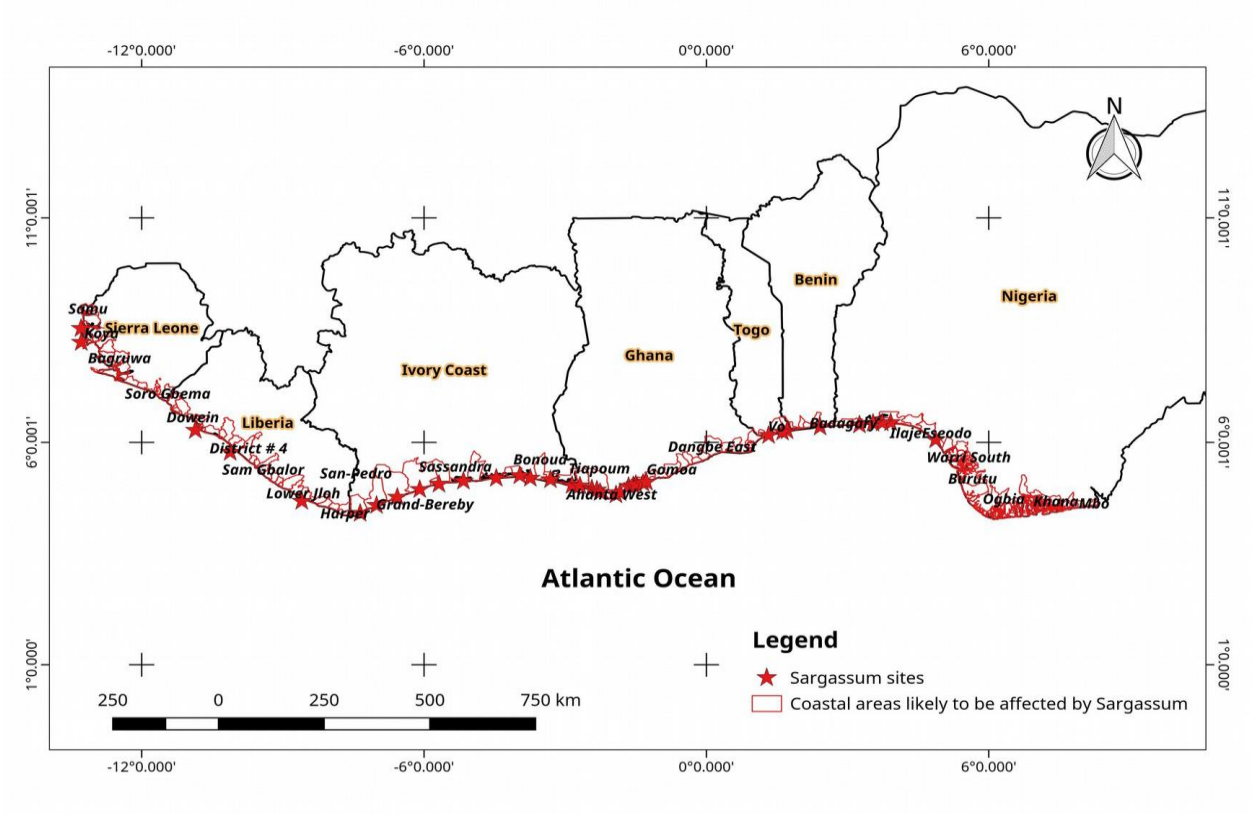

Figure 2: Mapping of coastal areas in West Africa showing the presence of Sargassum seaweed Source: Adapted from [15].

2.2 DATA SOURCE AND SAMPLING TECHNIQUES

Primary data was used for the study using an explorative approach (qualitative). Key Informant Interview (KII) was used with the aid of a KII guide to obtain the data from various key stakeholders in fishing industries, such as Fisheries Cooperatives, industrial fishermen, fishing crew members' supervisors, and fishers among others, along the coastal communities for this study. Several seaweeds do occur concurrently on the sea, and to avoid mix up about the seaweed, the study ensured that the pictures of the Sargassum were shown to the respondents (**See Figure 3**). Data collected involved challenges, benefits, occurrence, control method, and knowledge of Sargassum among others. Thirteen (13) respondents varying from fishermen to captains in the fishing industry were randomly selected along the coastal communities in Nigeria. The respondents were categorized into: Fishermen (2), Fisheries Cooperatives (3), managers in the fishing industry (2), Supervisors in the fishing industry (2), and Captains in the fishing industry (4).

Figure 3: Pictures of Sargassum

2.3 ANALYTICAL TECHNIQUES

This study employed descriptive statistics and narrative analysis using a thematic approach since the research was an exploratory study.

3. RESULTS AND DISCUSSION

3.1 Gender and Knowledge of *Sargassum*

The findings from the interviews revealed that two out of thirteen interviewed were female; representing 15.4 percent of the total respondents (**See Table 1**). Implying there are more men into fishing activities than women as also stated by [9] who found that about 70 percent of the household heads in fishing or coastal communities were men. The two women were deliberately interviewed to know the indirect effects of *Sargassum* on their businesses as receivers of catches, processors, and marketers of fish and fisheries products, as their community is not directly opened to the Sea. Only 46.2 percent of the respondents know the local name for Sargassum seaweed in the area, which is called *fetu* by most people. Sargassum seaweed in coastal communities in Nigeria appears more in the wet seasons than in the dry season (it is seasonal). The cause of *Sargassum* seaweed along the coastal environment is yet unclear to the respondents. This is in line with the findings of [9] who found that coastal population

knowledge about the reason for the occurrence of *Sargassum* species, is limited due to low education level and limited information access.

The occurrence of *Sargassum* in these coastal communities has led to disruptions in fishing activities and loss of income to households whose livelihoods depend on it. This finding is supported by [2] who found that the spread of *Sargassum hystrix var. fluitans* along the coastal communities has negatively impacted fishing activities via limited access to fishing grounds. Although physical/mechanical methods have been employed by most of the respondents to clear *Sargassum* seaweed from the sea surface, most respondents have done nothing to address the presence of *Sargassum* on the fishing grounds. This leads to the loss of man-hours used in clearing the seaweed [2]. Nothing is done to the washed debris of this seaweed at the shore. It is left to decay. It generates odour that makes the air unhealthy and has become a breeding ground for mosquitoes, aiding malaria in the coastal environment. This supports the findings of [16-17] who found that the decomposing *Sargassum* usually causes oxygen depletion, eutrophication, and releases hydrogen sulphide which threatens the health of human and coastal ecosystems. There have been no direct government or local interventions to address the challenges posed by *Sargassum* seaweed in the environment.

Table 1: Distribution of respondents by gender and knowledge of the local name of *Sargassum*

Variables	Frequency	Percentage
Gender		
Male	11	84.60
Female	2	15.40
Total	13	100.0
Knowledge of local name of Sargassum		
Yes	6	46.20
No	7	53.80
Total	13	100.0

Source: Field survey, 2021.

Specifically, the narrative of the interviews is given as follows:

Respondent 1

She is an executive member of the Ifelodun Cooperative Society Agbowa Ikosi made up of 30 women members who make 8 days' contributions yearly to meet members' needs, and they collect yearly registration fees from members. She is aware of *Sargassum,* but only about 2 years ago and she does not know the local name for *Sargassum.* It is not frequently observed but more now during the dry season when the water gets hot. They sometimes drift to their locations during the wet season too. It is dangerous to humans not in itself but because of other animals that hide under it that are dangerous to humans. Sometimes, those animals can kill. The thick mass of Sargassum weeds causes the death of fish, which makes them of no economic use. The weed, together with water hyacinth, block the way to the sea, and fishermen must stay far from shore while smaller boats are used to ferry goods and people to and from with utmost care using wood to clear the way. This seaweed is seen as a curse because it blocks their way of livelihood since they cannot get fish from the fishermen to process. The months of November to December are unsafe for fishermen to go to sea because of the co-existence of both water hyacinths in the rivers leading to the sea and *Sargassum* in the coastal waters of the sea. Influxes of Sargassum in coastal communities have led to the loss of livelihoods and economic opportunities for fishers [16]. She reported that the occurrence of *Sargassum* makes most of them engage in alternative means of livelihood such as piggery and catfish production to make ends meet. There has been no direct government intervention in addressing *Sargassum* seaweed. No financial support to cope with in times of no activities. The government once told them to register with a bank for general financial support which they did but to date no assistance yet.

Respondent 2

This is a female respondent in Irepodun Fish Processors Cooperative, Agbowa Ikosi, Lagos state. The association consists of 30 women members. She does not know the local name for *Sargassum* except

that they call it brown weed. It appears more in the wet season. The weed right now (August) is all over their waters with water hyacinth combined, making it impossible to go to sea for the last 3 months because the seaweeds have blocked their waterways completely. *Sargassum* traps heat because there is no movement, which makes the water hot and kills fish such as barracuda, shiny noses, and shrimps that normally hide under them. The dead fish become of no use to them, which is a great waste to us. The fishermen must disentangle the seaweed from the nets, which is extra labour, that provides job opportunities to young men in the community as the nets must be cleaned. Also, the young men before were paid to dig holes to bury the seaweed using wheelbarrows to transport them because of the offensive odour they emit. The odour is said to attract mosquitoes causing malaria in the community. Whenever there was no fish to process for about 3 months, their husbands became supportive and children whom they had trained that are now working support them in this period.

Respondent 3

He is the chairman of the Fishermen Cooperative Society in Lagos State. According to him, the presence of Sargassum seaweed is strange (not native) to our coastal waterways. He is not aware of its local name. It appears on top of the waters in creeks, thereby preventing us from fishing. The state government once came to address the challenges this seaweed created for us fishermen, but unable to do anything about it to date. It does not occur all around the year in our waterways. It starts disappearing in December. It carries our fishing gears away as if it were a ghost. We have lost a lot of money because of the presence of this *Sargassum* seaweed. It has not been of any benefit to us (fishermen) in our community.

Respondent 4

This is a male respondent and a captain in the fishing industry. This new seaweed is reported along the entire coast of Nigeria. Its occurrence in our sea or fishing grounds has occupied half of Nigeria's territorial waters, precisely from Lagos anchorage to Dodo beach in Bayelsa State. This seaweed is not common in our fishing grounds and has not much effect. It appears more towards the dry season (harmattan season). The seaweed is harmful to fish species except for wild tiger that survives inside this seaweed due to its hard nature. It produces heat and odour when the debris is decaying or decomposing but there has been nothing to control it other than to bury the debris washed at the shore. The mass of this seaweed is equally breeding mosquitoes.

Respondent 5

This is a male respondent of 42 years. He is a supervisor in the fishing industry. He has been working in this industry for 18 years. He is aware of *Sargassum* seaweed, and it does appear annually on the surface of our sea. It has always been a disadvantage to their fishing activities. This seaweed affects our number of catches of fish and crayfish whenever and wherever it appears. Its presence on our fishing ground signifies a loss period. This is in line with the findings of [18] in Ghana who found that the influx of *Sargassum* has negatively impacted coastal communities via a reduction in fish catch and fishing effort, leading to loss of investment and sustenance. When the debris of *Sargassum* is washed to the shore, it is burnt up by the sun after some hours. Nothing has been done by the government to address the presence of *Sargassum* seaweed on our sea and coastal community or individuals have not done anything to address it. If indeed the *Sargassum* seaweed has any benefit, the government should intervene on time for the benefit of the economy, especially for the lives around the coastal community.

Respondent 6

A male respondent of 39 years. He is a fish farmer with 15 years of experience in fishing activities. He is aware of *Sargassum* seaweed, but the local name is not known to him yet. The presence of *Sargassum* on the sea disturbs fishing activities through clogging of our fishing nets and engines. Its debris also causes a lot of dirt on the shorelines. Nothing has been done to address the mass of sargassum on our fishing grounds either by the government or the local coastal community.

Respondent 7

He is from Temidire, Sea Beach, Gberefu Ilaje 2, Lagos state. This is a male respondent aged 42 years. He is a manager/captain in the fisheries industry. He has had a long experience of 18 years in fishing activities. His fishing location and landing site is Temidire Gberefu Ilaje 2, Seabeach. He is very much aware of the *Sargassum* seaweed, and he first noticed the presence of *Sargassum* in 2010 (11 years ago). His experience with the *Sargassum* seaweed is that it appears annually on water from April to December but mostly during the wet season. Its presence has been a disadvantage to our fishing activities. The local name for *Sargassum* seaweed in this fishing environment is *fetu*. Nothing has been done to control the presence of this seaweed. The presence of *Sargassum* seaweed has caused a huge income loss to their fishing activities. This supports the findings of [18], which revealed a loss of income or investment due to the *Sargassum* influx. In controlling the presence of this seaweed, neither the fishers nor the government and fishing community have done anything worthy of note to overcome the challenges posed to fishing activities. *Sargassum* seaweed has been of no benefit to the fishing communities. They suggested government intervention in addressing the challenges posed by this seaweed to the fishing communities.

Respondent 8

He is from Temidire, Sea Beach, Gberefu Ilaje 2, Lagos state. He is 40 years old and he works as an engineer/captain in the fishing industry. He has been in this industry for 30 years. The location of the fishing ground and landing site is Gberefu Ilaje 2, Temidire Sea Beach. He is aware of the existence of *Sargassum* seaweed in this fishing environment. He first noticed this seaweed in the fishing ground in 2009, 12 years ago. The presence of *Sargassum* seaweed in the fishing ground has reduced the number of catches; both of fishes and crayfishes. The local name for *Sargassum* seaweed in this fishing environment is called Fetu. According to him, annually, Sargassum seaweed appears in their fishing ground from June to October. It is mostly noticed during the wet season. Nothing is done to the *Sargassum* seaweed debris when washed to the shore. The amount of income lost due to the presence of *Sargassum* seaweed on the fishing ground is difficult to quantify; it is enormous. Some of the challenges we face because of this seaweed on our sea include damage to our fish and crayfish net, and clogging/damaging of the engine of our fishing machines. Nothing has been done to control *Sargassum* seaweed whenever it appears on their fishing grounds. There has been no government intervention in controlling the seaweed and nothing has been done by the fishing community or individuals to control it. It has been of no benefit to the fishing community and fishing activities. It was suggested that the government should intervene to control this seaweed on the fishing ground.

Respondent 9

He is from the Gbagada community, Lagos state. The age of the respondent is 51 years. He is a manager in the fishing industry. He has been in fishing activities for 35 years. The name of the landing site is Gbagada Sea Beach while the fishing ground is Gbagada Sea Beach, Badagry. He is aware of the *Sargassum* seaweed, and the knowledge came about 25 years ago (1996). This seaweed has damaged their fishing nets. The local name for *Sargassum* seaweed in this fishing environment is *Fetu.* According to him, *Sargassum* seaweed appears annually on this fishing ground from April to September in the wet season. We have done nothing to the debris of *Sargassum* seaweed whenever it is washed to shore. It only pollutes our environment [16-18]. I have lost up to ₦150, 000 ($376.03, in 2021[1]) to the presence of this seaweed on the sea. In addition, the presence of *Sargassum* seaweed on our fishing grounds has reduced our catches and damaged our fishing gear (nets) [2]. Nothing has been done to control the presence of *Sargassum* on the sea and equally, nothing has been done by the government and fishing community to control this seaweed. It has neither been of benefit to fishing activities nor to the people living in fishing environments. He suggested that the government should do something quickly to correct the presence of *Sargassum* seaweed on our fishing grounds.

Respondent 10

He is from Airoji Sea Beach, Lagos state. He is 47 years old and a manager in the fishing industry. He has been working in this industry for the past 30 years. The name of his landing site and fishing ground is Airoji Sea Beach. He is aware of the presence of *Sargassum* seaweed, and he first noticed it about ten (10) years ago (2011). This seaweed always disturbs us by not allowing us to catch fish and tears our fishing nets. "I don't know any local name for it," he said. According to this respondent, the seaweed appears from September to November every year. Nothing is done to the debris of *Sargassum* that is washed to the seashore. The government and fishing community have not done anything to address the presence of *Sargassum* on the sea. *Sargassum* seaweed has no benefit to fishing activities and people living in coastal environments. In addressing the challenges of this seaweed in the coastal environment, government intervention is needed.

Respondent 11

He is a supervisor in the fishing industry from Daddy Sea Beach at Ajido, Lagos state. He is 48 years old with 21 years of fishing experience. His landing site and fishing ground is Daddy Sea Beach. He is aware of the *Sargassum* seaweed and first heard about it 16 years ago (2006). This seaweed floats on water and affects our fishing business/activities. We refer to it locally as a *flower*. It appears on water mostly during the rainy season but sparsely in the dry season. We have been unable to do anything to control this seaweed whenever it appears on the sea. Its presence on the sea has resulted in a loss of income annually, which is more than ₦200,000 ($501.39, in 2021[2]) because we hardly catch fish and crayfish when they appear. It has no benefits to us at all and we need the government's assistance to control this seaweed.

Respondent 12

He is a captain in the fishing industry at Gberefu Sea Beach, Lagos state. He is 39 years old with 16 years of fishing experience. His landing site and fishing ground is Gberefu Sea Beach. He is aware of the *Sargassum* seaweed and first heard about it 13 years ago (2009). This seaweed is not good for our livelihood or fishing activities. Locally, we call it *fetu.* It appears on water mostly during the wet season, from March to September, annually. We have not been able to control this seaweed. In other words, nothing has been done to control the appearance of this seaweed. Similarly, we have not done anything with the washed debris of this seaweed at the shore. Its presence on the sea has resulted in a loss of huge income because it affects our catches. The government has not given any support in this regard. It has been of no benefit to us, and we need the government's assistance to control this seaweed.

Respondent 13

He is a fisherman in the fishing industry at Gberefu Sea Beach, Lagos state. He is 34 years old with 11 years of fishing experience. His landing site is Gberefu Sea Beach, and his fishing ground is Gberefu Ilaje 1. He is aware of the *Sargassum* seaweed and first heard about it 10 years ago (2012). This seaweed has been a problem for us (fishermen). Locally, the seaweed is called *fetu*. It appears almost throughout the year but mostly occurs during the wet season. We have done nothing to control this seaweed. Similarly, we have not done anything with the washed debris of this seaweed at the shore. Its presence on the sea has resulted in a loss of a lot of money annually in this coastal community because it reduces our catches. The government has not given any support in this regard. It has been of no benefit to us, and I believe the government can be of great support in controlling this seaweed.

4. CONCLUSION

Many of the stakeholders in the fishing industry are aware of the presence of Sargassum in the coastal environment. It mostly occurs in the wet (rainy) season. The challenges faced by fishers on the sea because of the presence of Sargassum remain the same except that more has been discovered such as the foul-smelling of the decaying mass of Sargassum; which reduces the quality of air in the coastal environment. In addition, the Sargassum mass is also serving as the breeding ground for mosquitoes,

which could increase the prevalence of malaria in the area. It had reduced the number of catches of fish and crayfish thereby leading to a loss of income, for fishers, processors, or marketers. It has equally resulted in the loss of livelihoods due to the inability to go to the fishing grounds. However, it has indirectly provided opportunities/benefits to local fishing communities such as a diversified source of livelihood whenever they stayed off the fishing grounds e.g. Some have been involved in animal production, such as piggery and catfish production, to make ends meet. Also, a source of employment for young men who helped in clearing the mass of seaweed from the fishing nets and burying them in dug-out pits. Aside from these, its presence on the sea has not been of any benefit to the fishing industry and coastal communities. No meaningful efforts have been deployed to control the presence of Sargassum seaweed either by the government, communities, or individuals. Based on the findings and literature, the following recommendations were made:

1. With limited knowledge of the benefits of Sargassum seaweed in Nigeria, a collaborative effort of in-depth research can be made between government or private (industries) and any reputable university or research institute where the potential of Sargassum seaweed can be harnessed for the benefit of the economy, fisheries industry and coastal environments.
2. Equipment or a new technology can be developed to harvest Sargassum seaweed on waterways whenever it appears to ensure fishermen and other stakeholders have their way to the fishing grounds or as a source of livelihood.
3. The mass of Sargassum seaweed that is washed to the seashore should be properly processed or converted to manure or animal feed to prevent the odour and breeding of mosquitoes.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHORS' CONTRIBUTIONS

Areola, F.O. designed the study and was involved in the data collection, desk review, data analysis, report writing, proofreading of the manuscript. Osanyinlusi, O.I. was involved in desk review, data analysis, report writing, and manuscript corrections. Soyinka, O. was involved in report writing and proofreading of the manuscript. All authors read and approved the final manuscript.

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