

The Coastal Environment of Elmina in Ghana - Appraising the Causes and Effects of Coastal Pollution

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ABSTRACT

Coastal pollution is a serious threat to coastal ecosystem and dwellers whose livelihoods depend on coastal resources. Elmina is one of the major tourist destinations of Ghana owing to its attractive sandy beaches and many historical monuments. However, the coastal zone has been engulfed by marine debris, polluting the coastal environment thus decreasing its aesthetic attractiveness for tourism. The research investigated the causes, environmental and socio-economic impacts of the coastal pollution on the life of the people of Elmina and ecosystem. Social survey methods involving questionnaire administration, in-depth-interviews and focus group discussions were employed to collect field data. Systematic sampling process was used to select households for the questionnaire survey. Improper waste disposal, inadequate sanitary facilities coupled with weak enforcement of sanitation bye-laws among others accounted for the pollution and the unsanitary condition of beaches and consequently the spreading of diseases like diarrhea and typhoid. Revenue from beach tourism and income of fisher folks were also negatively affected by the polluted marine environment. The provision of adequate sanitary facilities, organization of regular clean-up exercises, education on sanitation and vigorous enforcement of coastal bye-laws are some of the proposed measures in curbing this menace within this tourist enclave of Ghana.

Keywords: coastal environment; coastal pollution; Elmina; marine debris; socio-economic life; waste management.

INTRODUCTION

Contamination caused by hazardous substances of maritime environments is a major environmental concern [50]. Coastal pollution is a serious environmental problem confronting many coastal communities in different parts of the world. Coastal societies in most parts of the world are facing crisis and threats as development, recreation and waste dumping activities rise [57]. Coastal pollution is defined as the introduction of impurities into the coastal environment which cause harm to marine species and human health. Coastal pollutants are constituents of waste; which include solid waste/marine debris, liquid waste and gaseous waste. This paper will look at the case of only marine debris pollution of coastal environments. Marine debris include items made or lost by people, and those deliberately discarded into or unintentionally lost in the marine environment including, among others, items of plastic, wood, metal, glass, rubber, clothing and paper [27,15]. Most marine debris consist of plastics [2,49]. Sources and pathways of marine litter are diverse, including rivers, drainage or sewerage

systems, and wind, and once there, debris persists, with its durability making it resistant to degradation [2,28]. Jambeck *et al.* [27,22] estimated that between 4.8 and 12.7 million tonnes of land-based plastic waste ends up in the ocean every year.

The incidence of marine debris is a cause for concern for several reasons [15]. Solid waste pollution has been reported to have damaged most of the coastal areas in the world by affecting coastal commercial activities and marine fisheries [30]. Marine debris is a problem at coastal zones and the floor of the sea at all depths, and its influence is of global concern [37,51]. Marine debris that collect along beautiful shorelines and waterways diminish the aesthetic attractiveness and gratification of those beaches and disturb tourism [43]. Rejected fishing lines, ropes and plastic bags can loop around and destroy boat propellers or penetrate boat engines [53], while medical wastes found on beaches can carry ailments, and fragmented glass and other piercing substances pose clear hazards for barefooted beachgoers [33]. Marine debris can

be fatal to marine wildlife as numerous species unintentionally consume trash [15,34]. Marine debris ensnare coastal wildlife such as sea turtles, manatees, sea birds and fish and destroy them [15,45].

Faecal deposits also often occur in zones where the nearby communities do not have enough toilet amenities and with tidal cycles these deposits are carried away into the sea and worsen the value of the water [55]. A Southern California study found that each year, faecal contamination at Los Angeles and Orange County beaches triggered between 627,800 and 1,479,200 excess gastrointestinal illnesses, with a public health cost of \$21 million to \$51 million [8]. There are other human health concerns emanating from the decay of marine litter [15,57]. Coastal pollution has affected various countries in the world. Economic activities such as shipping, fishing, aquaculture, tourism and recreation are directly affected by plastic pollution and the total negative impact on oceans has been estimated at least \$8 bn per year [15,53].

There are several global efforts aimed at addressing coastal pollution; reducing and preventing marine litter and for mitigating its impacts [28]. These include initiatives like the Global Partnership on Marine Litter (GPML), the Honolulu Strategy and the G7 countries, the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V, the EU Water Framework Directive (WFD, 2000/60/EC) and the Marine Strategy Framework Directive (MSFD) [28,50].

Current knowledge on the main causes of marine litter and about possible solutions offers a solid basis for effective actions [28,42]. Yet, it has become clear that so far, the effects of policies and other initiatives are still largely insufficient [22,15,28]. Although these environmental regulations are strict, polluting substances continue to be discharged into the seas, often illegally [50,20] owing to weak enforcement of the regulations. Elmina beaches and some of the major tourist destinations of Ghana are laden with marine debris. Without enough knowledge on the scope of the problem it is, however, difficult to develop legislation that is both adequate and effective [15].

This situation calls for a critical analysis of the underlying forces and environmental and socio-economic consequences of the pollution of marine environment that can help in policy development towards the realization of the SDG

14 as reduction of marine pollution is one of the targets of the Sustainable Development Goals (SDGs). Unfortunately, at the launch of Ghana's maiden SDGs indicator baseline report on September 8, 2018; Dr Felix Addo-Yobo of the NDPC said the baseline values for the indicators show that Ghana has a long way to go in achieving many of the SDGs target [16] (Ghana News Agency [GNA], 2018). This study was thus carried out to improve the knowledge regarding substances that are found in the marine environment, examine the causes and impacts of these pollutants on the coastal environment and socio-economic life/livelihood of the people in the coastal area of Elmina and make suggestions to control the problem in the area. Though this is a case study of a local problem, however, marine debris pollution is ubiquitous in most coastal tourist destinations in the developing world, so lessons from this study will shape policy formulations with a bottom-up focus (district-national-regional-global); that is, policies that reflect the local situation towards the attainment of global plans like the SDGs.

DESCRIPTION OF THE STUDIED SITE

Elmina coast is in Komenda-Edina-Eguafo-Abirem (KEEA) Municipal Assembly on the south coast of Southern Ghana in the Central Region (Fig.1). KEEA Municipal Assembly is one of the twenty (20) Metropolitan, Municipalities and District Assemblies (MMDAs) in the Central Region of Ghana.

Elmina is the administrative capital of the Komenda-Edina-Eguafo-Abirem Municipal Assembly bounded on the north by the Twifo-Hemang-Lower-Denkyira District, on the south by the Atlantic Ocean (Gulf of Guinea), and on the west by the Mpohor-Wassa East and Shama Districts and on the east by the Cape Coast Metropolitan Area. It is situated between longitude $1^{\circ} 20'$ - $1^{\circ} 40'$ West and latitude $5^{\circ} 05'$ - 15° North. The Municipality occupies an area of 452.5 square kilometres with a population density of 319.8 persons per square kilometre [11]. Elmina coastal area is situated on a south-facing bay on the Atlantic Ocean coast of Ghana which stretches 12 km within the Central Region west of Cape Coast [11].

The area is selected for the research due to the large influx of people into the area for tourism and fishing activities. Tourism is one of the major contributors to the Ghanaian economy with a current Gross Domestic Product (GDP) contribution of 3% per annum which is projected to increase by 5% annually between

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2018 and 2026 by World Travel and Tourism Council (WTTC) [31]. Central Region where the study is located is famous for its ancient forts and castles and beautiful coconut palm shaded beaches and apart from Cape Coast, Elmina is the next well-known destination for tourists in the Central Region (Ministry of Tourism, Arts

and Culture, 2018). Elmina has two out of three World Heritage Sites designated by UNESCO namely Elmina Castle and Fort St Jago [24,31] and other rich/fascinating historic places, cultures, traditions and natural resources like the Dutch Cemetery, Catholic Museum, Benya Lagoon and the beaches [46].

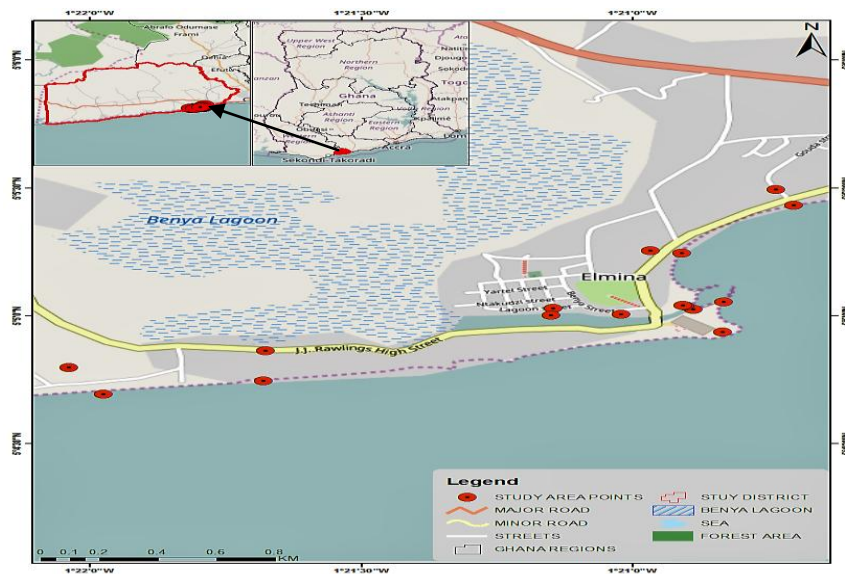


Figure 1. Map of Study Area-Elmina Coastal Zone

MATERIALS AND METHODS

Mixed methods to be more specific included quantitative and qualitative methods were used to complement each other in the field data collection. Field survey was carried out using questionnaires, interviews, focus group discussions (FGDs), observation and taking of photographs of unique features.

Systematic sampling was used in collecting the quantitative data in Elmina coastal area using 300 questionnaires. The Elmina coastal area was divided into east and west corridors of the Elmina Castle and in each corridor 150 questionnaires were administered to household heads at an interval of five houses. Respondents included individuals who have stayed in the area not less than five years and were at least 20 years of age. Where a household head of a selected house did not meet the criteria that house was skipped, and next house picked for the exercise. The respondents were picked from houses within 400 metres buffer along the coast. Non-probability sampling employed for the collection of qualitative data was purposive sampling. Participants were sampled based on the nature of information being sought [48]. Two FGDs were conducted involving ten participants in each group. One was organised for fishermen and boat owners who worked at

the beach and could account for pollution problems along the coast. The second group involved fishmongers who lived along the coastal environment of Elmina. Experts from various relevant state institutions in Cape Coast and Elmina were also interviewed for expert information on coastal pollution in the area. They were Principal Environmental Unit Officer of KEEA Municipal Assembly, Principal Director of Nurses of Ghana Health Service of Elmina and an Environmental Protection Officer (EPA) Officer of Cape Coast Municipal Assembly.

RESULTS AND DISCUSSION

An analysis of the social survey carried out revealed several types of marine debris, the causes and the socio-economic and environmental effects of this coastal menace.

Types of Marine Debris

Marine debris in Elmina coastal area included organic and inorganic substances. These include plastic waste, human excreta, discarded nets and boats, tins, coconut husks among others (Fig.2). It was observed that plastic waste formed a greater portion, over 80% of the pollutants at the beach. Plastic wastes consisted mainly of macro-plastic materials such as plastic bottles of drinks and water, polythene materials of sachets

water, carriage bags and take away food packages. Macro plastic pollution is a global issue and is perceived as one of the most severe

forms of pollution in shorelines, oceans and freshwater bodies [27].



Figure 2. Waste left unmanaged at the shore near Mpoden market

Discarded fishing gear such as nets, fishing ropes and broken pieces of canoes and boats were also washed ashore. Plant remains of fallen trees along the coastline such as coconuts branches, husks of the nuts and other trees were also found at the beaches. Other organic wastes included animal droppings, human faeces and discarded clothes. According to the KEEA Municipal Environmental Officer, “Household wastes such as rubbish, plastic materials form the greater portion of the pollutants”. The study revealed wide spatial variation in the amount of

marine debris found along the beach. The eastern section of the beach was cleaner with little waste materials along the beach than the western end. There were heaps of solid wastes/marine debris at various points along western corridor of the study area stretching from Mpoden Market beach west of Elmina Castle through Ayisah beach to Batuma beach (Fig.2). The presence of large heaps of wastes here was due to indiscriminate dumping and open-defecation by residents.

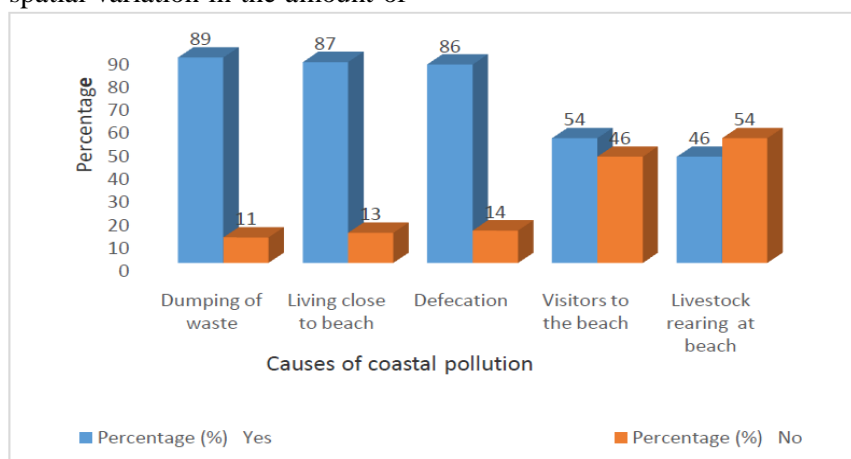


Figure3. Causes of Coastal Pollution

CAUSES OF BEACH POLLUTION

From the study, several practices were identified as factors that cause pollution in Elmina coastal zone. From Fig.3, the factors include dumping of waste at the beach, living close to the beach, defecation at the beach, visitors who come to the beach and livestock rearing at the beach. The leading factor contributing to the generation of high volume of solid waste at the beach was dumping of waste (89%) followed by people

living close to the beach (87%) while the least factor was the rearing of livestock at the beach which recorded 46% of the respondents saying yes and the rest 54% saying no. From transect observations; Benya Lagoon located in a bay contained a lot of debris that were dumped by residents. Residents living close to the beach dump their waste at the beach because of proximity to the beach and the lack of dustbins within their vicinities. This came up in the women’s FGD with the group leader saying: We

dump waste around since there are no waste containers for that and when the containers are available; they are located far away or not kept clean. The National sanitation Day¹ was helping to keep the surrounding clean but now that it is not operational hence the waste is not collected for several weeks. Zoom Lion² workers are not being paid these days, so they do not do their cleaning work effectively (Gifty, a 54-year-old fishmonger). The high abundance of polystyrene and other marine debris in coastal environments have been attributed to high population density with heavy commercial and industrial activity and the lifestyle of the people [27,47,13,19,14].

According to Biney [3], where a coastal community does not have adequate refuse dumping facilities, the inhabitants use the coastal environment as a waste dumping area and then create pollutants that disturb users of coastal environments. It was also detected that waste management was not effectively carried out in the study area. Some heaps of rubbish were found at various points along the beach unattended to. One of the offensive ones was one in front of the Mpoden Market between Ayisah community and the Elmina Castle (Fig.2).

Another causation factor that came up strongly was defecation at the beach due to lack of toilet facilities in homes and public places. The public toilets were in a deplorable state so residents along the beach prefer to use the beach as a place of convenience. Visitors to the area are also compelled to defecate into Benya River and at the beach which contribute to the pollution and poor sanitation condition in the Elmina coastal area. The men FGD asserted to this factor as: We defecate at the beach and the bank of Benya Lagoon because the public toilet facilities are not kept clean and they smell. We defecate at the beach because of inadequate public toilet facilities in the area and bad odour that comes out from the few that are available (Nkrumah, a 42-year-old fisherman). In response to the issue of littering of the beach and open defecation, KEEA Municipal Environmental Officer related to it in a

discussion as: KEEA Municipality provides some public toilet facilities and waste containers but due to negative attitude, residents do not use them. Residents do not want to go far away to access the facilities, so they throw the rubbish around and defecate at the beach. Also, some of the houses built 30 years ago do not have toilet facilities, so occupants defecate at the beaches (A 51-year-old Environmental officer of KEEA Municipality). Other comments related to the use of the beach as a place of convenience and refuse dump was more attitudinal rather than that of lack of adequate facilities as: Attitudinally, residents dump waste at the beaches and defecate as well. But the beaches are not dumping grounds. People deliberately dump waste materials along the shore all over the country, an act which is not only limited to Elmina. The cause of pollution along the coast of Ghana is due to the attitude of the people. People deliberately carry rubbish from their homes and dump them into the sea which is eventually brought back to the shore by the sea making the beaches dirty (A 41-year-old EPA Officer in Cape Coast).

Activities of visitors that lead to the littering of the beach include tourists who do not dispose off their waste into bins and boat builders and fishermen whose activities generate waste such as debris of wood, abandoned damaged boats and nets. One of the reasons why people are attracted into the area as a fishing enclave is because of the thriving fishing activities, good landing beaches and the tourist sites in Elmina coastal zone. These factors attract fisher folks from other towns along the coast such as Apam, Cape Coast, Ada, Kpone etc. to engage in fishing in the waters of Elmina, but there are inadequate waste management facilities for these migrant fisher folks. Hence these migrant fishers dumped their domestic waste and sewage at the beach. According to KEEA Municipal Environmental Officer; Seasonal fisher migrants are attracted to Elmina coastal area from different fishing communities along the coast of Ghana. The influx of the people into Elmina coastal area leads to people dwelling very close to the beach as in the case of communities in Elmina such as Ayisah and Batuma. As a result, residents generate a lot of waste and dump them at the beach as well as practising open defecation due to their negative attitude. Some of the tourists or visitors to the beach also defecate and drop litter along the beach. This view is in agreement with literature that, in addition to the natural factors affecting the

¹ The First Saturday of every month from November 1, 2014 was declared as National Sanitation by the Government of Ghana to carry out clean-up exercises in the whole country to reduce unsanitary conditions that breed diseases and causes injuries.

² Zoomlion Ghana Limited is a waste management company in Ghana.

plastic accumulation in the oceans, human activities have been a major source of macro and micro-plastics in the marine environment [27,41,10].

In relation, the municipal officers attested to the pouring of unwanted engine oil into the sea and Benya Lagoon as one of the factors contributing to coastal pollution in Elmina. This is a gist of what they said: The fishermen in Elmina pour unwanted petroleum product like engine oil removed from their machines into the Benya Lagoon which affect the aquatic species (A 50-year-old officer of the Ministry of Fisheries in Elmina). Interviews with the chief fisherman and local opinion leaders such as boat owners and fishmongers of Elmina coastal area revealed that ocean current was also a causation factor. According to the men focus group; Apart from individuals who dump rubbish, defecate and rear pigs at the beach thus polluting the coastal environment, the sea also brings some waste materials or pollutants of various types like polythene bags, plastic substances and others from neighbouring towns to the beach. So, pollution in Elmina coastal area is also caused by transportation process of the sea (Kofi, a 30-year-old man of men FGD). These findings are in line with literature that, the directions of the wind and ocean currents are important determinants of the level of plastic contamination on beaches [2,21].

Run-offs from Elmina township was also mentioned as a cause of the pollution at the beach and Benya Lagoon as solid wastes are transported from the town through drains into the lagoons and beaches. According to the KEEA Municipal Environment Health Unit Officer, the low topographical nature of the coast of Elmina causes runoffs to transport waste materials whenever it rains into the sea, lagoon and the rivers in the area. Therefore, the coastal area becomes dirty and polluted (A 45-year old man of KEEA Municipal Environmental Health Unit). River and drainage systems have been found to be the conduit for marine debris into marine environments and marine debris accumulation at beaches are higher in rainy seasons than in the dry seasons [4,25,26].

EFFECTS OF POLLUTION ON THE COASTAL ENVIRONMENT

Pollutants impact negatively on the coastal zone, users, residents and socio-economic activities in that enclave. The effects of coastal pollution are

discussed under environmental, socio-economic and health.

Environmental Effects of Coastal Pollution

The research reveals that pollution in Elmina coastal zone affects the environment by making the beach and coastal zone dirty and unclean. This makes the place less attractive to residents and visitors particularly tourists. Sections of the beach were very filthy. The hot-humid tropical environment enhances the decomposition of biodegradable marine debris which made the environment stink and attract houseflies. This condition breeds a lot of micro-organisms and rodents making the environmental unhygienic and unattractive to tourists. The pollutants also negatively impact on the development of marine organisms. Sometimes debris trap and kill marine species in the area. Dead fish are occasionally found floating on the sea, some of which are believed to have died of consuming plastic. Women interviewees revealed that “The pollutants make the beach dirty and unclean and also plastic pollutants trap, choke and kill fishes and birds” (Tutu, a 45- year old woman in Elmina). The following narrative was also giving by the KEEA Municipal Environmental Officer: Marine debris cover the habitation and breeding grounds of marine species at the shore and affect them as well. Debris in the coastal zone trap and kill marine species such as fishes, birds, turtles and others. These marine pollutants also retard the growth of important marine species that are useful for the support of the ecosystem (A 56-year old Environmental Officer in KEEA Municipality). Coastal pollutants can result in wide diversity of hostile environmental effects to individual creatures and ecosystems particularly plastic debris are toxic chemicals which can affect marine species [5,35,32]. The effects include blockage of the intestinal tract, inhibition of gastric enzyme secretion, reduced feeding stimuli, decreased steroid hormone levels, delays in ovulation and failure to reproduce and entanglement encounters which can lead to mortality [58,17,18,12,44]. The Officer of Ministry of Fisheries in Elmina Municipality stated that, Unwanted oil poured by fishermen into the sea and Benya Lagoon prevents marine species from getting enough oxygen which is needed by marine species to live and reproduce. If the pollution process continues, it will result not only in the reduction in the number of coastal marine species but also lead to the extinction of the organisms in the coastal environment.

Socio-Economic Effects of Pollution

The socio-economic effects comprise the effects of marine pollution on the social life in terms of health, fishing, recreation and other economic activities. The socio-economic effects of pollution in the coastal area occur in various

forms. Debris in the coastal area leads to wide variety of undesirable ecological, economic, social and public health as well as security impacts [32].

Fig. 4 indicates the various ways by which marine pollution affects the people in Elmina coastal area. Beach pollutants are believed to cause the spread of certain diseases which affect inhabitants. Majority of respondents 91% indicated that the pollution in Elmina coastal zone cause poor health conditions and about 89.3% stated that bad odour emanates from the beach wastes which is very awful and sickening (Fig.4). The pollutants contaminate water bodies and air which can lead to the contraction of various diseases by residents.

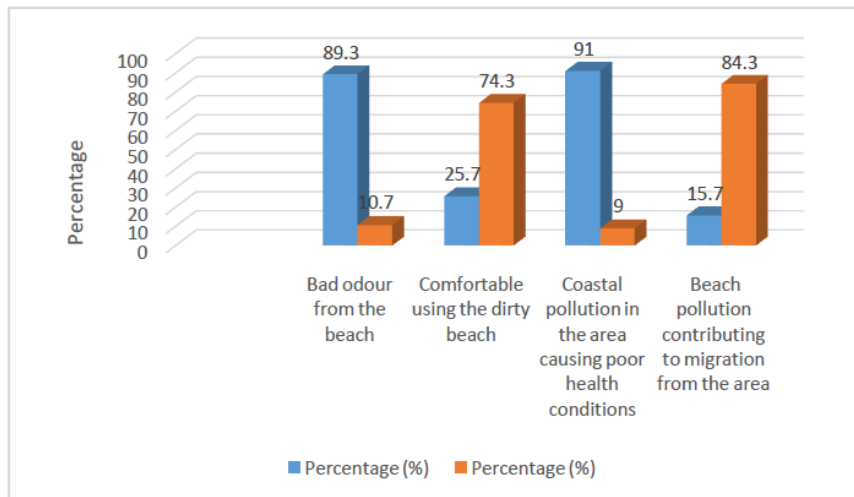


Figure 4. Social effects of Pollution in the Area

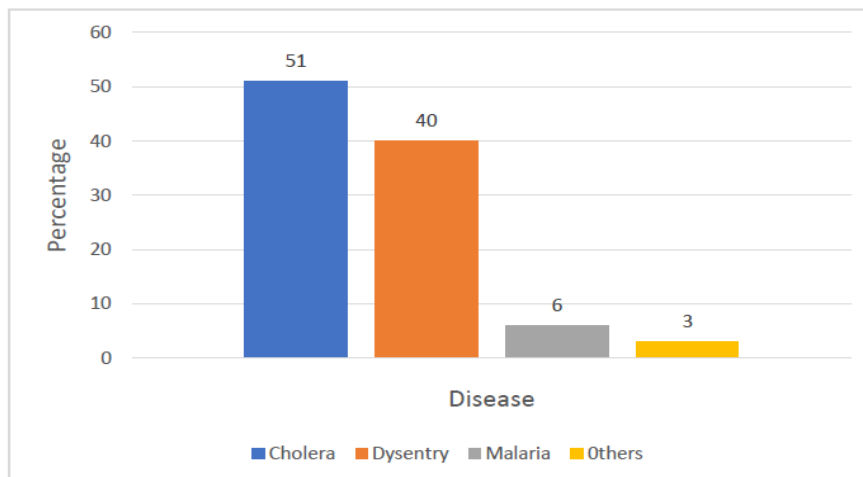


Figure 5. Health condition of the people in Elmina coastal area

In Fig.5, cholera was mentioned by 51% of respondents as a health problem in the area, followed by malaria with 40%, dysentery 6% and other health problems followed with 3%. Poor sanitation condition such as poor waste disposable, defecation into water bodies such as the sea and the Benya Lagoon were the causes of these diseases. Choked gutters and stagnant water created by improper dumping of waste provide breeding grounds for mosquitoes which cause malaria in the area. Cholera is a common

disease that occurs mainly in the raining season in Elmina coastal area. The disease was common in the area due to poor sanitation as people defecate around which pollute the water bodies and food (A 44-year-old Deputy Director of Nursing in Elmina). The men focus group again stated that: We use the sea water as substitute for salt when cooking in our boats. So, the presence of faeces in the sea water makes us to contract diseases such as cholera, typhoid fever and other water borne diseases.

We end up at the hospital which imposes financial burden on us and reduces productivity because working hours are lost (Kwame, a 40-year-old fisherman at Elmina coast). Available OPD cases at Elmina Urban Health Centre (EUHC) showed most of the diagnosed cases were related to poor sanitation and contaminated water and food. Malaria recorded 66% of cases,

followed by diarrhoea with 27% and typhoid 7% (Fig.6). Comparable observations of faecal contaminated water and insanitary conditions of choked drainage systems and poor waste management causing diarrhoeal and skin diseases have been noted by other scholars [1, 8, 36, 45].

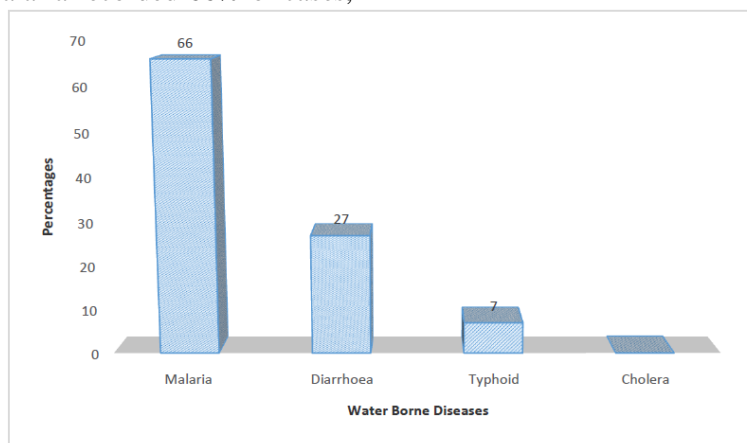


Figure 6. Water Borne Diseases Diagnosed at EUHC

Though respondents acknowledged that the polluted beach make them contract diseases however, they will not migrate from the area because the sea serve as livelihood. As shown in Fig.4, 84.3% of respondents stated that the pollution at the beach will not cause them to migrate from the area. This is the view of men FGD: Although

pollution makes us fall sick sometimes and we visit the hospital, we do not want to migrate because fishing is our main source of livelihood and the activity is thriving in the Elmina coastal area. Therefore, we prefer to stay in the area and work to earn income and food rather than leave the area (Mensah, a 50-year old Fisherman at Elmina coast).

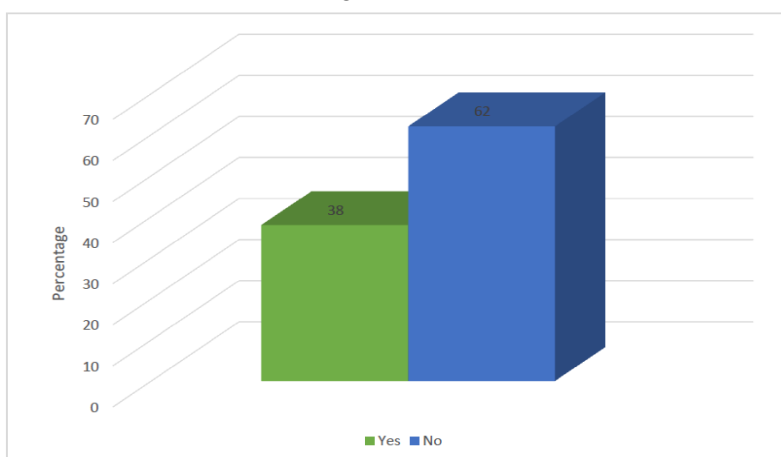


Figure 7. Effects of Pollution on Economic Activities in Elmina

Another kind of effect was the impact on economic activities including fishing and tourism. It was observed that pollutants at the coast made the beach dirty and less attractive to its users. The Ministry of Fisheries, Environmental Protection Agency and Local Government narrated that pollutants discourages beach users and tourists and make them feel uncomfortable at the beach and this can reduce revenue mobilisation from tourism. The

pollutants make the beach dirty and unclean which discourage users of the beach. Pollutants like faeces unattractively reduce tourist patronage in the area leading to decrease in revenue generated from tourism sector in Elmina (A 56-year old Environmental officer in KEEA Municipality). However, from Fig.7, 62% of the respondents indicated that pollution in the area did not affect the economic activities like fishing and tourism while 38% claimed

coastal pollution affected economic activities in the area. Marine debris are caught by fishermen instead of fish. These reduce the catch of the fishermen and lead to low level of income generation. This is an excerpt from the discussion: There are times that we catch plastic waste instead of fish and that makes us poor as well as debtors because we credit petrol and food before going to sea. Pollutants like ropes, polythene bags and nets loop around propellers of outboard motors and damage them (Badu, a 43-year-old fisherman in Elmina). They divulged that marine debris affected those who carried out fishing activities close to the shore than those who did fishing off-shore because debris are less off-shore. Tonnes of debris are hauled by fishers that fished close to the shore especially those that use the drag nets which sometimes tear their nets. Propellers of outboard motors also get destroyed by debris in the sea. The situation does not only put financial burden on them as they must repair destroyed working gears, but it also reduces the income of the fishermen and productivity in the fishing industry.

CONCLUSION AND RECOMMENDATIONS

Coastal pollution is a serious environmental problem which affects the environment, life and productivity along the central coast of Elmina, Ghana. The coastline is desecrated by many types of marine debris including plastic materials and organic debris. Beach pollution in Elmina is mainly due to negative attitude of residents regarding improper waste management, the lack of inadequate sanitary facilities and ineffective implementation of policies on sanitation and coastal management. A myriad of environmental, socio-economic and health issues including reduction tourism revenue, diseases, financial challenges are associated with marine pollution and needs to be tackled. Measures towards addressing this menace in Elmina lie in the ambit of the implementation of coastal management and sanitation policies and public education. Sanitation bye-laws should be strictly enforced without fear or favour. KEEA Municipal Assembly should liaise with Ghana Health Service of Elmina Municipality and other environmental health officers and opinion leaders in the communities to educate residents about the importance of good sanitation practices. The Municipality must provide more waste disposal containers for residents in the communities, public places and ensure that residents built toilets in their homes for their

own use and public toilets should be used by visitors. These among others will ensure the sustainable growth and development of the coastal environment.

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