POLLUTION STATUS OF IDUA-ASSANG BEACH, ORON, AKWA IBOM STATE, NIGERIA.

BY

Okon Edet Eto
Centre for Wetlands and Waste Management studies
University of Uyo, p.m.b 1017, Uyo, Akwa Ibom State, Nigeria.

Bassey Effiong Akpan
Centre for Wetlands and Waste Management studies
University of Uyo, p.m.b 1017, Uyo, Akwa Ibom State, Nigeria.
And

Rosemary Tamunosaki d. Jamabo
Centre for Wetlands and Waste Management studies
University of Uyo, p.m.b 1017, Uyo, Akwa Ibom State, Nigeria.

ABSTRACT

Beaches are important part of Nigerian life as they provide recreational opportunities, unique habitat for varieties of plants and animals as well protection to coastal residents from high winds and waves of powerful storms. It has high economic potentials which are however truncated by solid waste pollution. There is high concentration of economic activities in Idua-Assang beach such as off-loading of fish, crayfish, periwinkle, and other sea foods, trading on local wares and foreign ones from the Republic of Cameroon, and other neighboring countries. These activities generate huge solid wastes in the beach. This study investigated solid waste pollution status of Idua-Assang beach in Oron, Akwa Ibom with specific objectives of identifying the solid waste items in the beach, determining the sources of waste items, and discussing the health implications of the waste pollution in the beach. A total of 2922 pieces of assortment of solid waste with heterogeneity index (Hi) of 51 was recorded, 76.83% of the wastes are plastic. Higher quantity of wastes was observed in the wet season with the month of June recording the highest (14.30%), compare to the highest quantity of solid wastes that was also observed in the dry season in the month of February (12.28%). Apart from the human health implications of the beach solid wastes such as injuries by sharp objects and infection by pathogens associated with contaminated wastes, marine litters degrade the beauty (aesthetic values) of the communities and reduce their tourism potential.

KEYWORDS: Beach, Pollution status, Human health and Environment.

Introduction

Marine litter (also called marine debris) is recognized as a worldwide rising pollution problem affecting all the oceans and coastal areas of the world (Galgani *et al*., 2015; Ryan, 2015; Thompson, 2015). The increasing production and use of durable synthetic materials such as plastics has led to a gradual, but significant accumulation of litter in the marine environment, making it ever more difficult to tackle (Barnes *et al*., 2009; Kühn *et al*., 2015). Moreover, the high-profile reports of garbage patches found in the North Pacific and North Atlantic regions (Pichel *et al*., 2007; Law *et al*., 2010; Howell *et al*., 2012) further propel an intensified

international drive to address the ongoing problem of marine litter. Indeed, the model simulations suggest that debris accumulates in a number of convergence zones or gyres where they remain for many years (UNEP, 2013).

Marine litter is defined as "any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment" (UNEP, 2005, 2009). It is largely associated with diverse human activities occurring both on land and at sea, and is concomitant with the increasing use of synthetic materials, industrialization and urbanization of coastal areas, and inadequate disposal practices. Generally it can be said that the problem of Marine litter is rooted in the prevailing production and consumption pattern and the way we disposed of and manage waste. Marine litter originates from three main sources: land-based, riverine, and ocean-based sources (Galgani *et al*., 2015; Browne, 2015; Jambeck *et al*., 2015). The former include public littering, poor waste management practices, industrial activities, sewage related debris and storm water discharge (Eto, 2014), all of which can be transported via rivers (Morritt *et al*., 2014; Free *et al*., 2014; Hoellein *et al*., 2014). The latter include fishing activities, shipping, marine leisure industry, and offshore oil and hydrocarbon industries (Mouat *et al*., 2010). In particular, derelict fishing gear has become a serious concern with the intensified fishing effort in the world's oceans and the increasing durability of fishing gear (Macfadyen *et al*., 2009; Bilkovic *et al*., 2014). It is widely documented that marine litter has a wide range of adverse environmental, economic, social and public health and safety impacts (Newman *et al*., 2015). They are illustrated by marine litter injuring or killing wildlife by ingestion and/or entanglement (Allen *et al*., 2012; Bond *et al*., 2013; Baulch and Perry, 2014; Kühn *et al*., 2015), altering ecosystems by introducing non-native species (Barnes, 2009; Kiessling *et al*., 2015), threatening sensitive habitats (e.g. corals, salt marsh) by moving along the seabed (derelict fishing gear) (Arthur *et al*., 2014), posing risks to human health and safety (e.g. hazards to navigation) (Taylor *et al*., 2014), entailing economic costs to coastal towns/communities, fisheries, tourism, and other maritime industries (Mouat *et al* l., 2010; Jang *et al*., 2014; Newman *et al*., 2015). For instance, the total number of turtles entangled by the 8,690 derelict fishing nets sampled in northern Australia was estimated to be between 4,886 and 14,600 (Wilcox *et al*., 2014). In addition to these negative impacts, there is a growing concern about microplastics as they increase the risk of plastics entering food webs (Lusher, 2015). If ingested microplastics have the potential to transfer toxic substances to the food chain, posing a threat to the health of humans and ecosystems (Eto, 2014; Rochman, 2015).

On the other hand, beaches are an important part of Nigerian life. Apart from the range of recreational opportunities they offer, beaches provide unique habitats for a variety of plants and animal. Beaches provide protection to residents living near the ocean by acting as a buffer against the high winds and waves of powerful storms, and help drive economic activities important to nearby communities and countries. According to King and Jonathan (2003), beaches constitute a source of enrichment of human life by granting the environment for inspiration and vision, antidote to stress, scope for peaceful enjoyment and physical, mental and spiritual development and rejuvenation. Beaches are therefore, important world-wide income yielding natural resources. The level of use of each beach varies based on several factors (Tudor and Williams, 2006; Oh *et al.,* 2010). The different levels of beach usage are mainly determined by factors such as proximity to urban centers and ease of access (Paula *et al.,* 2013), infrastructure availability (Silva *et al.,* 2013), and frequency of routine cleaning of the area (Tudor and Williams, 2006). The rapid growth in coastal development, stimulated by tourism and residential expansion, often results in dense population and infrastructure that can cause resource degradation and pollution (Lithgow *et al.,* 2014; Botero *et al.,* 2015). Beach quality assessments are often related to user perception, and aesthetic values, such as hygiene and cleanliness, are their main concerns (Lozoya *et al.,* 2014; Botero *et al*., 2015). However, the realization of the full benefits of the above values is often truncated by number of factors, one of which is solid waste pollution of

global concern. Beaches are critical to the development of coastal tourism industry in Nigeria and this can only be achieved by characterizing the associated solid wastes and determining means of proper disposal, thus mitigating ecological and human health impacts (King *et al*., 2013).

Despite the current environmental conditions, the estuaries of Idua-Assang beach are potential revenue-yielding coastal area. Pollution at this beach can results in users getting sick or temporary beach closure that negatively affects the local economy of the area. Overuse by the visitors can damage sensitive habitats, such as beach dunes, and create marine debris. The good news is that we can all help to protect our beaches and our health. It was therefore, important to carryout assessment of pollution status of Idua-Assang beach in Oron Local Government Area of Akwa Ibom State, Nigeria. The study will also contribute to knowledge in environmental health management and biodiversity conservation management in Nigeria and as well as help future scholars or researchers to build upon this study. Beaches are important part of Nigerian life. Apart from the range of recreational opportunities they offer, beaches provide unique habitats for variety of plants and animals. They also, provide protection to residents living near the ocean by acting as a buffer against the high winds and waves of powerful storms, and help drive economic activities importance to nearby communities and countries. But the realization of the full benefits of the above values is often truncated by a number of factors, one of which is solid waste pollution that forms part of marine waste or debris. Marine debris is eyesore along shorelines around the world. It degrades the beauty of the coastal environments and in many cases may cause wildlife entanglement, ingestion and habitat damage, economic loss if an area is a popular tourist destination. Idua-Assang beach in Oron Local Government Area is a potential tourist area in Akwa Ibom State with lots of human activities which affect it as a tourist centre. These include mineral exploration, buying and selling of all kinds, dredging, physical development as well as landing and takeoff point for many light sea vessels, out board engine, boats, transportation of goods and services with motors, ports construction and coastal control works. There has been no report or study of the pollution condition of this beach. These therefore prompt this study to assess the pollution status of this beach.

2. Objectives of the Study

The aim of this study was to investigate solid waste pollution status of Idua-Assang beach in Oron, Akwa Ibom state, Nigeria. The specific objectives are to:

i. Identify the solid waste items in the beach,
ii. Determine the sources of waste items,
iii. Discuss the health implication of the waste pollution in the beach.

3.1 Research Methods

The Study Area:

The study area was at Idua-Assang beach in Oron Local Government Area of Akwa Ibom State. This area is found in Oro Nation which settled down in the flood plain of South-Southern Niger Delta Region of the Federal Republic of Nigeria, with the land mainly intersected by numerous streams and tributaries flowing into Cross River. The entire coastline stretches from Uya-Oro to Udung Uko. Oron Local Government Area situates within latitudes 4°3'21″ – 4°4'51″ North and longitudes 8°1'21″ – 8°2'01″ East. The area is rich in oil and natural gas, and most of its oil reserves are off-shore, with over 25 corked oil wells (Ekpo, 2012). This region is extremely fertile and is known for its topographical oil palm Belt, swamps, sandy beaches and littoral, beautified by forested foliage and mangroves with mahogany that provide timber (for boat and canoe constructions), and ornamented with irresistible fauna and flora. Deposits of solid minerals such as iron, free silica or glass sand and gravel are also found in the area (Uya, 1984). Seafood such as; crayfish, snipers, oyster, and periwinkle, etc, abound richly in all their coastal areas.

These have been known to attract tourists and commerce to this area and Akwa Ibom State in general.

There are two main season; dry (November-December) and wet (April-October). Oron Local Government Area has a population of over 250,000 people with several villages and towns. The people have a distinct Oro language, although many speak and understand the Efik, Ibiobio, and Anang languages. Their predominant occupation are fishing and farming. As oil producing communities, they play host to multi-national oil companies like: ExxonMobil, Addax, Total, and Shell, among others, and has witnessed a number of major and minor oil spills within the past three decades (Ekpo, 2012).

3.2 Methods of Data Collection

At the study area, sampling and collection of solid wastes for analysis was carryout throughout research period. Spatial measurement of $10m^2$ was marked along Idua-Assang beach each month. Solid wastes within the marked area was collected and sorted into wastes categories or types. These was counted, weighed, and recorded. Wastes collection was conducted once in a month for twelve (12) months. This was to ensure that the wastes collected, truly represented the actual amount of wastes disposal that had accumulated at this beach within one month's duration.

3.3 Data Analyses

The analytical technique used was specifically based on the stated objectives of the study. Descriptive statistics (percentage) was employed and used in this study.

4. Result and Discussion

Solid waste pollution status of Idua-Assang beach in Oron Local Government Area of Akwa Ibom State, Nigeria was evaluated. A total number of 2922 pieces of assortment of solid waste materials heterogeneity index (Hi) = 51 from 6 waste-types viz: plastic, paper, wood, cotton, soft organic debris, and mixed materials (metals and glasses, etc) were found littering the beach. Plastic materials constituted the most diverse and predominant material type (76.83%) follow by paper materials (14.16%), mixed materials [metals, and glass, etc (3.59%)], cotton materials (2.53%), soft organic materials (1.88%), and wood materials (0.99%) has the list. It was also observed for the two main seasons; dry [November (3.9%), December (3.73%), January (7.25%), February (12.28%), March (5.44%)], and wet [April (6.12%), May (8.35%), June (14.30%), July (11.19%), August (8.69%), September (8.72%), October (9.99%)]. Highest quantity of solid waste gotten in dry season was in February (12.28%) > January (7.25%), and low quantity gotten was in December (3.73%) < November (3.90%). Also, highest quantity of solid waste gotten in wet season was in June (14.30%) > July (11.19%), and low quantity gotten was in April (6.12%) < May (8.35%)(Table 1).

The problem of marine litter is rooted in the prevailing production and consumption pattern, and the way we dispose of and manage waste. Solid wastes origin at Idua-Assang beach was investigated from three main sources according to Galgani *et al*., 2015; Browne, 2015; Eto, 2014 Jambeck *et al*., 2015, viz: land-based, riverine, and ocean-based sources. From Table 2: the following observations was recorded; the highest solid wastes at this beach came from land-based sources with 49.17% follow by riverine sources with 30.15%, and ocean-based sources contributed the list with 20.67%. Also, out of 49.17% of solid wastes that came from land-based sources; plastic materials top with 74.53% follow with paper materials (15.79%), mixed materials (3.75%), cotton materials (2.78%), soft-organic materials (2.01%), and wood materials (1.11%). Riverine sources that contributed 30.15% with plastic materials topping with 77.63% follow by paper materials (13.84%), mixed materials (3.63%), cotton materials (2.15%), soft-organic materials (1.92%), and wood materials (0.79%). While the ocean-based sources with 20.67% has

plastic materials recorded as 81.12%, paper materials 10.76%, mixed materials 3.14%, cotton materials 2.48%, soft-organic materials 1.49%, and wood materials 0.99%.

According to the records of this study stated above, it is seen that plastic materials top other wastes and in addition to these negative impacts, there is a growing concern about microplastics as they increase the risk of plastics entering food webs (Lusher, 2015). If ingested microplastics have the potential to transfer toxic substances to the food chain, posing a threat to the health of humans and ecosystems (Eto, 2014; Rochman, 2015). It was also stated earlier that marine litter is widely documented has having health and safety implications (Newman *et al*., 2015). They are illustrated by marine litter injuring or killing beach goers as a result of been exposure to shape and dangerous solid wastes, posing risks to human health and safety (e.g. hazards to navigation) (Taylor *et al*., 2014), entailing economic costs to coastal towns/communities, fisheries, tourism, and other maritime industries (Mouat *et al* l., 2010; Jang *et al*., 2014; Newman *et al*., 2015). It was generally, observed that in the three sources in which solid waste is generated at this beach, plastic materials was the highest, follow by paper materials, mixed materials, cotton materials, and lastly by wood materials.

Table 1: The Types of Solid Wastes on Idua-Assang Beach, Oron, Akwa Ibom State Nigeria

S/N	Waste Types	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
1.	Plastic materials	158	225	109	103	192	379	262	211	219	239	80	68	2245	76.83
2.	Paper Materials	25	79	30	62	31	30	44	29	19	29	12	24	414	14.16
3.	Wood materials	7	6	2	1	-	-	1	4	1	3	4	-	29	0.99
4.	Cotton materials	10	12	6	3	9	3	5	3	4	8	4	7	74	2.53
5.	Soft organic materials	10	14	5	-	-	2	6	1	4	4	4	5	55	1.88
6.	Mixed materials	2	23	7	10	12	4	9	6	8	9	10	5	105	3.59
	Sub Total	**212**	**359**	**159**	**179**	**244**	**418**	**327**	**254**	**255**	**292**	**114**	**109**	**2922**	
	Percentage (%)	**7.25**	**12.28**	**5.44**	**6.12**	**8.35**	**14.30**	**11.19**	**8.69**	**8.72**	**9.99**	**3.90**	**3.73**		

Table 2: Rank and Sources of Solid Wastes on Idua-Assang Beach, Oron, Akwa Ibom State Nigeria

Rank	Sources of Solid Waste	Plastic materials	Paper Materials	Wood Materials	Cotton Materials	Soft organic materials	Mixed Materials	Total	%
1.	Land-based sources	1071	227	16	40	29	54	1437	49.17
2.	Riverine Sources	684	122	7	19	17	32	881	30.15
3.	Ocean-based sources	490	65	6	15	9	19	604	20.67

CONCLUSION

There is a general conviction that Akwa Ibom State has great potential for coastal tourism (King *et al*., 2013), to attend the full benefits like; economic explanation, recreational and leisure/relaxation centre at this beach. Beach management studies must be addressed, one of which is solid waste pollution. This study has recorded that Idua-Assang beach is polluted with varieties of solid wastes that came from three main sources like; land-based, riverine, and ocean-based. These pieces of litters contained both hazardous and dangerous substances with potential ecological, social, and human health implications. Therefore, there is need for public awareness and enlightenment campaign among residents, other beach users, and school children in order to influence their behavior toward the way that litter is disposed of or managed. This will in return help to reduce marine litter and it human health implications on this potential tourism centre.

RECOMMENDATIONS

Beach cleaning program should be embark on to eliminate or reduce solid wastes that are already present in this coastal/marine environment,

Awareness and enlightenment program should be encourage among residents, beach users, and school children to change their behavior; not only to reduce litter but also to regard waste as resources,

Management measures on fishing vessels should be strengthening like; promoting recovery of lost gear, encouraging the use of environmental friendly gear, as well as adopting develop waste recycling practice among fishers (Gold *et al*., 2013; Arthur *et al*., 2014),

National marine litter program or a similar management scheme should be established. This accord to Hastings and Potts, 2013; Eto, 2014: would constitute a high-level political commitment that could be a driver for relevant actions to be undertaken, and ensure that marine litter issues are reflected in all policymaking.

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