

RESEARCH ARTICLE

“Where does it go?”: Perceptions and problems of riverine and marine litter amongst South Africa and Malawi’s urban poor

Marc Kalina ^{1,2*}, Jonathan Kwangulero ^{3‡}, Fathima Ali ², Yared Getachew Abera ², Elizabeth Tilley ^{1,3‡}

1 Department of Mechanical and Process Engineering (MAVT), ETH Zürich, Zürich, Switzerland, **2** School of Engineering, University of KwaZulu-Natal, Durban, South Africa, **3** Department of Environmental Health, The Polytechnic, University of Malawi, Blantyre, Malawi

✉ These authors contributed equally to this work.

‡ JK and ET also contributed equally to this work.

* mkalina@ethz.ch



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Abstract

With the world’s oceans in crisis, citizen knowledge and awareness around riverine and marine waste has become an increasingly crucial topic of study. For most investigations, spatial analysis has centered on the coastline, or most specifically the beach, i.e., the space where most respondents (urban, Northern, middle class), encounter marine litter. Yet, by focusing on *the beach* as the primary space of analysis, most studies have severely limited the scope of citizens they can engage, because in many African cities it is a space of exclusion. Moreover, for individuals further upstream, in spaces distant from the coast, what are their understandings of riverine and marine litter? What is their knowledge of the hydrological systems standing between them and the sea, and how do they see their ability to influence them? Drawing on extensive qualitative fieldwork in low-income, riverine adjacent communities in Durban, South Africa, and Blantyre, Malawi, the purpose of this article is to understand how Africa’s urban poor experience and understand riverine and marine litter. The study utilises Foucault’s notion of problematisations, and more recent adaptations of Foucault’s work toward waste as a lens to conceptualise processes of problem formation: how individual respondents view riverine and marine litter as a *problem*. Findings suggest that problematisations around waste, in the community and in the hydrological system, are formed through daily experience and personal hardship; in the case of Blantyre, through the perceived impact waste can have on hydroelectricity generation, and in Johanna Road, by its contribution to flooding within the community. However, understandings of the marine environment and respondents’ impact on the hydrological system, remain limited. Recommendations include rooting education and messaging around riverine and marine litter within low-income individuals’ lived realities. However, any interventions targeted towards the poor *must* be accompanied by broader systemic change: improving access to solid waste management services and creating cleaner and more equitable communities.

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1. Introduction

Human activities on land are, without a doubt, the principal source of marine litter, and rivers are one of the primary channels funnelling this waste to the sea [1, 2]. In addition to the impact that this pathway has had on the health of our riverine ecosystems, the growing flood of waste, and plastic waste in particular, has shaped a growing and evocative dialogue around the world's oceans in crisis, which has captured immense popular and scholarly attention [3–5]. With this spotlight on our oceans, citizen knowledge and awareness around riverine and marine waste has become an increasing topic of study. For most investigations, spatial analysis has centred on the coastline, or most specifically the beach, the space where most respondents (urban, Northern, middle class), encounter marine litter [6, 7]. Kusumawati et al. [8] also centres their investigation on the beach, though within a South context, while Lewin et al. [9] and Ferreira et al. [10] also centre on coastlines, but through the lens of recreational or subsistence fishing. As Ferreira et al. [10] point out, awareness and perception plays a key role in ecosystem management. Despite the growing body of scholarship on both the causes and consequences of riverine and marine litter, research on public awareness and perceptions around the problem lags, particularly in South and African nations. Moreover, by focusing on *the beach* as the primary space of analysis, most studies have severely limited the scope of citizens they can engage. The beach is not, in Lefebvre's [11] reckoning, a lived space for all Africans. Yet, Africa is also a continent of great lakes and rivers. For individuals further upstream, in spaces distant from the coast, what are their understandings of riverine and marine litter? What is their knowledge of the hydrological systems standing between them and the sea, and how do they see their ability to influence them? Moreover, even near the African coast, for the urban poor, for whom beach spaces may be an inaccessible luxury, what is their awareness of a marine environment they may have little relationship with, and how do these understandings resonate within their daily life?

Malawi, hundreds of kilometres from the sea, is much more bound, culturally, economically, and geographically, to Africa's great inland lakes than to the distant ocean. Yet, although Malawians may be more familiar with freshwater, in Blantyre, the country's second largest city and industrial centre, the numerous rivers which cross the city flow not to the lakes, but south, into the Shire River, which flows into the Zambezi, through Mozambique, and into the Indian Ocean (see Fig 1). Malawi's history of colonialism followed this flow in reverse, with missionaries and soldiers following the course of the Zambezi and the Shire north to occupy the rich land around Malawi's great lake. Thus, although the ocean may be hundreds of kilometres away, its connection to Malawi has shaped, and continues to shape the nation's history. Moreover, the health of Blantyre's rivers affect waters downstream, influencing the entire hydrological system. Yet for Blantyre's urban poor, many of whom have never seen the Shire, let alone the Zambezi (and certainly not the ocean), how do they perceive this flow? When they see waste going into their local watercourse, how do they understand the potential impacts, and how, and to what degree do they recognise it as a problem?

Durban, South Africa, on the coast of the Indian Ocean, and one of the world's busiest ports, has a more intimate relationship with the marine environment. Considered one of the surfing capitals of the world, and a year round, popular beach destination for locals and tourists, the ocean is, for many, the focal point of daily life in Durban. Yet, in Durban, and South Africa more broadly, the beach has also been a space of exclusion. Under Apartheid, beaches were segregated: a reserved and protected space for a privileged, white racial minority. Although this has changed since democracy in 1994, for Durban's poor, a trip to the beach remains an expensive luxury, a once-a-year special occasion for many, an impossibility for some; yet the sea remains present, even at a glance, on the horizon, as they navigate a busy city.

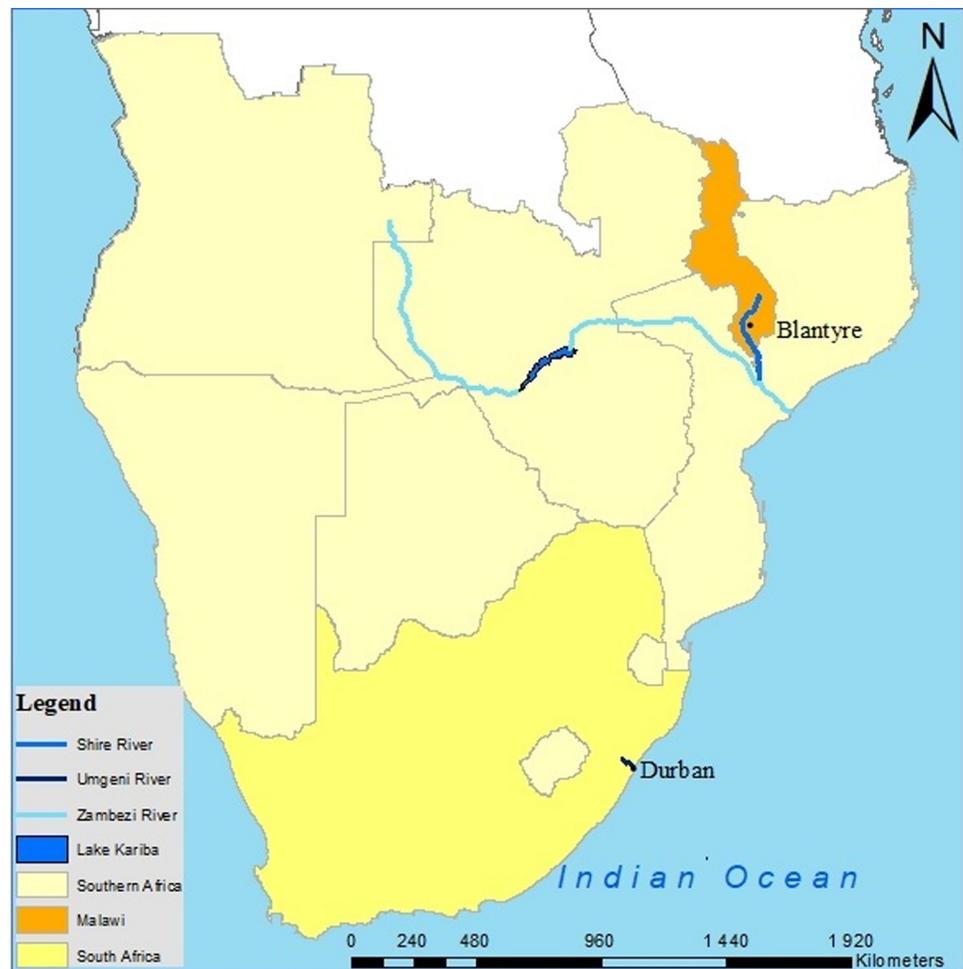


Fig 1. Southern Africa, with the rivers of interest indicated (adapted from Shapefiles sourced from [OpenStreetMap.org](https://www.openstreetmap.org) and [MapCruzin.com](https://www.mapcruzin.com)).

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How do these individuals understand riverine and marine litter, and their own role in its generation? Moreover, without a strong relationship to the coast, to what degree do they experience its impacts and how do these experiences shape the way they view this issue as a problem?

This investigation draws on extensive qualitative fieldwork, including 96 semi-structured interviews with respondents within low-income, riverine-adjacent informal communities in Blantyre, Malawi and Durban, South Africa. The purpose of the study was to develop a broader understanding of citizen awareness and perceptions around riverine and marine litter in previously neglected African contexts, specifically low-income, and in the case of Blantyre, inland, urban areas. Interviews were conducted in a number of different informal communities in the two cities, situated along, often highly polluted rivers and streams, and began with a basic question about the local watercourse “where does it go?”. Moreover, when there is litter on the ground, and it rains, what happens to it? When waste ends up in the river, what happens to it then? Findings suggest that for these respondents, awareness of both the hydrological system, and the potential impacts of waste on it, is limited, and often characterised by misinformation. Moreover, perceptions are strongly informed by individual respondents lived experiences: by the ways in which they interact with either the river or the sea, or more likely, how distant either of those spaces are from their lived reality. Finally, the study adapts Michel Foucault’s

notion of *problematizations* as a lens to conceptualise processes of problem formation: how individual respondents view riverine and marine litter *as a problem*. Analysis suggests that to citizens in both case studies, problematisations around riverine and marine litter are, as Kalina and Tilley [12] described, personal, and do not exist independently from the people they affect. Problematisations around waste, and waste in the hydrological system, are formed through daily experience and personal hardship; in the case of Blantyre, through the perceived impact waste can have on hydroelectricity generation, and in Johanna Road, Durban, by its contribution to flooding within the community. As noted, these findings are important because they shed light on how a previously understudied demographic, the African urban poor, understands and perceives waste within the riverine and marine environment. Findings hint at ways to make education and messaging around riverine and marine litter resonate with low-income individuals, by rooting the potential impacts within their own lived realities. Yet as authors, we are wary of placing the burden for environmental change at the feet of the poor, and insist that these recommendations be accompanied with a demand for broader, systemic change, if we are to realistically address our oceans in crises.

2. Foucault and problematisations

As Kalina and Tilley [12] have described, there remains a theoretical and empirical gap on how society, and particularly individuals, view waste as a problem. Furthermore, although the formation of problems is, naturally, one of the fundamental concerns of social science research [13], few works have spoken directly to these processes of problem formation. Within the literature that has addressed problem formation, emphasis has instead been on matching problems with policy [14–16], or on analysing how problems have been represented within public policy [17]. Furthermore, specifically regarding solid waste, Gregson and Crang [18] point out that much of the work that does address problem formation has done so at the level of the categorical [19–22]: rather than opening out into its ontological politics, waste is problematised in ways that can be neatly categorised within policy frameworks. Though valuable, as Kalina and Tilley [12] note, these contributions, focus on problem formation and problem solving (e.g. through public policy approaches) at a societal level, and do not necessarily shed light on how an individual may construct problems while going through daily lives, open to the possibly untidy representations of social construction.

These contributions are heavily rooted in the writings and social-constructionist traditions of Michel Foucault, specifically his notion of ‘problematization’ as an approach for understanding processes of problem formation [12]. To Foucault, problematisation is the process through which inert, apolitical, and fixed objects (such as marine litter, for instance) transform into sets of fluid, conditional, political relations [23]. Usefully, problematisation, as conceived by Foucault, and developed by subsequent scholars, can be seen as having two aspects: as both a noun and a verb. First, problematisation, *the noun*, characterises the problematisation as an object of analysis. As Barnett and Bridge [13] describe, it is the label attached to the process by which, for example, various realities, lifestyles, or spatial arrangements are questioned and become the focus for motivated change. Problematisation, or problematise, *the verb*, refers instead to a method of analysis, most commonly utilised by researchers within critical urban studies. Within this sense of the term, according to Barnett and Bridge’s [13] understanding of Foucault’s original intent, the purpose of critical analysis is to question understandings, relationships, and settlements that were previously taken for granted. Bacchi [24] defines the two usages slightly differently. To Bacchi [24], problematisations (the noun) generally refers to the outcomes of processes of problem formation, either in the way in which problems are framed, or governmental problematising processes, while ‘problematise’ (the verb) tends to be used to

describe what individuals or governments do in the face of problems. In other words, problematise may refer to the ways in which individual put an issue, object, etc. forward, or designate something, as problematic—“that, is to give a shape to something as a ‘problem’” [24]. As Oberg [25] has commented, the power of Foucault’s writings on problematisations is in his characterisation of them as results of specific social relations, contingent on human practice, rather than mere inevitabilities. Practically, Foucault’s notion of problematisation has primarily been utilised as a means for critique within urban studies, again at a societal, not individual, level. Yet recent post-Foucauldian scholarship [13, 24, 25] has explored how the concept can be utilised as an analytical tool to understand processes of problem formation that occur within the individual, while Kalina and Tilley [12] have specifically demonstrated how the term may be usefully applied in regards to solid waste and litter.

Foucault’s concepts have often served as frames of analysis, within a multitude of contemporary scholarship, on the ways in which we engage critically with the city. Yet, to Barnett and Bridge [13], Foucault is not *just* a theorist of critique, as he has often been characterised, but also a theorist of action. This emphasis is reflected within Barnett and Bidge’s own interpretation of problematisation, which they, repeating Foucault’s [23] own characterisations, place on action as a “responsive disposition to difficult situations” [13]. Yet their view is more democratic than Foucault’s. Foucault’s level of analysis around problem formation never drifted below the city’s elite centres of decision-making power and policy formulation, but Barnett and Bridge [13] start from a presumption that the act of problematisation is a more broadly lived reality of urban life. As Kalina and Tilley [12] have commented, to Barnett and Bridge, problematising is not a refined academic skill, “but a basic feature of engaged action and conscious decision-making across any number of issues or lifestyles.” Within both Barnett and Bridge’s [13] and Bacchi’s [24] readings of Foucault, problematisations have primarily occurred at the societal level: from the perspective of, in concert with, or in opposition to, the state. Bacchi [24] also extends these processes of problem formation to the individual, considering how people (predominantly policy makers and scholars, but also regular citizens) internally and phenomenologically examine, consider, interpret, and then ‘frame’ an issue as potentially problematic. Yet as Kalina and Tilley [12] note, these contributions do not explicitly speak to the ways in which individuals might problematise specific objects, or groups of objects, such as waste, and despite the shift to include the individual as a unit of analysis, the urban experiences accounted for could hardly be considered inclusive.

Oberg [25], however, has broadened the possibilities of the term, shifting the scope of analysis from problematisations around a given issue, to understanding how individuals problematise certain experiences, in this instance open defecation in India, while also demonstrating how the concept can be applied to analyse the lived reality of the urban poor. To Oberg [25], there is value in simply recognising the existence of all problematisations. The value in using the concept of problematisation as an analytical tool is that it allows for the full range of experiences in a given context to emerge. Accounting for the full spectrum of experiences “gives voice to subordinated problematisations and the groups enacting them, answering the normative imperative to be more inclusive” [25]. A focus on problematisations allows for hidden factors to emerge within decision making and problem formation processes, while considering respondents as rational decision-makers. Furthermore, and most importantly, to Oberg [25], exploring the full range of problematisations counters dominant problematisations by presenting other, more inclusive, alternatives. The problems of the poor matter too, and may often uniquely inform urban policy, by presenting, other, previously unheard challenges or possibilities. Lastly, Kalina and Tilley [12] build on the previously cited post-Foucauldian scholarship, adapting Foucault’s problematisations as an analytical lens through which to interpret how individuals problematise waste objects within their daily lives. Specifically, Kalina and Tilley

[12] examine how dumpsite workers in Malawi problematise the often hazardous waste fractions they encounter daily, and how these problematisations are shaped through their interactions with each other and the broader community, beyond the dump. Their findings reflect Foucault [26], in that a problematisation is a response or 'answer' to something that is real: a concrete situation or a lived reality. To Kalina and Tilley [27] problematisations, and problematisations of waste in particular, form due to the tangible impacts waste has on individuals' lives, though despite clear problematisations forming, actors in such contexts often lack the agency and resources to pursue solutions. The specific contribution of this investigation is to build on this body of scholarship. For respondents within the case study area, how do problematisations around riverine and marine litter form? To what degree are problematisations around litter shaped by culture, values, and other contextual factors? Are problematisations centred at the national, community, or individual level? For the African urban poor, is riverine and marine waste even considered a problem?

3. Methodology

3.1. Ethics statement

This study was granted ethical approval by the National Committee on Research in The Social Sciences and Humanities in Malawi, Protocol No. P.03/19/356. Participation was voluntary, and verbal, informed consent was gained from each respondent before every interview. The anonymity of respondents was maintained throughout the research process.

3.2. Methodological approach

As noted, the overriding purpose of this investigation was to understand the awareness and perceptions of riverine and marine litter, including the pathways that move waste through riverine systems and its potential impacts, for citizens previously neglected in the literature, principally low-income individuals and upstream communities. To meet these aims, 96 semi-structured interviews were conducted across four different low-income riverine-adjacent communities in both Durban, South Africa and Blantyre, Malawi over two periods between August and October 2020 and in March 2021. Specifically, 32 interviews were conducted with residents of Johanna Road, an informal settlement located on the fringes of Durban's central suburbs, 28 interviews were conducted with residents of Ndirande, a dense low-income neighbourhood in Blantyre, 18 were conducted with residents of Likhubula, a sprawling low-income area outside Blantyre, and a final 18 interviews were conducted in central Blantyre. All communities and respondents were purposively selected to meet the criteria of the study (low-income and upstream), and based on where the researchers had previously established research connections, and could therefore easily negotiate access, and could safely conduct in-person, qualitative research during the Covid-19 pandemic.

Johanna Road is a dense, informal settlement (Within a South African context, an informal settlement implies that the residents do not own the land on which their homes are built. Therefore, the structures are generally informal dwellings or shacks, as tenure is often precarious. In many instances, informal settlements are illegally built on municipal land), located just north of central Durban, and named for the road it straddles. Containing around 700 houses, the settlement is sandwiched on a spit of land that rises above Sea Cow Lake (Fig 2), which joins the uMgeni nearby before flowing into the Indian Ocean just a couple of kilometres downstream. Although the community is informal, it does have some municipal services, including regular waste collection from a centralised collection point. Nearby, on Sea Cow Lake, Green Corridors, a municipal-owned organisation operates a litter boom, which collects plastic floating on the surface of the river. Employees from the community operate the boom,



Fig 2. Johanna Road, viewed from Sea Cow Lake.

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and, as a result, most residents were aware of the boom's existence and purpose. Nonetheless, littering and illegal dumping are still common: building rubble, and other waste items the municipality will not collect are particularly problematic.

In Malawi, 28 interviews were conducted in Ndirande, Blantyre's largest slum. Home to nearly 200,000 people, Ndirande's dense sprawl begins just outside the Blantyre CBD (central business district) and creeps for several kilometres, climbing the slopes of Ndirande Mountain at 1,800 metres. A mix of informal and formal housing, Ndirande does not have reliable solid waste management services. Some sections have access to municipally serviced skips (dumpsters), which are infrequently emptied, and from which trash usually overflows. However, most sections do not even have this service, and rely on informal dumping grounds, or burning, to dispose of their household waste. The Nasolo River bisects Ndirande, flowing south into the Mudi River near the Blantyre central business district (CBD). Oftentimes, more a stream than a river, the Nasolo is nonetheless prone to flooding during the rainy season, and is heavily polluted from local dumping. The 28 respondents interviewed in Ndirande were purposively selected for living alongside the Nasolo.

An additional 18 interviews were conducted in Likhubula, a small but sprawling low-income community near Blantyre's airport. Less dense than Ndirande, Likhubula has even fewer public services, with no municipal waste collection at all, except for one communal dumping spot near the main road which is occasionally cleared with a backhoe. As a result, residents rely entirely on informal dumping or burning to dispose of their household waste. Likhubula is bounded by the Likhubula river, which eventually flows into the Mudi River, though well outside of Blantyre, to the southwest. Like the Nasolo, the Likhubula is highly polluted from local dumping (see Fig 3), with many informal dumping grounds being situated on the banks of the river itself. The 19 respondents interviewed in Likhubula were purposively selected for living alongside the Likhubula River.



Fig 3. Solid waste in the Likhubula River, Blantyre.

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A final 18 interviews were conducted with street vendors and pedestrians crossing the bridge over the Mudi River (near Rangely Gardens) in the Blantyre CBD. The Mudi, which flows into the Shire River near Chikwawa in the south of Malawi, is notoriously polluted, and has been the subject of numerous clean-up campaigns, with little impact [28, 29]. The bridge itself is notorious for its ever-present mounds of solid waste (principally plastic bags) which have accumulated over the years on the upstream sides of the bridge piers (see Fig 4). Respondents were purposively selected for their daily association with the space, either through their livelihood activities or through their daily commute.

Interviews were semi-structured, with questions centred on litter, the river, the ocean, and the connections between these forces. As noted, 96 interviews were conducted, across the four contexts, which was the maximum feasible number that could be conducted with the time and resources available; however, the consistency of respondents' responses suggests that saturation was achieved. Interviews were conducted in the local language (Chichewa for Blantyre, and isiZulu in Durban), audio recorded, and transcribed into English. Data was analysed thematically, and stored, transcribed, and then coded within the software programme Nvivo, which organises research materials and assists with the coding process.

4. Results and discussion

4.1. Where does it go?

In Johanna Road, despite regular municipal waste collection, residents described a substantial amount of waste scattered on the ground, concentrated in innumerable informal dumping spots, and, when the wind blows or it rains, waste flowing, inevitably, down the slopes of the settlement, into the river, with most ending up in the Indian Ocean. Nearly every respondent (97%) *knew* that the river flowed into the ocean, because with the river mouth just a few



Fig 4. Mudi River bridge, Blantyre.

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kilometres away, it was a known space for respondents. In fact most, when prompted, with the question, 'how do you know the river flows into the ocean?' either answered, 'because I've seen it,' 'it is general knowledge,' or simply 'I just know'. Finally, as previously mentioned, Green Corridors, operates a number of litter booms on the uMgeni River, including one on Sea Cow Lake near Johanna Road (see Fig 5). More than a third of the respondents (42%) noted that the



Fig 5. Green Corridor litter boom on Sea Cow Lake.

<https://doi.org/10.1371/journal.pwat.0000013.g005>

booms might be pulling some of this waste out of the river, however most had a clear idea that the majority of the waste would flow out to sea. Importantly, although a few residents noted that waste from Johanna Road might end up washing up on the sandbar at the uMgeni mouth, which is often choked with rubbish, especially during the rainy season, nobody mentioned the many beaches that stretch for kilometres from both directions from the river mouth as a possible end destination for their community's trash.

Much further from the sea, for respondents speaking to us alongside Blantyre's different watercourses, the pathway for discarded litter was less clear. All respondents *knew* that when it rained, the rubbish that lined the side lanes of Ndirande and Likhumbula, and choked the banks of the Nasolo, the Likhumbula, and the Mudi, would be swept into the rivers. They *knew* it because it was something they saw they witnessed every time it rained. In Ndirande and Likhumbula, where waste collection is almost non-existent, the community relies on this hydrological function as a central part of the community's waste management system: dumping by the river, and relying on the rains to sweep everything clean. A respondent from Ndirande (07/10/2020) described this relationship:

When I was young, when it was raining I would run after runoff water to the river with friends and would see a lot of plastic waste and other waste. It is even a habit here in rainy season to see people throwing waste collected in the bin into the water pathways so that waste it should carried off into the river. Every household here does that. I have done it myself and I still do it, because it's tiresome to go to dump waste at the dumping area. It is easy to just dump waste [by the water], after all it all goes to the river. Sometimes, it does not go according to plan, you dump waste in the water pathways and it spreads in the community instead.

It was also broadly held knowledge, usually from school or picked up from other media such as the radio or the newspaper, that each of the rivers eventually make their way to the Shire. This being part of the school curriculum is not particularly surprising, as the Shire features prominently in the history and geography of the region. Moreover, although most Malawians do not travel much, if you travel overland from Blantyre to most other points of the country, you will eventually have to cross the Shire. Furthermore, many towns in the region are located on its banks, so it is a place that may have personal meaning to some, as one respondent (07/10/2020), originally from Chikwawa, said, "I know these things, I'm from Chikwawa, I see the Shire flow". Understandings of which direction the Shire flowed, were less clear however. A handful of individuals (5%) correctly identified that the Shire flowed into the Zambezi, which then flowed into the sea. Respondents described this as something that was taught to them in school—none of the participants interviewed had ever actually seen the ocean first hand. In addition, a slightly larger proportion of respondents (10%) were able to nebulously state that the Shire eventually reached the ocean, as one resident of Likhumbula (08/10/2020) articulated, "I do not really know where exactly this river [the Likhumbula] goes. But, I think it connects to another river which goes to the Shire and then to the ocean." Only a small minority of respondents had no answer to the question at all. However, more than half of all respondents (51%) incorrectly believed that the Shire flowed *into* Lake Malawi (which is known to most Malawians known as *the* lake, despite Malawi having many lakes), as opposed to draining it, as residents of Ndirande (09/03/2021) and of Likhumbula (08/10/2020) described:

This river. . . I do not know where it goes exactly. I think it goes to Luchenza. From Luchenza, it goes to the Shire and then to the lake. Simply put, all rivers end up in the lake. Thus, when we dispose of waste here, it will eventually up end in the lake.

We know that all the rivers goes into the lake. Thus, all the waste is carried with into the lake. For example, if you leave a shirt here you will not be surprised to find it in the lake (Laughs).

Yet, unlike those who spoke of learning about the Zambezi and the ocean in school, those who *know* that the Shire flows into Lake Malawi describe learning it implicitly or tacitly, saying it is something they have 'seen' or 'heard'. Several described it as 'common knowledge' that all rivers, including the Shire flowed into the lake. This misunderstanding is not surprising considering how much more central the lake (and the Shire) is in Malawian cultural and economic life than the distant, and for most, unknowable sea.

4.2. Waste as a problem

Like northern beachgoers who formed their own problematisations of riverine and marine litter from encountering it at the beach, and through their relationship to the sea [6, 7], our respondents, low-income residents of Durban and Blantyre, formed their own problematisations of waste based on the ways in which it has impacted them and their community: as Kalina and Tilley [12] describe, "for the tangible impacts it has on their lives." For residents in both contexts, this manifested in concern for the impact that litter, in their communities and local watercourses, can have on the health and well-being of their neighbourhoods through personal experience of flooding, and disease caused by trash. As the waste moved further downstream, however, problematisations shifted, with Johanna Road residents, disconnected from the sea, having less clearly defined or broadly held problematisations of riverine or marine waste, while processes of problem formation in Blantyre being clearly shaped by the Malawian national connection to its rivers and lakes.

4.2.1. Johanna road. Residents of Johanna Road problematised a number of waste fractions: discarded glass bottles break, and the broken shards get ground down into the soil, posing a constant hazard to barefoot pedestrians. Organic waste decomposes, contributing to what many residents described as a chronic rat and snake infestation within the community. Yet, the most often problematised waste was plastic: discarded bags, bottles, and other scraps, which would blow in the wind, settle in heaps in low-lying areas, and when it rains, the trash washes down the slopes that bound each side of the settlement, choking the stormwater drains, before discharging into the river. Often, as residents described, the drains become so clogged with trash, that they back up causing heavy flooding within the community. These were events that respondents were able to articulate clearly, because it affected their life tangibly. A number of residents (25%) vividly describe the impacts that this flooding can have on the community, which, over the years, has caused damage to dozens of homes. One woman (08/08/2020) described a typical rainy season in Johanna Road, "[When it rains] waste floods into the sewage pipes and block them. During heavy rainfall the roads get flooded and also some of the houses." Several respondents (19%) described being personally affected, having water breach their homes during past periods of flooding. Furthermore, residents also problematised the flooding for its potential health impacts, believing it contributed to disease within the community, as one resident (08/08/2020) described:

[The flooding causes] huge problems my child, I do not know which example to make but just look here: all this waste is going to block the storm drains that should be transporting all this wastewater. When it rains all this waste gets flooded into the storm drains, blocking them and in turn causing a wastewater overflow. I do think about the impact it has on our health because we end up getting sick and not knowing the cause of that sickness. We end up having many mosquitoes getting people sick.

This clear connection that respondents make to disease is in addition to the general insalubrious nature that most residents described the community taking on when it is both muddy, wet, and full of trash; while with the storm water drains blocked, there is nowhere for any of it to go.

As far as problematisations of litter *in* the river or the ocean go, however formations for Johanna Road residents were much less clear or non-existent. For the uMgeni, problematisations centred around vague notions that litter would 'pollute' the river, however only a few individuals articulated further on that, expressing a belief that too much waste might harm the creatures living in the river or make the water unsafe to drink: potential impacts respondents described learning about on television or in school. Furthermore, a handful of respondents (12%) expressed a belief that too much waste in the river may inhibit its flow: a belief that has been informed by their own observations and may be bound to the community's own history and trauma with flooding, as one resident (08/08/2020) described:

Even the plastic that we throw in the river causes major problems. I do not have enough knowledge but let me make an example: when you get into the river you find a lot of plastics hindering the river flow into the ocean. I also sometimes see leaves and grass cuttings that end up blocking things that the river is transporting, causing a waste pile up since the water can no longer push all that waste.

Problematisations of ocean litter were less clearly formed, and less informed by personal experience, ranging from general notions that litter would 'pollute' the ocean and could kill fish, or that waste in the ocean may harm people trying to swim. However, despite the proximity of Johanna Road to the sea, these problematisations were not borne from experience, but rather from second-hand sources, with respondents describing seeing ocean plastic on television or other media, or the common responses of 'someone told me' or 'I just know.'

4.2.2. Blantyre. The residents of Blantyre's various riverine adjacent communities also hold clearly developed problematisations about the litter within their communities. However, unlike in Johanna Road, where plastic waste is problematised for its effect on the stormwater system, most of the respondents interviewed described plastic as rather benign, as something that takes up space rather than something that causes a problem. Instead, organic waste was strongly and broadly problematised by respondents for the perceived negative health impacts (and odours) it can have when left out to rot. These problematisations were accentuated for vulnerable people in the community, such as children, the sick, and the elderly, who were perceived to be more at risk. A resident of Ndirande (07/10/2020) described this process of problem formation:

When waste is left out for some time, it starts to rot and attracts flies that transmit germs on food that cause diarrhoea. The problem mostly affects children because they interact with rotten items without knowing it is very risky.

Respondents described knowledge of these health impacts as being taught in school as well as by the community Health Surveillance Assistants (HSAs) who regularly visit, as one resident noted, "there is no student who has gone from grade 1 to 5 without learning about hygiene." However, these health impacts are also experienced first-hand, as persistent and seasonal sickness are real challenges within Blantyre's poor communities, as another Ndirande (08/10/2020) resident described:

When waste is left out it rots it attracts tsetse flies which transfer germs to food after contact. As a result, you have diseases like cholera. We will start hearing people talking about cholera next month during the mango season, all because of poor waste management.

Respondents know their communities are unclean, and that the piles of rotting waste heaped around the neighbourhood can make them sick. The state underscores this connection at every opportunity (as if the persistent odours were not reminder enough) through the education and community healthcare system, but without providing waste management solutions residents were at a loss. They know the waste is a problem, but they do not know what else to do with it: until it rains and the river washes it away.

Unlike the residents of Johanna Road, respondents in Blantyre had very clearly formed problematisations regarding riverine waste. However, unlike within their own neighbourhoods, where organic waste was principally problematised and plastic was considered benign, *within* the rivers, organic was not considered by respondents to be harmful ('it will just decompose or the fish will eat it'), while plastic waste and other inorganics such as 'chemicals' were strongly problematised. Chemicals and other ill-defined waste which might pollute the rivers were problematised by respondents for impacting domestic functions such as bathing, washing, and drinking. One resident of Ndirande (07/10/2020), lamented the degradation of the Nasolo, "The river you saw when coming, used to be a beautiful river. People would go bathe, wash clothes, even drink water. Now it is heavily polluted that it can't be used for any purpose." Respondents also problematised the impact that waste (particularly plastic and chemicals) could have on fish (It is not a surprise that respondents would consider the impact on fish life, when fish figures so prominently within the national diet) life, by poisoning the waters, or by being so choked with waste that fish would suffocate. Moreover, respondents in Ndirande and Likhubula also echoed some of the fears of Johanna Road residents, of watercourses being blocked with waste, and potentially contributing to flooding. One resident of Ndirande (07/10/2020) explained how they see this problem:

It is the plastic bags and bottles because they block rivers that may cause the river to flood and in some cases cause the river to die. . . .Waste can accumulate in the river causing the river to block. As a result, the river may flood destroying buildings especially those built with unburn bricks. It seems simple that some people can't understand that floods can be caused by littering of paper and plastic. They may even say you are mad to make this connection to them.

Though in this instance, flooding was not a common fear of daily life, at least in the Blantyre communities we visited, but something that had been observed by respondents occurring in other communities, from the newspapers, radio, and television.

However, amongst Blantyre respondents, the most broadly held problematisations of riverine waste, and riverine *plastic* waste in particular, was of the impact it could have on the nation's hydroelectric system, largely centred on a system of dams on the Shire River. Although the point at which the Mudi River flows into the Shire is below Malawi's dams (and therefore plastic waste from Blantyre would not affect them), respondents held a near universal awareness that plastic waste in the river interfered with the dams, contributing to power cuts (Conversely, a few did *not* think that plastic in the river was a problem because the dams had filters that scooped it out, cleaning the rivers), as the following quotes from three different Ndirande residents illustrate:

When rubbish is carried off by runoff water into the rivers it blocks Escom (The national power utility) and Water Board equipment, affecting water supply and electricity generation which in turn affects businesses (07/10/2020).

As you are aware here in Malawi, we use hydroelectric, and the water intakes are in the rivers. As a result, we face power and water shortages because of waste. This derails development in the country as business struggles (07/10/2020).

It is a problem that affects those around the river and lake, and people in general. You hear all the noise that waste has blocked power generation plants at Nkula (Nkula Falls Power Station is located on the Shire about 50km from Blantyre, and about 70km upriver from Chikwawa). The problems that follow affect everyone. You have business failing to operate, wedding ceremonies affected due to power shortage all because of human activities (07/10/2020).

This process of problem formation was not informed by first-hand knowledge (it was unlikely that any of the respondents had ever seen one of the power stations), and although they would have been impacted by power cuts in innumerable ways (as the third quote points to), many of the respondents did not have access to electricity at home, while for those that did, it remained an expensive luxury. Rather, this problematisations seemed to have been informed by the state, and in particular Escom, through information campaigns about riverine plastic on the radio, in print media, and as one respondent was even able to show us, posters and even a calendar of plastic being screened from the river at a power station. This breadth of media demonstrates the role that the state and news outlets can play in shaping in processes of problem formation. For instance, for many respondents, plastic waste was intrinsically with the country's instable power grid, as one resident of Ndirande (07/10/2020) illustrated, "when the electricity was going off daily we were hearing on the radio that it was a result of waste blocking machines at the Nkula power generation station."

Although Blantyre is about 200km from the southern tip of Lake Malawi, respondents still held clearly formed problematisations for lake waste. These were more the same as those expressed regarding riverine waste: waste (and 'chemicals' in particular) would pollute the lake and render it unsuitable for domestic use (bathing, swimming, drinking, etc.), waste might kill aquatic life (fish in particular), or plastics might choke up the lake, reducing its size. Some of the respondents' problematisations were informed by observation, as they had visited the lake before. However for most, their understandings of the problem of lake waste were developed in school or from news programmes on the radio. For instance, one respondent (07/10/2020) described hearing a story about pollution in Lake Chilwa (Located on the border with Mozambique, north of Blantyre), "I heard on the radio that Lake Chilwa is so full of waste and heavily polluted that the water is discoloured and muddy." Problematisations regarding marine waste however were barely formed, with few respondents have *anything* to say regarding the sea, and in many instances respondents simply reverted back to discussing the lake, or just conflated the two. There was however, a handful of respondents (11%) who felt that the lake, and the ocean especially, were too big to be affected waste at all, or that they were too distant to be impacted by litter from Blantyre, as one respondent from Likhubula (08/10/2020) explained:

I do not know about oceans as I have never been to one, but as far as I'm concerned waste from this place can't go as far as the Indian ocean. It is broken down along the way or eaten by aquatic life. Maybe plastic can [reach the lake] because they say it does not decompose, still I doubt if it can reach the ocean. Let us take a big tree that has fallen in the river after 500 meters it is shredded. ... God has his ways of ensuring that no impacts happen and that plastic does not get into the oceans. I do not think waste can have impacts on the lake.

These individuals, were however the minority, with most Blantyre respondents expressing a sense of concern for the state of Malawi's rivers and lakes

4.3. Who is responsible?

As we have shown, respondents in both Durban and Blantyre were clear that waste in their community was a problem. These problematisations were formed through personal experience

and observation; through the hardship of living in low-income urban communities, which are inundated with trash, contributing to flooding, injury and illness. Problematisations of riverine (and lake) litter were more clearly developed amongst Blantyre respondents, who had a greater connection to those environments and information on potential problems than the residents of Johanna Road. Moreover, Blantyre respondents also believed that they were personally affected by the problem of riverine and lake litter, through power outages, pollution, etc. However, neither group had clearly formed problematisations about marine litter, as it was not a problem within their lives, or something they had heard much about.

As for *who* was responsible for these problems, respondents in both cities put most of the burden on themselves and their fellow community members, claiming that both the waste problems within their neighbourhood and within the hydrological system was due to their actions, and it was their responsibility to do something about it. Residents of all the visited communities spoke of a need to not litter, engage in community clean-ups, and take a greater personal responsibility for disposing of household waste 'properly'. Johanna Road residents additionally centred the role of the municipality in keeping their community clean, while Ndirande and Likhubula residents had fewer expectations from the City of Blantyre. Respondents also took responsibility for riverine and marine litter, with Blantyre respondents in particular, echoing a familiar refrain that it was the 'duty of every Malawian' to do their part to keep such places clean. Nonetheless, these clear problematisations and this sense of responsibility does not seem to have contributed to any change in behaviour or choice amongst respondents. For instance, a number of residents in Johanna Road responded defensively when asked what actions they were taking to keep their neighbourhood clean, and to keep trash out of the storm water drains, pointedly saying that it was not their responsibility alone. As one resident (08/08/2020) exclaimed, "Oh so you want me to do it?" Moreover, respondents in Ndirande and Likhubula know that riverine waste is a problem, yet they continue to dump on the banks of the Nasolo and the Likhubula. They know it is harmful for the health of the river, lakes and ocean, but without access to solid waste management services, what other alternatives do they have? One disposal method many Blantyre respondents espouse is burning as much household waste as possible, but that has other environmental implications, and in such close living quarters, can have serious health impacts as well. We cannot ask the poor to jeopardise their own health to safeguard the health of our planet's hydrological systems.

5. Conclusions

What has happened? The thing that has happened in this valley has happened in hundreds of others. The town, the whole valley, has turned its back upon the river. They have sought to get away from it. They have neglected it. They have used it as a sewer, a drain, a place for throwing their waste and their offal. Mills, homes, and farms have poured their dirt and refuse into it; outhouses and dung heaps have lined its banks. Almost as if by miracle some beauty still remains in places where the river for a moment free of its enemies and tormentors, dark and exhausted under its tall trees, has sunk back to vestiges of its former charm, in great, slow, breathless curves and still murmurs.

The health of our planet's rivers, and the potentially harmful impacts of the communities living along their banks is not a recent problem, as the quote above by W.E.B. Du Bois [30], speaking about the Housatonic River in western Massachusetts, would suggest. Yet, although the Housatonic may have begun to recover, the state of our planet's hydrological system has never been direr, as the world's great rivers continue to flood the ocean with unprecedented

amounts of waste; plastic waste in particular. Drawing on extensive qualitative fieldwork within low-income, riverine-adjacent informal communities in Blantyre, Malawi and Durban, South Africa, the purpose of the article was to develop a broader understanding of citizen awareness and perceptions around riverine and marine litter in contexts (Africa, urban, and low-income) previously neglected within the literature. Moreover, the study draws on Foucault's notion of *problematizations*, and more recent adaptations of Foucault's work toward waste [12, 25] as a lens to conceptualise processes of problem formation- how individual respondents view riverine and marine litter *as a problem*.

Findings have suggested that individual problematisations of waste, in the community and in the hydrological sphere, are, as Kalina and Tilley [12] described, personal, and do not exist independently from the people they affect. Problematisations around waste, in the community and in the hydrological system, are formed through daily experience and personal hardship; in the case of Blantyre, through the perceived impact waste can have on hydroelectricity generation, and in Johanna Road, by its contribution to flooding within the community. As the waste moved further downstream, however, problematisations shifted, and became less clearly formed as the rivers reached, for most, the unknowable sea. To Oberg [25], the strength of exploring the full range of problematisations counters dominant problematisations by presenting other, more inclusive, alternatives. But now that the poor residents of Durban and Blantyre have spoken honestly about how waste affects them, will their cities prioritise these problematisations?

Finally, respondents across both contexts did not hesitate to take responsibility for their own contribution to the waste crisis, and from these findings it seems that rooting messaging around pollution and environmental change in recipients own lived reality, may open the possibility for positive behavioural change outcomes. As we showed earlier, most investigations on riverine or marine litter have centred on the coastline, or most specifically the beach, the space where most traditional respondents (urban, Northern, middle class), encounter marine litter [6, 7], and this study confirms how limiting this scope is for gaining the understandings of the vast majority of Africa's urban poor. The poor do not, and should not, care about plastic on the beach when the beach remains inaccessible or unknowable.

Finally, it is important to note that the 'enemies and tormentors' of the Housatonic, of which Du Bois spoke, were explicitly not the poor citizens of western Massachusetts, but the uncontrolled industrial growth and capitalism which had marginalised these individuals and fouled the river in search of short-term profits. Although individuals may have contributed to the river's decline, Du Bois was deeply aware of the broader socio-economic systems that structured that behaviour, while his gaze remained fixed much more firmly on the capitalists on the top of the hill than on the workers and unemployed huddled on the rivers banks. Likewise, along the Shire and Umgeni, by shifting responsibility to the individual, we fundamentally ignore the systemic, socio-economic, and socio-political conditions that have created, and continue to create, these communities waste challenges. The poor residents of Blantyre and Durban may contribute to the flood of plastic in our rivers and oceans, but their contribution is dwarfed, per capita, by that of the rich. Moreover, blaming end-users and recommending end-of-pipe solutions does not address the continued production of single-use plastics [31]. Furthermore, while small steps are important, and studies which centre individual action are potentially illuminating, they are as Kalina [32] points out, inherently non-transformative. Instead they tend to individualise responsibility for ecological failure instead of centring structural failures [32]. Responsibility must be accompanied by change, and ultimately, meaningful change will come by improving service delivery within low-income areas and addressing the inequalities that have created the conditions that currently existed within these communities, because without reliable waste management services, awareness can only go so far to prevent the leakage of waste into the hydrological system.

Supporting information

S1 File. Interview schedule isiZulu.

(DOCX)

S2 File. Interview schedule Chichewa.

(DOCX)

S1 Data. Map datasets and source.

(DOCX)

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Author Contributions

Conceptualization: Marc Kalina, Jonathan Kwangulero, Fathima Ali, Elizabeth Tilley.

Data curation: Marc Kalina, Jonathan Kwangulero.

Formal analysis: Marc Kalina.

Funding acquisition: Elizabeth Tilley.

Investigation: Marc Kalina, Jonathan Kwangulero.

Methodology: Marc Kalina.

Project administration: Marc Kalina.

Resources: Marc Kalina.

Software: Marc Kalina, Yared Getachew Abera.

Supervision: Marc Kalina, Fathima Ali, Elizabeth Tilley.

Validation: Marc Kalina.

Visualization: Marc Kalina, Yared Getachew Abera.

Writing – original draft: Marc Kalina.

Writing – review & editing: Marc Kalina, Elizabeth Tilley.

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