Health & Place 95 (2025) 103548



Contents lists available at ScienceDirect

Health and Place

journal homepage: www.elsevier.com/locate/healthplace





Community insights into societal causes of and solutions for schistosomiasis transmission in Lake Albert fishing villages: A participatory approach

Maxson K. Anyolitho [a], Stella Neema [b], Paskari Odoi [b], Moses Adriko [c], Birgitte J. Vennervald [d], Edridah M. Tukahebwa [c], Shona Wilson [e,*]

[a] Department of Community Health, Lira University, Uganda
[b] School of Social Science, Makerere University, Uganda
[c] Vector Control Division, Ministry of Health, Uganda
[d] Section for Parasitology and Aquatic Pathobiology, University of Copenhagen, Denmark
[e] Department of Pathology, University of Cambridge, United Kingdom

ARTICLE INFO

Keywords:
Schistosomiasis
Community participatory
Cause
Solution
Uganda

ABSTRACT

Introduction: Schistosomiasis presents a significant public health concern with debilitating effects on millions of people, mostly in sub-Saharan Africa. In Uganda, despite intervention via mass drug administration (MDA) of praziquantel to combat the disease, prevalence remains alarmingly high within hotspots such as Lake Albert. Integrated control methods, including water-contact reducing behavioural change, have therefore been advocated. Despite the potential benefits of community involvement in the design of schistosomiasis behavioural change interventions, this approach has not been implemented in these Ugandan hotspots. Utilising community involvement, this study explored societal resource-based causes of lake-derived schistosomiasis transmission in hotspot communities of Hoima, western Uganda, how changing levels in these resources and access to them are altering infection-risk behaviour, and locally devised solutions for reducing infection-risk behaviours.

Materials and methods: A bottom-up participatory qualitative research design was employed. Purposive sampling was utilised to select 84 community advisory board (CAB) members to participate in focus group discussion sessions and participatory workshops. The CAB members comprised of fishermen, housewives, snail harvesters, village health teams, female and male youths, and community leaders. The data collected was analysed thematic-wise.

Results: The importance of the lake includes fish for both consumption and sale, water mainly for domestic use, papyrus for a variety of purposes, including roofing, sleeping mats, and mattresses and other resources such as oil, clay, sand, and salt. Community members reported that local conflicts, unfavourable and restrictive government policies, floods, migration, and instability have changed lake-derived resource levels. Recommendations for minimising contact with the lake suggested by participants were the provision of alternative water sources, promoting education, literacy and vocational skills, financial support, community empowerment and joint collaborative approaches.

Conclusions and recommendations: Despite challenges, Lake Albert provides a significant source of livelihood to communities. Providing alternative water sources and empowering local communities through the provision of alternative livelihood strategies is critical to reducing contact with the lake. A bottom-up participatory approach to community engagement facilitates community understanding of schistosomiasis problems and allows them to devise sustainable solutions to the problem.

1. Introduction

Schistosomiasis is a debilitating neglected tropical disease (NTD) caused by parasitic flatworms of the genus *Schistosoma*. It continues to be of significant public health concern in several parts of the world, particularly in sub-Saharan Africa, where it affects millions (Buofrate et al., 2025). In Uganda, the prevalence remains alarming, with hotspots bearing a disproportionate burden of the disease (PMA 2020.

* Corresponding author.
E-mail address: sw320@cam.ac.uk (S. Wilson).

https://doi.org/10.1016/j.healthplace.2025.103548
Received 22 January 2025; Received in revised form 8 September 2025; Accepted 11 September 2025
Available online 17 September 2025
1353-8292/© 2025 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Schistosomiasis Monitoring in Uganda, 2017). *Schistosoma mansoni,* which causes gastrointestinal schistosomiasis, is the most common species and is endemic among fishing communities on Lakes Victoria and Albert (Exum et al., 2019; Adriko et al., 2018). In its severest form, intestinal schistosomiasis presents with large fibrotic deposits in the liver (periportal fibrosis) that can lead to death. The development of severe disease is dependent upon prolonged exposure to high worm burdens (Booth et al., 2004).

In Uganda, in line with WHO recommendations, preventive chemotherapy (PC) is provided annually through mass drug administration (MDA) of the safe and efficacious drug praziquantel (PZQ) (World Health Organization, 2020). Despite good reported intervention coverage rates, infection prevalence is persistent, with some areas having (re)-infection rates greater than 90 % (Exum et al., 2019). Worse still, in the Lake Albert region, periportal fibrosis affecting both children and adults is still detectable (Anjorin et al., 2024). It is evident that the traditional top-down approaches to control and prevention of the disease using PC are not leading to morbidity control. Alternative strategies are therefore required to complement the current strategy, amongst which is promotion of behavioural change to reduce infection risk (World Health Organization, 2020).

The *Schistosoma mansoni* lifecycle involves two points of human behaviour for its completion: one, defecation in or near fresh water for deposition of the parasite eggs in the water, where hatched miracidia larval stages infect the intermediate aquatic snail host; and two, water contact for the free-living cercarial stage released by the snails to infect the human host through skin penetration. In Lake Albert, the force of transmission to the human host is known to be driven by a complex relationship between intermediate snail host species, population numbers and human water contact behaviours (Pinot de Moira et al., 2007). The dependence upon water contact behaviours results in transmission being influenced by environmental factors and by social, demographic and cultural practices, socioeconomic status, knowledge and attitudes regarding the disease, myths and misconceptions (Angora et al., 2019; Folefac et al., 2018; Anyolitho et al., 2022). Research has highlighted the importance of engaging local communities in understanding the complex interplay of societal factors contributing to the transmission of schistosomiasis (Onasanya et al., 2021; Lund et al., 2019) and community-led participatory approaches are effective in designing interventions that reduce schistosomiasis transmission (Person et al., 2016; Wairimu Macharia et al., 2016).

In Uganda, limited research has applied participatory approaches to understand factors that drive behaviours that lead to schistosomiasis transmission, and how best to promote behaviour change that reduces transmission. This study sought to bridge this by utilising participatory approaches to gain insights into the societal causes of schistosomiasis transmission and devise locally relevant solutions, with a specific focus on hotspots of transmission in Hoima, western Uganda. Specifically, the study attempted to answer three key research questions: How important is the lake to hotspot communities in Hoima? How do the communities interact with the lake and what are the implications of such interactions? What suggestions do the communities propose for minimising interaction with the lake? Within the context of these research questions, we also aimed to capture the dynamic nature of the interaction between the community members and the lake by recording the factors that drove changes in resources and associated behaviours, and the power dynamics between different agents in controlling how lake-based resources are utilised.

2. Material and methods

2.1. Study design

Participatory qualitative research involves collaboration between researchers and participants, focusing on collecting data through qualitative means and giving participants a voice in the research process (Mangrum, 2016). This collaborative and iterative approach constitutes a distinct design for conducting research. The design was chosen to allow the communities to voice their opinions, concerns and suggestions that can guide reductions in water contact behaviour and by extension schistosomiasis risk.

2.2. Study area and setting

Two villages, Kaiso from Kabaale (formerly Buseruka), and Runga from Kigorobya sub-counties in Hoima District were purposively selected, due to their location along the shores of Lake Albert. Lake Albert is shared between Uganda and the Democratic Republic of Congo (DRC). For many years, DRC has experienced civil war resulting in many of its nationals crossing into Uganda (D'Udine and Crawford, 2015). Actual and perceived unwanted behaviours by some refugees mean conflict and mistrust exist between sections of the established and immigrant populations (Renata, 2017). The sites experience a lack of access to clean and safe water and have low latrine coverage (Bwire et al., 2020; Uganda Bureau of Statistics, 2020). Both communities largely rely on fishing as their main economic activity, while Kaiso also has limited farming activities (Nakayi and Witte, 2019). Other economic activities include the harvesting of papyrus, and mining of local materials like clay, salt and sand for home use and for sale (Hoima District Local Government, 2023). The sites have poor road networks, and low levels of literacy, with high school dropout rates and low school enrolments (Kabera, 2019). Hoima District has a substantial praziquantel treatment history via PC implementation and Lake Albert shoreline community members report being well sensitised on the dangers of the infection, the benefits of praziquantel treatment and are aware of water contact being a risk factor (Odoi et al., 2024). Despite this, failure to meet PC control programme targets has been reported (Besigye et al., 2025).

2.3. Participants

A Community Advisory Board (CAB) was formed to engage with researchers. A CAB refers to "community members who share a common identity, history, language, and/or culture by which the community's interests in research or program development can be conveyed" (Kubicek and Robles, 2016). They play important roles in collaborating with stakeholders, act as entry points to the community and are bridges between communities and research institutions (Mhando and Juma, 2023). Groups of individuals key to understanding schistosomiasis-risk-related activities and solution development were purposively chosen. The CAB comprised 84 individuals, representative of 7 researcher-identified groups: 1) fishermen, 2) housewives, 3) snail harvesters, 4) community leaders, 5) Village Health Teams (VHTs), 6) male youths and 7) female youths. The participants were chosen by the community during community meetings, of which two were held, one for each of the villages. For these meetings community members were mobilised by the local council one chairperson with support and guidance of the project focal person. Attendees were guided on the above seven criteria for participants' selection and were asked to consider the purpose of the study and roles of the CAB members. Thereafter, selection commenced through voting by show of hands. For each category, 6 participants were required giving a total of 42 participants per village. FGD sessions consisting of the 6 selected participants were held for each of the 7 groups within each village. In groups 1–5, only adults aged 18 years or older were included. In the youth groups emancipated minors aged 16 and 17 years were also included. Within the groups, heterogeneity in regard to educational level, ethnicity and religious belief was maintained to ensure the collection of diverse views.

2.4. Data collection

Data was collected in September 2021 using focus group discussions

(FGD) and participatory activities. Research assistants who were skilled, experienced, and knowledgeable in the local languages of Alur and Lunyoro were recruited and trained to gain an in-depth understanding of the study topic. A one-day exercise was conducted in which the FGD tool was pre-tested in a neighbouring village not participating in the study. During the pre-test, emerging ideas not included in the probe were noted, and the format was analysed to ensure participants understood the questions. Required changes were incorporated into the guide. Key guide themes included 1) understanding the importance of the lake, 2) changes that have taken place to the resources from the lakes and the factors therein, 3) interactions with the external market, 4) interaction with the lake and solutions for reducing/minimising this and 5) sustainability/attitudes regarding reducing contact with the lake. Probes and prompts were encouraged during discussions to dig out the underlying aspects of each theme to gain more insight. With consent, all sessions were audio recorded and audio recordings transferred for transcription and analysis.

The participatory techniques employed included 1) problem tree analysis – in which participants were asked to prioritize a problem, define the root causes, and the outcomes of the problem; 2) resource mapping – in which participants were asked to map their community, the location of resources, lake-based or otherwise, 3) prioritisation and ranking – in which participants were asked to identify and rank stakeholders by the need for the lake, and by the power to change interaction with the resource. Two sessions, one per village, were held with CAB members nominated by the others to represent the key groups. Participants were actively encouraged to contribute to the discussion and decision-making process, sharing their ideas, perspectives, and experiences (Wallerstein and Duran, 2010).

2.5. Data analysis

FGD data was analysed thematic-wise using Clarke and Braun's six-step model (Clarke and Braun, 2013). All data were transcribed into English and the transcripts were uploaded into Nvivo V.1.7, for analysis. Transcripts were read to gain familiarity and insights into the data. The FGD guide and one transcript from Runga village were used to generate an initial coding frame for subsequent coding of all transcripts. New codes for themes that emerged were created. Next, codes with similar meanings were grouped to form themes and sub-themes, that were later reviewed to identify relationships between them; themes and sub-themes with recurrent patterns were put together and interpretations made. Variations between different populations and geographical groups were identified and are illustrated in the interpretations. Verbatim quotes with striking narratives are used to support the findings.

2.6. Ethical considerations

Ethical approval was obtained from the Vector Control Division Uganda Ministry of Health Research Ethics Committee (REC; VCDREC-149), the University of Cambridge Human Biology REC (HBREC.2021.15) and the Uganda National Council for Science and Technology (HS1616ES). Participants' information sheets (PIS) and consent forms were translated into the local language Alur. Written individual informed consent was obtained from study participants. For illiterate participants, the PIS and consent forms were read to them in the presence of a witness. Study identifiers were assigned to anonymise data.

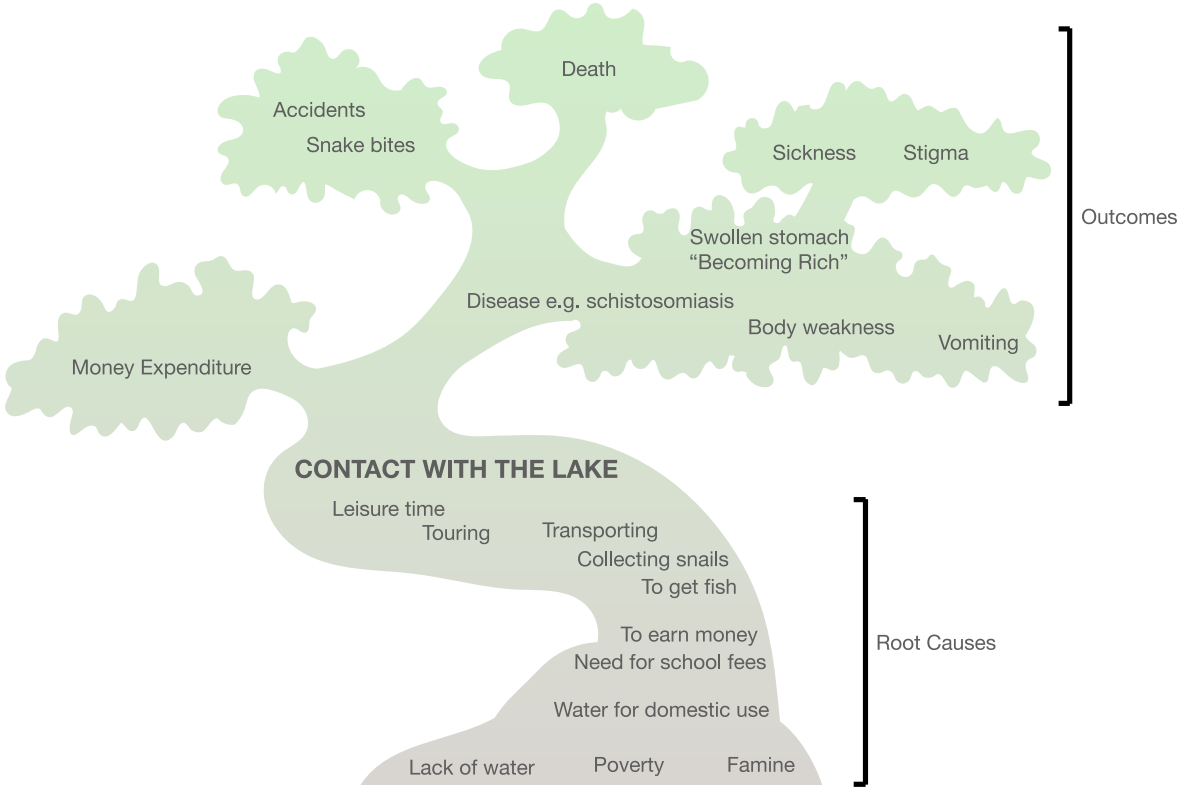


Fig. 1. Problem Tree. Shown are the root causes and outcomes of the problem "Contact with the lake" as identified during participatory activities. The results are the amalgamation of the activities conducted separately in Kaiso and Runga villages. The positioning of the causes and outcomes within the tree do not reflect an order of importance given by the participants, rather are researcher groupings of the answers. Deep root causes are assigned to the lowest level of the tree, and the root causes that are a consequence of these are provided above, with leisure-related causes given last. Outcomes are provided first as those that are a direct consequence of contact wiht the lake, with symptoms and consequences of schistosomiasis shown as a linked branch. "Becoming rich" does not refer to financial return, instead participants were referring to the ascites that can develop during severe schistosomiasis with the resultant swelling of the abdomen being equated with the stomach of a well-fed rich individual. Economic outcomes are shown as a branch.

3. Results

Problem tree analysis clearly indicated that the communities recognised the dangers and health implications associated with contact with the lake. Within the health-related outcomes were schistosomiasis, its symptoms and impacts (Fig. 1). Key themes and sub-themes emerged from the analysis of the FGDs: the importance of the lake, changes in lake resources, and changes in resource utilisation over time; as well as factors driving change such as government policies, rising water levels, and conflicts; and these were mirrored in the resource mapping and actor ranking activities. Suggestions for minimising contact with the lake include vocational and skills training, provision of clean water sources, financial support for diversification of employment and empowerment of local leaders to drive change.

3.1. The importance of the lake

The theme covers how life, economy, and survival are intrinsically linked to the lake. Three key aspects were further explored: 1) categories of persons interacting with the lake, 2) for what purposes and 3) how often. There is a consensus that interaction by men, women and children occurs on a daily or near-daily basis but varies greatly, reflecting their unique needs and roles within the community.

3.1.1. Water for domestic use

The lake serves as a critical water source for these communities. Water collection sites were identified during resource mapping and the need for water and the lack of alternative sources were highlighted amongst the root causes of lake contact during problem tree analysis (Fig. 1). Lake water is used for varied domestic uses including washing, drinking, and cooking. The lake is therefore life-sustaining and, hence has non-negotiable importance.

> "Water for domestic purposes such as cooking, washing, bathing and more so people use it for drinking." **(Runga, community leaders)**

> "We get water for domestic use such as washing clothes, drinking and also for cooking." **(Kaiso, fishermen)**

It is for these domestic purposes, that women in both communities primarily interact with the lake. They appreciate the availability of the lake for these tasks:

> "I think women are happy because there is no other place where they can fetch water for domestic activities." (**Runga, housewives)**

However, interaction with the lake for domestic purposes is not limited to women:

> "I go to fetch water for domestic use daily; R1: I go to fetch water for washing clothes several times a week; R6: I go to fetch water for drinking but I go to the point of the lake which reaches my chest and it's from there that I get my drinking water from since the deeper end is cleaner than the shallow parts of the lake." (**Kaiso, fishermen)**

Most of the participants concurred that contact with the lake has increased due to the dependency on the lake for domestic use. This need overshadows known detrimental factors:

> "My contact with the lake has increased since I need water for domestic use, we always need water for washing, cooking, and even bathing from the lake." (**Kaiso, fishermen)**

3.1.2. Fish for home consumption and sale

Fishing is the main source of livelihood in the community, with silverfish (Mukene) being the most common catch. The local economy is intertwined with fishing both directly (catching and selling fish) and indirectly (fish processing, equipment supply, etc.). The dual purpose of fish as a source of protein-rich food that ensures food security and as a significant economic asset was predominant in the findings and was mentioned by nearly all participants from both sites, though fishermen and community leaders have stronger, more dominant views in support of it as the main resource:

> "We get fish and sell some to get money and some home consumption." **(Kaiso, fishermen)**

> "Silver Fish (Mukene) is one of the resources we get from the lake and is for both subsistence and commercial." **(Runga, fishermen)**

The income generated from the sale of fish is used for meeting other basic needs such as paying for school fees, buying clothes and medication and building houses. However, regulations and environmental conditions can impact on the frequency of fishing:

> "For me, I only get to the lake twice a week because I can't afford to go there daily since we have the schedules to allow others to also participate." **(Runga, fishermen)**

> "At times there are strong winds which may not allow you to go fishing every day as you may wish." **(Runga, fishermen)**

Illuminating the importance of fishing, during resource mapping participants from the Kaiso CAB indicated fish breeding zones, and fishing grounds for different techniques and catches (pursen fishing method, baya fishing method, hook fishing method, net fishing method for Nile perch and silverfish). Fish and the need for a source of income were also identified as root causes of contact with the lake during problem tree analysis (Fig. 1).

3.1.3. Snail collection

The commercial collection and sale of snails, in particular their shells, for animal and chicken feeds, known as 'Osongoro', represents a use of the lake's biodiversity beyond fish that contributes significantly to the local economy. 'Osongoro' was equally important across the two villages:

> "Snail (Osongoro) is one of the resources we get from the lake which benefits us commercially." **(Runga, fishermen)**

> "We also get 'Osongoro'(Snails) and sell to get money." **(Kaiso, fishermen)**

3.1.4. Sand and salt mining

Sand was mentioned by fishermen, housewives and male youths from Kaiso, but only fishermen and VHTs from Runga. Meanwhile, salt was strongly mentioned by housewives, VHTs and male youths from Runga, but only male and female youths from Kaiso, highlighting micro-geographical optimisation of resource utilisation by the communities. Sand is mined from the lake for use as a construction material. Like fish, sand represents a dual-purpose resource, as it is used both as an income stream through the sale of sand to builders, and for local benefit through the building of houses, infrastructure, and other community amenities.

> "Some people used to mine sand mainly for selling to the builders and in return, they get money." **(Runga, fishermen)**

> "Other than water for domestic use, we also get sand, and we use it for house construction." **(Kaiso, fishermen)**

The harvesting of salt from the lake serves both culinary purposes and forms another commercial good that can be sold for profit. Its extraction again demonstrates the lake's significance in fulfilling local needs and in creating economic opportunities.

> "Salt is also for domestic usage and commercial purpose where people mine and take some to market and keep others for cooking at home." **(Runga, housewives)**

> "We also extract salt from the lake and sell it to get money." **(Kaiso, male youths)**

3.1.5. Other resources

The lake is essentially an 'in-house' supply of building materials and source materials for household goods, reducing dependencies on external sources, and saving money for households. The natural resource, papyrus is exploited for constructing roofs, making sleeping mats, and serving as mattresses:

> "People also collect reeds and papyrus for the construction of houses those that have grass-thatched houses and others use them as mattresses. Even most of the buildings within here, we use papyrus for building them." **(Kaiso, community leaders)**

Clay is used as a local form of cement for house construction. It was, however, only recognised as a resource by snail harvesters and female youths in Runga and Kaiso community leaders, implying lower perceived importance compared to other lake resources; however, it not only represents the lake's utility in providing building materials but also showcases how the local communities have adapted to their locally available resources, indirectly contributing to their economic sustainability.

> "We get clay for smearing on our houses." **(Runga, snail harvesters)**

> "We also get floor substrates at the lake and it's black in colour for smearing the house, it's another cement here for house construction." **(Kaiso, community leaders)**

Scraps washed by rain into the lake such as nails and stones from submerged homes are repurposed for construction, exemplifying the resource optimisation practiced by the communities. It is the children who look for these scraps (zagazaga). This serves both for subsistence and to earn a small additional income. Their interaction with the lake is also for recreational purposes such as swimming:

> "Children love to swim in the lake and collect silverfish during their free time." (**Runga -Snail harvesters**)

> "Scrap from submerged homes that children pick like nails, stones for building." **(Runga, snail harvesters)**

> "Children, during their free time, swim in the lake, sometimes they also look for "zaga" (metal scraps), it helps them get a bit of pocket money." (**Kaiso – Female Youth**)

The multi-faceted use of the lake was corroborated by resource mapping when snail, papyrus reed, and sand harvesting zones were identified. It is the men in both communities who spend a significant amount of time at the lake for dual and economic purposes. Their interaction with the lake is therefore crucial to their livelihoods:

> "Men who are fishermen spend more time compared to the other community members." (**Runga, fishermen**)

> "It's mostly the men, why, the reason is he has to go and look for fish to find a way of surviving because the woman is at home …" (**Kaiso, community leaders**)

In actor ranking analysis (Fig. 2), the male-dominated dual-purpose resources of fish and sand were both mentioned, but interestingly it was the female-dominated resource of water that ranked highest both in terms of need and power; reflecting the onus on the life-giving importance of the lake apparent in FGD analysis.

3.1.6. Oil

The presence of oil in the lake signifies an economic opportunity. The exploitation of this resource leads to employment generation within the community, whilst the sale of oil can bring in significant revenues. It's a resource that has the potential to substantially improve the socioeconomic status of the communities. From the data, the importance of the lake in providing oil seems recognised more in Runga, where it was expressed by fishermen, community leaders and VHTs, than in Kaiso where only community leaders mentioned it as an important resource.

> "We also get oil from the lake; the oil has brought in income and employment for people in this community." **(Runga, community leaders)**

> "We get fish and right now we have petrol." **(Kaiso, community leaders)**

3.2. Changes in lake resources and their utilisation over time

This theme reflects the complex interplay between environmental changes, human activities, and government interventions, and how these changes are affecting local economies and ways of life.

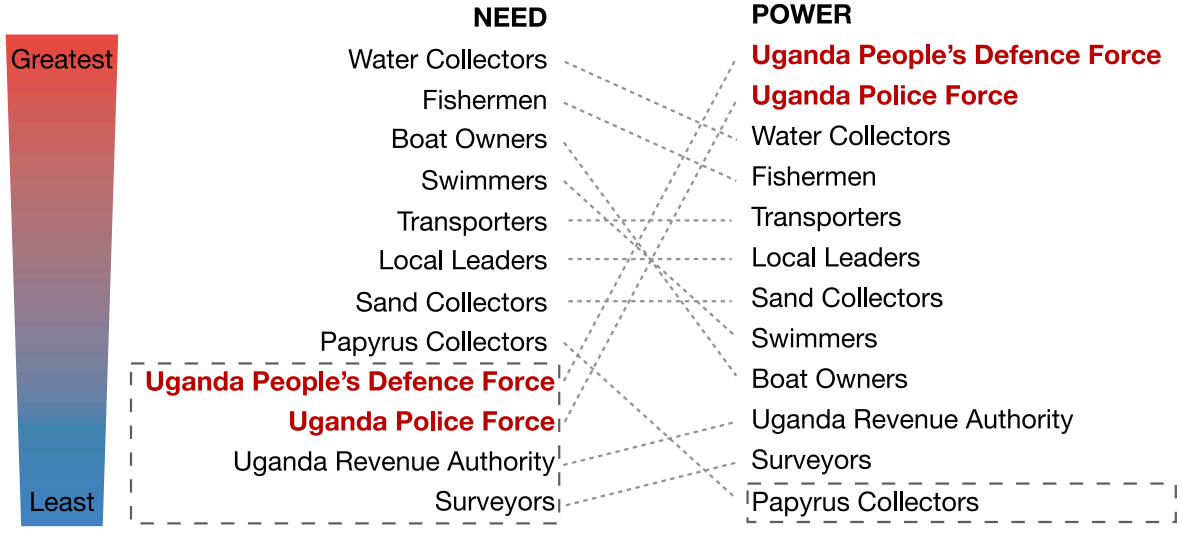


Fig. 2. Actor Ranking. Shown are the rankings from greatest to least in descending order for actors who have a need for Lake Albert's resources and for power to determine how those resources are managed. Actors who appear within dashed boxes are those who were not mentioned during activities in relation to either need or power but appeared in the other ranking. The position of the mentioned actors in the rankings is the amalgamation of the scores provided by the participants in the two villages. Actors' positions are linked by dashed lines to show movement up and down in ranking when moving from need to power. The actors with the greatest change between "need" and "power" - the Uganda People's Defence Force and Uganda Police Force - are highlighted in red.

3.2.1. Reduced fish catch-stock

Almost all FGD participants of different categories from both sites agreed that fish stocks have greatly reduced over time and that this is a critical issue. Overfishing, use of poor fishing methods, use of illegal fishing gear, population growth, and changes in climate such as the lack of rain were given as reasons for the decrease in fish stocks. This decline is negatively affecting livelihoods and more widely the communities.

> "Fish has decreased due to overfishing and the use of poor fishing methods or illegal fishing gear which is not recommended by the government." **(Runga, housewives)**

> "Fish has reduced because of catching immature fish." **(Runga, community leaders)**

In both Runga and Kaiso, reduced stocks of fish and enforcement of illegal fishing practices have greatly decreased contact with the lake:

> "It (contact) has greatly decreased due to the decreasing stock of Nile perch from the lake, yet it is one of the most lucrative types of fish." (**Runga, fishermen**).

The decreased fish stock impacts the fishermen's livelihoods, and the business of fish traders, and leads to a general decrease in the communities' interaction with the lake.

3.2.2. Increase in water levels

In June 2020 lake levels rose rapidly, adversely affecting the communities. Findings, especially from fishermen from Runga, and VHTs and male youths from Kaiso indicate this resulted in migration from the landing sites and decreased interactions with the lake due to fears of drowning and an increase in dangerous animals at the shore.

> "Water levels have increased due to natural occurrences which are beyond human control and many people have been forced to move away from the landing sites." **(Runga, fishermen)**

> "Also, people interact less with the water now because of the increase in the water level which has brought many dangerous animals to the shores like the hippos, and snakes, which pose a threat to the lives of people and so discourage people from swimming in the lake." **(Kaiso, VHTs)**

The practicalities of accessing papyrus and sand had also changed due to the floods covering papyrus and sand harvesting areas. The decreases were more strongly voiced by participants from Runga village.

> "Yes, papyrus has tremendously decreased because of floods. All the places where we used to get it from are already swallowed by the water." (**Runga, housewives**)

> "Sand is reducing because of the water flooding so it's hard to access it." **(Runga, snail harvesters)**

A significant reduction in snail shells was also noted by participants in both villages. This significantly affects income as they were collected solely for commercial reasons. They explained that when the water levels increase, snails are deeper in the lake, making them difficult to collect. Also, a reduction in waves means fewer shells swept to shore:

> "Snail shells have reduced because water volume has increased and no strong winds to blow them to the shore" **(Runga, snail harvesters)**

> "Snails have all decreased and now we earn less than we used to get from the sale of fish, silverfish, and snails. The cause has been due to natural changes brought by God such as over-flooding." **(Kaiso, snail harvesters)**

3.3. Factors that have driven changes in the use of resources

This theme highlights participants' views on what factors are responsible for the changes in lake resources' availability, accessibility, and utilisation. Flooding, addressed above, was mentioned by Runga housewives and male youths from both villages in the context of factors that change the use of resources. It is not clear why other participants did not mention this point.

> "Indeed, external factors like floods have a great influence on fishing activities and how we can manage other lake-related resources." **(Runga, housewives)**

Instead, other groups focused largely on external societal causes, beyond the communities' control. When internal factors were mentioned they often had underlying external influences.

3.3.1. Local policies

Community leaders, such as village health teams (VHTs) and local council members, discussed their role in making decisions about the lake's use and conservation, and their work to resolve conflicts over lake resources. A Runga VHT explains,

> "We monitor the health issues caused by the lake and guide the community in making the right decisions about using the lake."

A Kaiso local council member adds,

> "We try to manage the conflicts that arise over the lake's resources, we also contribute to the planning of the lake's conservation."

Conflicts, particularly over sand mining rights have arisen in Runga. These conflicts are not just between community members but also involve local and sub-county leadership, so are influenced by larger political forces, with the lack of local control sometimes exacerbating the situation.

> "There have been conflicts resulting from sand mining sites between the landing site, local leadership, and the sub-county leadership. To be honest, we had no control over that because there was political influence from above." **(Runga, fishermen)**

3.3.2. Government policies

Government policies are having a significant impact on the use of lake resources. The enforcement of policies by security forces and restrictions on certain fishing gear are seen as hindrances to the normal operation of these communities. This opinion was shared by almost all participants from both sites and in different categories emphasising the significant implication on the livelihoods of the communities.

> "Some of the government policies are not favourable to us because we no longer use the resources the way we want to use them." **(Runga, fishermen)**

At the time of the study, the COVID-19 pandemic and related regulations had a significant impact on lake resource use. Curfews and restrictions on the number of people allowed to gather at a time affected the community's fishing schedule.

> "Of recent, the implementation of the COVID-19 standard operating procedures has greatly affected time to go to the lake and fish and also even step in the lake." **(Runga, community leaders)**

Actor ranking activities emphasized the perceived considerable influence of government actors involved in policy enforcement in the use of the lake resources, being assigned as those with the most power over them despite having been given no ranking in the need for the resources (Fig. 2).

3.3.3. Migration and instability from the Democratic Republic of Congo (DRC)

Migration, both in and out of the communities, impacts the use and management of lake resources. In some instances, newcomers may disrupt existing fishing activities through their practices but also

reportedly through fishing gear targeted crime.

"Other people (fishermen) from Congo have been flooding the fishing ground and disrupting fishing activities." **(Runga, housewives)**

"Congolese also steal and rob people's boats and engines making it difficult to do fishing in the lake." **(Runga, housewives)**

Meanwhile, the departure of community members can lead to a decrease in those using and managing the resources.

3.3.4. Disparity in socioeconomic status

Wealthy individuals play a role in how local resources are used and managed. Runga snail harvesters and male youths complained that these individuals gained control over significant portions of the land, preventing others from accessing and using alternative resources.

"Some rich man came and fenced most of the land, we cannot do any other activity like cultivation." **(Runga, snail harvesters)**

3.3.5. High prices due to inflation

Rising prices due to inflation have reduced the profitability of snail harvesting and fishing, causing external buyers to stop purchasing these commodities. Ultimately, the reduced demand decreases harvesting and fishing activities. This view was mainly held by Kaiso snail harvesters.

"Snails are now very expensive, so the buyers nowadays hardly come to this side because, to them, it's no longer as profitable as it used to be, hence snail harvesting has reduced due to reduced demand from external buyers." **(Kaiso, snail harvesters)**

The apparent ebb and flow of the communities' responses to social and environmental influences on their available resources results in a fatalistic response from sections of the community, notably the youths of Runga village:

"I think we are still doing the same thing we used to do 10 years ago since we don't have any alternatives. Therefore, whether you want or not, you should have contact with water either for fishing or bathing, swimming, and fetching water for domestic usage." **(Runga, male youths)**

3.4. Suggestions for minimising contact with the lake

This last theme highlights participants' views on potential solutions to minimise their interaction with the lake, which if addressed could help solve the problem of schistosomiasis in their communities.

3.4.1. Provision of alternative water sources

There was a consensus across the communities regarding the provision of alternative water sources and they proposed that the government should provide alternative sources of water such as boreholes and tap water. This would reduce their reliance on the lake for their domestic water needs, thus minimising the contact they have with it.

"We need alternative water sources and supplies for domestic activities because we don't have any boreholes …" **(Runga, fishermen)**

"We need alternative water sources like boreholes so that we can limit our contact with the lake." **(Kaiso, VHTs)**

3.4.2. Education, training and diversification opportunities

The communities around Runga and Kaiso recognize that education is a powerful tool to curb the over-reliance on lake resources.

"We need schools to be constructed in this community … the majority of children spend most of their time in contact with the water …" **(Runga, fishermen)**

"We need schools for our children so that they may reduce their time going to the lake." **(Kaiso, VHTs)**

Vocational skills for the youth were also suggested by participants from Runga village. The need is for vocational training centres where individuals who are not willing or not able to go to formal learning could learn hands-on skills, opening up job opportunities outside of fishing:

"Youths to be improved with e.g., mechanics, driving schools for the young men." **(Runga, snail harvesters)**

Relatedly, both communities suggest the need for diversification of income sources, such as farming and business opportunities. This would not only improve their economic condition but would also lessen their dependence on the lake resources.

"If the land that is taken up by one person could be released to the community so that some people may start other kinds of activities like cultivation." **(Runga, snail harvesters)**

"I would like to reduce this (fishing) but even when I would like to do farming, there is no place for such activity." **(Kaiso, fishermen)**

The communities argue that providing financial support or loans would help them to establish other businesses, decreasing their reliance on lake resources.

"Let the government address the issue of loans …" **(Runga VHT)**

"The government should help us and create savings and credit cooperative organizations (SACCOs) for us to get some money for work …" **(Kaiso, housewives)**

3.4.3. Putting in place strict laws and proper implementation of already existing ones

The communities propose stricter regulations regarding fishing and the use of lake resources. The participants reasoned that these laws could guide their practices, protect the lake's ecosystem, and manage the resource for future generations.

"I think if we had serious laws and they are being implemented in this community, things can change …" **(Runga, community leaders)**

"The government should continue with the enforcement it is making concerning fishing to protect fish for the future." **(Kaiso, VHTs)**

The communities emphasize the importance of implementing existing policies to manage and protect the lake's resources. They believe this could bring significant change if coupled with proper law enforcement.

"There is a need to implement the policies that are already in place …" **(Runga, community leaders)**

"The government should provide security to prevent our neighbours from coming to fish on our side …" **(Kaiso, VHT)**

3.4.4. Community empowerment and collaborative approach

The communities strongly feel that empowering local leaders could play a significant role in managing lake resources. Through education, participants thought that leaders would have the knowledge to value and prioritize community needs and challenges in areas such as education and law enforcement.

"The local council one (LCI) needs to be empowered to do their roles since they are the first point of contact with the community …" **(Runga, community leaders)**

The communities believe in the power of collective action in managing the lake's resources. They suggest that religious leaders and community leaders should create awareness of the proper management of the lake.

"There should be a joint effort for leaders like religious leaders should take part in mobilizing people on how to manage the lake …" **(Runga, VHTs)**

4. Discussion

We utilised a participatory approach to gain community insights into the societal causes of schistosomiasis transmission, which is dependent on water contact, and the development of locally relevant solutions that reduce infection-risk behaviours The design enabled us to understand the hotspot communities' perceptions of the lake and its importance; their interactions with it and what they think can or should be done to minimise contact with the lake. In line with previous findings, we found that the lake's resources are expertly utilised and optimised, providing food, income, employment, and necessities, making the lake an irreplaceable asset for these communities (Uganda Bureau of Statistics, 2020; Muhumuza et al., 2013; Uganda Bureau of Statistics, 2002).

Livelihood and socio-economic development in Uganda and other least-developed countries are largely dependent on the environment and natural resources (Ssali et al., 2023; Ofosu et al., 2020). In the study area, fishing is the main source of livelihood (D'Udine and Crawford, 2015; Clemens et al., 2022; Oporia et al., 2022), and the main resource mentioned by all groups was fish. The use of fish for both home consumption and for sale was found to resonate with findings from other lakeshore communities in Uganda (Ojambo, 2021; Nsubuga et al., 2014). Reduced fish catches are a critical issue noted and have previously been recorded in studies on peacebuilding in the Albert region and DRC (Westerkamp and Houdret, 2010). Overfishing, use of poor fishing methods, use of illegal fishing gear, population growth, and climate changes were given as reasons for the decrease in fish stocks, corroborating previous findings for the Uganda portion of Lake Albert and Albert Nile during the 2001 to 2012 period (Muhumuza et al., 2013).

The water levels in Lake Albert significantly increased in 2020, resulting in the loss of fisheries infrastructure and ecosystem misconfiguration (Kibego, 2022). The increase in water levels resulted in forced migration from the landing sites; a decrease in interactions with the lake due to fears of drowning, and has affected the availability and accessibility of other economic resources such as snail shells, papyrus reed stock and sand, corroborating findings from elsewhere (Oporia et al., 2022; Whitworth et al., 2019; Miller et al., 2019). The heavy rains responsible for the rise in rivers and lakes in several parts of Uganda have been attributed to the effects of climate change (Turyasingura et al., 2023) and are likely to become more frequent and persistent in the future. However, a subtlety of understanding is required, as not all sections of the community reported a decrease in their water contact behaviours due to the role the lake takes in meeting domestic needs.

Regarding non-environmental factors that have driven changes in the use of lake-derived resources, we found out that nearly all mentioned were external and beyond the community's control. While those that are internal were influenced by external forces. Factors mentioned include conflicts between the community and local leaders over local resource extraction; unfavourable and restrictive government policies, and their implementation; migration due to the instability of neighbouring DRC; wealth disparity; and inflation. Our findings are supported by other studies (D'Udine and Crawford, 2015; Ojambo, 2021; Westerkamp and Houdret, 2010; Nakiyende et al., 2023; Isingoma, 2020; Biryabarema, 2014).

The communities were aspirational regarding long-term solutions to their need for interaction with the lake. Key suggestions include promoting education; providing vocational skills training for those who are not able/willing to go to school and providing alternative livelihoods support through organised financing. Despite voicing negative associations with government regulations regarding their interaction with the lake, the participants had a thorough understanding of why fishing regulations were in place and were keen to help protect the lake as a biodiverse resource for future generations. They proposed restrictive laws against the overuse of lake-derived resources and their proper implementation amongst the solutions required but emphasized the need to empower local leaders in the implementation of laws, policies and provision of security to the communities. The need to strengthen enforcement and compliance with the existing regulations and laws, through training and education, coupled with affirmative actions such as extending soft loans to the affected communities have previously been highlighted (Nakiyende et al., 2023).

Interaction with the lake varies greatly between groups of individuals, reflecting unique needs and roles within the community. A case in point, the women in both communities primarily interact with the lake for domestic purposes, while the men spend a significant amount of time at the lake for economic activities; such gender divisions of labour are common in Ugandan lake shore communities (Ssali et al., 2023). A one-solution-fits-all fix is therefore unlikely and various perspectives in any discussion or decision-making process about the lake and its resources will be required. Our own research design could have produced subjective results due to biases in participation; for example, we did not set out to systematically capture the views of the established and immigrant populations and expect that the community representatives are skewed towards the former. It does, however, provide perspectives from within the communities on how they utilize the lake-based resources available to them, the factors that influence how they utilize them and their current feeling of disempowerment, and solutions to how they could decrease their almost total reliance upon them. They hold an understanding of why tough regulation on the use of these resources is required, and indeed welcome them, as long as local empowerment to aid their implementation is integrated; and due to their dependence on the lake-derived resources they also require appropriate support to diversify their livelihoods during any period of transition. A knowledge base is therefore provided for the design of potential interventions, but crucial to any success will be the continued involvement and support of the communities, with an iterative, flexible approach that responds to the feedback provided by the communities.

Funding

This work was supported by a Research England Global Challenges Research Fund Award (G108162 A21231). SN, PO, MA, BJV, EMT and SW were supported by the FibroScHot project which is part of the EDCTP2 programme supported by the European Union (RIA2017NIM-1842-FibroScHot).

CRediT authorship contribution statement

Maxson K. Anyolitho: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Stella Neema:** Writing – review & editing, Project administration, Funding acquisition, Formal analysis, Conceptualization. **Paskari Odoi:** Writing – review & editing, Investigation, Data curation. **Moses Adriko:** Writing – review & editing, Project administration, Investigation. **Birgitte J. Vennervald:** Writing – review & editing, Funding acquisition, Conceptualization. **Edridah M. Tukahebwa:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Shona Wilson:** Writing – review & editing, Visualization, Project administration, Funding acquisition, Conceptualization.

Data availability

The focus group transcripts supporting this work are available from the UK Data Service ReShare repository: Anyolitho, Maxson K and Neema, Stella and Odoi, Paskari and Moses, Adriko and Vennervald, Birgitte J and Tukahebwa, Edridah M and Wilson, Shona (2025). Community Insights Into Societal Causes of and Solutions for Schistosomiasis Transmission in Lake Albert Fishing Villages: A Participatory Approach,

2021. [Data Collection]. Colchester, Essex: UK Data Service. 10.5244/UKDA-SN-857628.

References

Adriko, M., Tinkitina, B., Tukahebw, E.M., Standley, C.J., Stothard, J.R., Kabatereine, N. B., 2018. The epidemiology of schistosomiasis in Lango region Uganda 60 years after Schwetz 1951: can schistosomiasis be eliminated through mass drug administration without other supportive control measures? Acta Trop. 185 (June), 412–418.

Angora, E.K., Boissier, J., Menan, H., Rey, O., Tuo, K., Touré, A.O., et al., 2019. Prevalence and risk factors for schistosomiasis among schoolchildren in two settings of Côte d'ivoire. Trop. Med. Infect. Dis. 4 (3).

Anjorin, S., Nabatte, B., Mpooya, S., Tinkitina, B., Opio, C.K., Kabatereine, N.B., Chami, G.F., 2024. Epidemiology of periportal fibrosis and relevance of current Schistosoma mansoni infection within the context of repeated mass drug administration in rural Uganda: a population-based, cross-sectional study. Lancet Microbe 5, 100944.

Anyolitho, M.K., Poels, K., Huyse, T., Tumusiime, J., Mugabi, F., Tolo, C.U., et al., 2022. Knowledge, attitudes, and practices regarding schistosomiasis infection and prevention: a mixed-methods study among endemic communities of western Uganda. PLoS Negl. Trop Dis. [Internet] 16 (2), 1–21. https://doi.org/10.1371/journal.pntd.0010190.

Besigye, F., Rowel, C., Adriko, M., Muyodi, F.J., Kisakye, J.J., Nalwanga, R., et al., 2025. School-aged Schistosoma mansoni infection levels after long-term programmatic control show failure to meet control programme targets and evidence of a persistent hotspot: evaluation of the FibroScHot trial baseline data. PLoS Neglected Trop. Dis. 19, e0012708.26.

Biryabarema, E., 2014. Uganda ups oil reserves estimate by 85 pct, finds natural gas _ reuters [Internet]. https://www.reuters.com/article/business/energy/uganda-ups-oil-reserves-estimate-by-85-pct-finds-natural-gas-idUSL5N0QZ1EW/.

Booth, M., Vennervald, B.J., Kabatereine, N.B., Kazibwe, F., Ouma, J.H., Kariuki, C.H., et al., 2004. Hepatosplenic morbidity in two neighbouring communities in Uganda with high levels of Schistosoma mansoni infection but very different durations of residence. Trans. R. Soc. Trop. Med. Hyg. 98 (2), 125–136.

Buofrate, D., Ferrari, T.C.A., Adegnika, A.A., Stothard, J.R., Gobbi, F.G., 2025. Human schistosomiasis. Lancet 405, 658–670.

Bwire, G., Roskosky, M., Ballard, A., Brooks, W.A., Okello, A., Rafael, F., et al., 2020. Use of surveys to evaluate an integrated oral cholera vaccine campaign in response to a cholera outbreak in Hoima district, Uganda. BMJ Open 10 (12).

Clarke, V., Braun, V., 2013. Teaching Thematic Analysis: Overcoming Challenges and Developing Strategies for Effective Learning. SAGE Encycl Qual Res Methods [Internet]. Available from: https://uwe-repository.worktribe.com/preview/937606/Teaching.

Clemens, T., Oporia, F., Parker, E.M., Yellman, M.A., Ballesteros, M.F., Kobusingye, O., 2022. Drowning in Uganda: examining data from administrative sources. Inj. Prev. J. Int. Soc. Child Adolesc. Inj. Prev. 28 (1), 9–15.

D'Udine, F., Crawford, A., 2015. Migration and Conservation in the Lake Albert Ecosystem. The International Institute for Sustainable Development, Geneva, pp. 1–2, 2015;(August). https://www.iisd.org/system/files/publications/migration-conservation-lake-albert-ecosystem-report.pdf.

Exum, N.G., Kibira, S.P.S., Ssenyonga, R., Nobili, J., Shannon, A.K., Ssempebwa, J.C., et al., 2019. The prevalence of schistosomiasis in Uganda: a nationally representative population estimate to inform control programs and water and sanitation interventions. PLoS Neglected Trop. Dis. 13 (8), 1–21.

Folefac, L.N., Nde-Fon, P., Verla, V.S., Tangye, M.N., Njunda, A.L., Luma, H.N., 2018. Knowledge, attitudes and practices regarding urinary schistosomiasis among adults in the Ekombe Bonji health area, Cameroon. Pan Afr. Med. J. 29, 1.

Hoima District Local Government, 2023. Hoima district investment profile [internet]. https://hoima.go.ug/download/hoima-investment-profile-2021-uganda-investment-authority/.

Isingoma, T., 2020. Africa_2020_07_16_how_covid_19_health_responses_impact_displaced.pdf [Internet]. http://eprints.lse.ac.uk/.

Kabera, P., 2019. Inclusive development and the emerging oil sector. A Case of Hoima District in the Albertine Region of Mid-western Uganda. https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/2642193.

Kibego, J., 2022. Economic effects of Lake Albert flooding 'devastating' for affected ugandans. https://news.un.org/en/story/2022/03/1113732.

Kubicek, K., Robles, M., 2016. Resource for voices community integrating into a research study. https://sc-ctsi.org/uploads/resources/CommunityAdvisoryBoard_Toolkit.pdf.

Lund, A.J., Sam, M.M., Sy, A.B., Sow, O.W., Ali, S., Sokolow, S.H., et al., 2019. Unavoidable risks: local perspectives on water contact behavior and implications for schistosomiasis control in an agricultural region of Northern Senegal. Am. J. Trop. Med. Hyg. 101 (4), 837–847.

Mangrum, R., 2016. Participatory qualitative research methodologies in health: a review. Qual. Rep. [Internet]. https://doi.org/10.46743/2160-3715/2016.2597.

Mhando, F., Juma, O.A., 2023. Engaging communities for better public health projects outcomes: a story of Bagamoyo community advisory board members. Voice Publ. 9 (2), 60–73.

Miller, L., Alele, F.O., Emeto, T.I., Franklin, R.C., 2019. Epidemiology, risk factors and measures for preventing drowning in Africa: a systematic review. Medicina (Kaunas) 55 (10).

Muhumuza, S., Olsen, A., Katahoire, A., Nuwaha, F., 2013. Uptake of preventive treatment for intestinal schistosomiasis among school children in Jinja district, Uganda: a cross sectional study. PLoS One 8 (5).

Nakayi, R., Witte, A., 2019. Making Cultural Heritage Claims on Profitable Land: the Case of the Ngassa Wells in Uganda's Oil Region: kontroverse um kulturelles Erbe auf lukrativem Land: Der Fall der Ngassa-Bohrlöcher in Ugandas Ölregion. Afr. Spectr. 54 (3), 222–243.

Nakiyende, H., Basooma, A., Ikwaput Nyeko, J., Okello, W., Rugadya, R., Albrecht, C., et al., 2023. Limitations for informed decision making and better management of the transboundary Lake Albert fisheries resources. J. Great Lakes Res. [Internet] 49 (6), 102165. https://doi.org/10.1016/j.jglr.2023.02.006.

Nsubuga, F.N.W., Namutebi, E.N., Nsubuga-Ssenfuma, M., 2014. Water resources of Uganda: an assessment and review. J. Water Resour. Protect. 6 (14), 1297–1315.

Odoi, P., Neema, S., Vennervald, B.J., Tukahebwa, E.M., Wilson, S., 2024. Barriers and facilitators to programmatic mass drug administration in persistent schistosomiasis hotspot communities: an ethnographic study along Lake Albert, midwestern Uganda. PLoS Neglected Trop. Dis. 18 (12), e0012002, 2024.

Ofosu, G., Dittmann, A., Sarpong, D., Botchie, D., 2020. Socio-economic and environmental implications of artisanal and Small-scale mining (ASM) on agriculture and livelihoods. Environ. Sci. Pol. 106, 210–220.

Ojambo, R., 2021. On the waters: economic and political drivers of maritime conflicts between Uganda and its neighbors. Afr. Stud. Q. 20 (3), 60–72.

Onasanya, A., Bengtson, M., Oladepo, O., Van Engelen, J., Diehl, J.C., 2021. Rethinking the top-down approach to schistosomiasis control and elimination in Sub-Saharan Africa. Front. Public Health 9, 622809.

Oporia, F., Kibira, S.P.S., Jagnoor, J., Nuwaha, F., Makumbi, F.E., Muwonge, T., et al., 2022. Determinants of lifejacket use among boaters on Lake Albert, Uganda: a qualitative study. Inj. Prev. J. Int. Soc. Child Adolesc. Inj. Prev. 28 (4), 335–339.

Person, B., Knopp, S., Ali, S.M., A'Kadir, F.M., Khamis, A.N., Ali, J.N., et al., 2016. Community co-designed schistosomiasis control interventions for school-aged children in Zanzibar. J. Biosoc. Sci. [Internet] 48 (S1), S56–S73. https://doi.org/10.1017/S0021932016000067 [cited 2021 Jun 16].

Pinot de Moira, A., Fulford, A.J., Kabatereine, N.B., Kazibwe, F., Ouma, J.H., Dunne, D. W., et al., 2007. Microgeographical and tribal variations in water contact and Schistosoma mansoni exposure within a Ugandan fishing community. Trop. Med. Int. Health 12, 724–735.

PMA2020. Schistosomiasis monitoring in Uganda. https://www.pma2020.org/sites/default/files/Schistosomiasis_Brief-Round2.pdf, 2017.

Renata, M.I.C.H.A., 2017. The effects of perceived discrimination on immigrant and refugee physical and mental health. Physiol. Behav. 176 (1), 100–106.

Ssali, S.N., Morgan, R., Nakiranda, S., Opio, C.K., del Barrio, M.O., 2023. Gendered lives, gendered vulnerabilities: an intersectional gender analysis of exposure to and treatment of schistosomiasis in Pakwach district, Uganda. PLoS Negl. Trop Dis. [Internet] 17 (11), 1–19. https://doi.org/10.1371/journal.pntd.0010639.

Turyasingura, B., Hannington, N., Kinyi, H., Mohammed, F., Ayiga, N., Bojago, E., et al., 2023. A review of the effects of climate change on water resources in Sub-Saharan Africa. Afr.J. Clim. Chang. Resour. Sustain 2, 84–101.

Uganda Bureau of Statistics, 2002. Uganda Population and Housing Census: Population Size and Distribution, pp. 1–72. Ubos. 2006;(October).

Uganda Bureau of Statistics, 2020. Statistical Abstract, vol. 1. Uganda Bur Stat [Internet], p. 303, 2020. http://www.ubos.org/onlinefiles/uploads/ubos/pdfdocuments/abstracts/StatisticalAbstract2013.pdf.

Wairimu Macharia, J., Ng, Z.W., Michugu Njenga, S., Macharia, J.W., Ng'Ang'A, Z.W., Njenga, S.M., 2016. Factors influencing community participation in control and related operational research for urogenital schistosomiasis and soil-transmitted helminths in rural villages of Kwale county, coastal Kenya. Pan Afr. Med. J. [Internet] 24, 1–7 [cited 2020 Apr 27].

Wallerstein, N., Duran, B., 2010. Community-based participatory research contributions to intervention research: the intersection of science and practice to improve health equity. Am. J. Publ. Health 100 (Suppl. 1).

Westerkamp, M., Houdret, A., 2010. Peacebuilding across Lake Albert reinforcing environmental cooperation between Uganda and the democratic republic of Congo. https://adelphi.de/system/files/mediathek/bilder/us_038_-_peacebuilding_lake_albert.pdf.

Whitworth, H.S., Pando, J., Hansen, C., Howard, N., Moshi, A., Rocky, O., et al., 2019. Drowning among fishing communities on the Tanzanian shore of Lake Victoria: a mixed-methods study to examine incidence, risk factors and socioeconomic impact. BMJ Open 9 (12), e032428.

World Health Organization, 2020. Ending the Neglect to Attain the Sustainable Development Goals: a Road Map for Neglected Tropical Diseases 2021–2030. [Internet]. WHO, p. 196. Available from: https://www.who.int/publications/i/item/9789240010352.