UNLOCKING THE POTENTIAL OF CITIZEN SCIENCE IN THE FIGHT AGAINST BILHARZIA

HIGH BILHARZIA RE-INFECTION RATES IN UGANDA

Snail-borne diseases pose a **significant public and veterinary health burden in Uganda.** Bilharzia is highly prevalent around major water bodies, where infection levels can reach up to 90% [1]. Also, liver fluke disease in cattle is highly prevalent, causing lower milk production and an estimated annual loss of US$ 92.4 million due to condemned liver alone [2].

Since mass drug administration alone does not suffice to control these diseases, the World Health Organization recommends complementing treatment by snail control and community involvement. However, the **lack of snail experts** and snail data hampers the design of targeted control measures. Also, despite behaviour change interventions, **risky practices** such as open defecation **persist** in Uganda, **resulting in high re-infection rates** [3].

SOLUTION

*To tackle these challenges, ATRAP proposes an innovative approach, called '**citizen science**', whereby non-expert community members are involved in scientific research.*

KEY MESSAGES

- Community-based snail monitoring presents a valuable and cost-effective complement to classical surveillance programs, and increases scientific literacy at the same time.
- Co-designed and community-led bilharzia awareness campaigns increase ownership and are more sustainable and cost-effective compared to conventional top-down interventions.
- Citizen-generated recommendations can elicit preventive actions & bylaws at the local level, but national support is needed for up-scaling.

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SUCCEED WE MUST
CITIZEN SCIENCE in UGANDA
Citizen Science in Uganda
AFRICA museum

ACTION TOWARDS REDUCING AQUATIC SNAIL BORNE PARASITIC DISEASES (ATRAP)

ATRAP is a transdisciplinary collaboration between the Mbarara University of Science and Technology (MUST) in Uganda and the Royal Museum for Central Africa (RMCA) in Belgium. Since 2019, ATRAP has worked with the communities of western Uganda to develop **innovative and inclusive monitoring and awareness-raising tools to prevent bilharzia and liver fluke disease.**

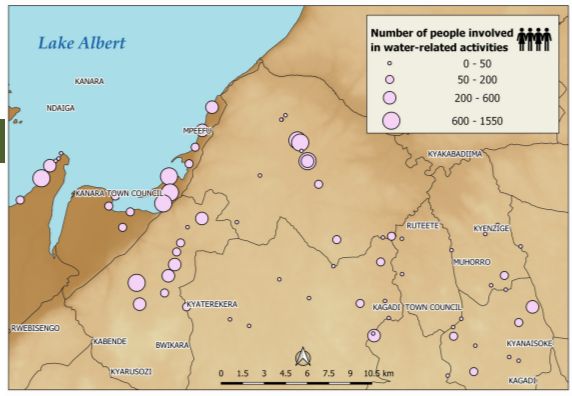
CONCEPT & METHODOLOGY

Together with village and district leaders, ATRAP established a network of 25 community members, also called *citizen scientists* (CSs). They weekly monitored snail presence and water-related activities between 2020-2023 at 76 fixed preselected water contact sites [4]. These data together with expert data were used to identify potential snail-borne disease transmission sites. The CSs simultaneously developed and coordinated community-led awareness campaigns to induce sustainable behaviour change [5].

KEY RESULTS

1) Large-scale data generated

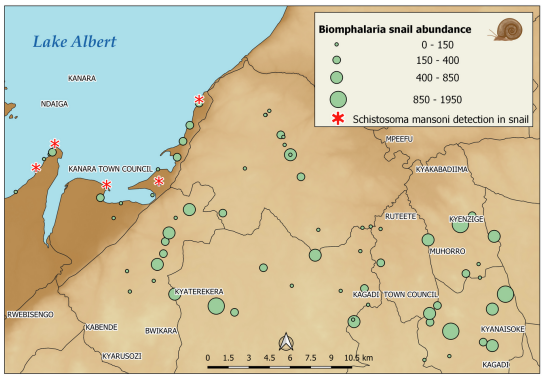
Citizens submitted over 6,400 reports and recorded 82,000 snails and all data have passed the quality check by experts.



- **Key finding 1**: More vector snails found in upland streams & rivers, compared to lake sites (map below).
- **Key finding 2**: Risky water practices are most frequent at lake sites <u>but</u> also **upland (map right).**
- **Key finding 3:** citizen-driving snail monitoring is 8x cheaper than expert sampling [6].
- **Key finding 4**: Key stakeholder interviews (n=110) highlight risky practices like free-range grazing and unsafe water sources for livestock. This, together with limited knowledge of the diseases, poses a greater risk of spreading liver and blood flukes among animals.

2) Proof of active human and animal disease transmission

Shedding experiments & diagnostic PCR tests on snails revealed human bilharzia transmission at the lake and some stream sites while snails upland were positive for animal bilharzia and liver fluke



- **Key finding 1**: High prevalence & overlapping distribution of human and animal parasites.
- **Key finding 2**: Abattoir visits revealed 57% of livestock infected with liver flukes.
- **Key finding 3**: First record of snail **host of urogenital bilharzia** in Ntoroko and Kagadi, highlighting the potential for outbreaks of the disease given the observed risky water practices in the area [7] .

3) Awareness raised & communities empowered

The skills and knowledge of snail disease vectors of both the citizen scientists and the community at large improved significantly.

- **Key finding 1**: Local communities better understood and appreciated bilharzia problems after their active involvement in interpreting the study findings.

- **Key finding 2**: They recommended appropriate actions & channels to use for awareness and subsequently owned and took charge of the awareness campaign, reaching an estimated 50,000 individuals in just one week [5].
- **Key finding 3**: After the campaign, at least 91% as opposed to 73% at baseline, think it is important to avoid contact with contaminated water [8]. Actual preventive practices and health-seeking behaviour, however, did not significantly change [9].
- **Key finding 4**: CSs gained more respect and trust from the community because of their accumulated knowledge and meaningful contribution to the community's well-being.

4) Bridging policy with citizen science

Throughout the project, ATRAP has engaged over 30 leaders at the district, sub-county and community levels to discuss study outcomes and co-design sustainable policy recommendations

- **Key finding 1**: Over 50% of consulted leaders trust data generated by the ATRAP citizen scientists given the proof of robust quality checks and the regular training of the CSs.
- **Key finding 2**: The leaders also recommend constant supervision to ensure that the citizen scientists carry out their tasks precisely and that the data is accurate.

- **Key finding 3**: Citizen-generated recommendations can incite actions at the local level as demonstrated in several sub-counties, with the creation of Water Teams and reparation of water boreholes after dissemination of ATRAP findings [5].

CONCLUSIONS

- **Participatory community-based approaches** support communities to take responsibility, implement vector control measures & ensure that healthy behaviours are part of the social fabric.
- The high prevalence and overlapping distribution of human and animal parasites call for an integrated **One Health approach & cross-ministry collaboration.**

RECOMMENDATIONS

- Recognize and support CS as a way of doing science by **streamlining CS in government activities**.
- Adopt bottom-up citizen-led approaches in designing & implementing behaviour change campaigns.
- Ensure continued communication and **involvement of citizens right from the start**
- Support modern farming practices such as routine de-worming, controlled grazing, and use of cow troughs.
- Implement **citizen science** to **monitor snail distribution** to guide snail control in areas with proven disease transmission.
- **Prioritize safe water access** and **drug treatment** in areas with a **higher risk of transmission** of snail-borne diseases based on citizen-generated data.
- **Empower** communities to take an active role in the mass drug administration program.

References:

1 Loewenberg, S., 2014. The Lancet.
2 Joan et al., 2015 British Microbiology Research Journal.
3 Exum et al., 2019 PLOS Neglected Tropical Diseases.
4 Brees et al., 2021 Citizen Science: Theory and Practice.
5 Anyolitho et al., 2023. HSS Communications.
6 Tumusiime et al. (submitted to PNTD).
7 Tumusiime et al. Accepted in Parasites & Vectors.
8 Anyolitho et al., 2022. PLOS Neglected Tropical Disease.
9 Anyolitho et al., 2023. BMC Public Health.

Contacts:
Dr. Casim Umba Tolo
Department of Biology
Mbarara University of Science & Technology Mbarara, Uganda.
E-mail: tolocas@must.ac.ug

Dr. Tine Huyse
Departm. of Biology, Royal Museum for Central Africa, Belgium.
E-mail: tine.huyse@africamuseum.be

ATRAP is funded by the Belgian Directorate-General Development Cooperation and Humanitarian Aid - 15/09/2023