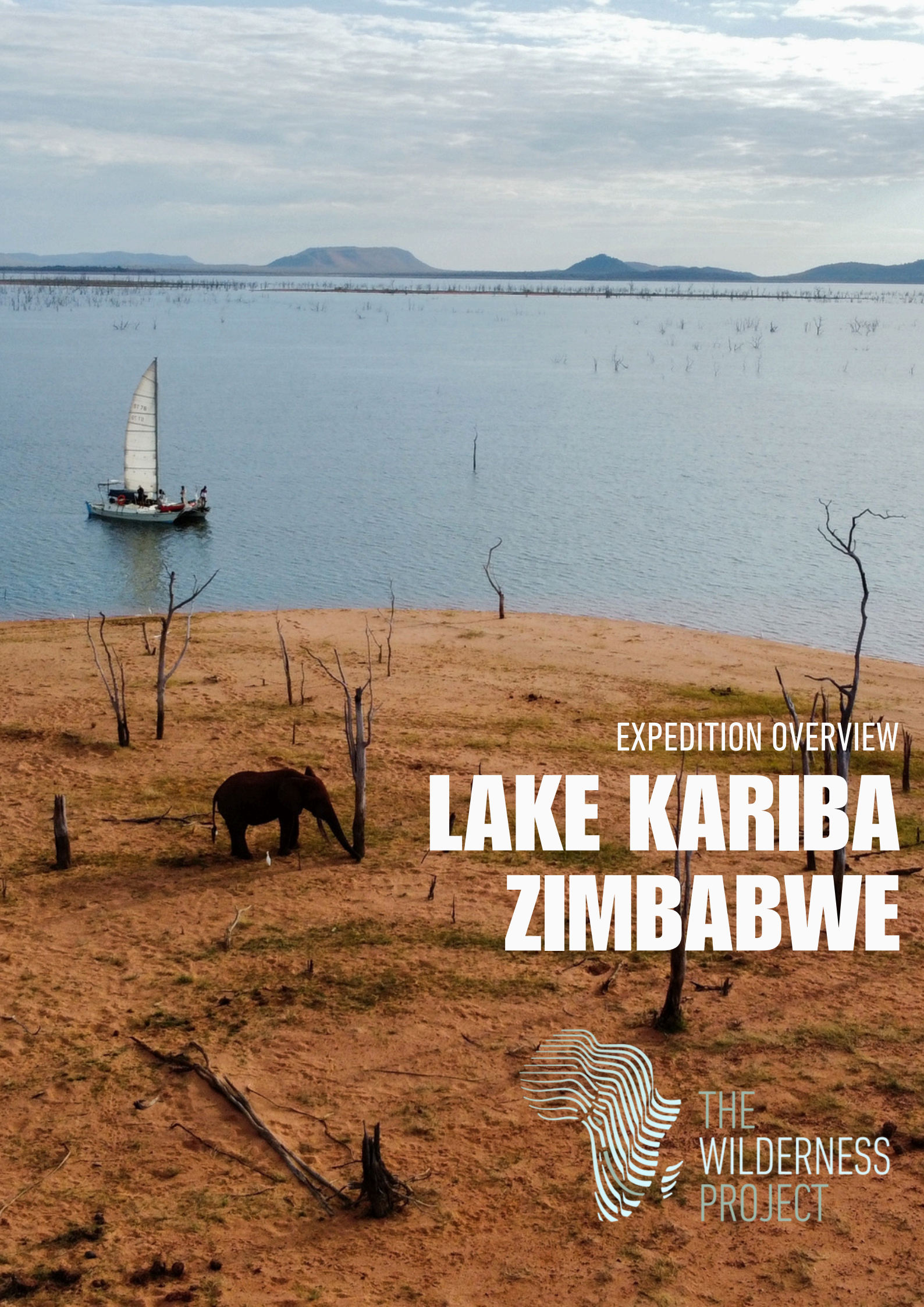


EXPEDITION OVERVIEW

LAKE KARIBA ZIMBABWE

THE WILDERNESS PROJECT

THE WILDERNESS PROJECT

ABOUT THE WILDERNESS PROJECT

By 2035, in partnership with local communities, governments, researchers and NGOs, The Wilderness Project aims to explore, study and better protect 1.2 million square kilometres of irreplaceable African wilderness. Central to this effort is to establish detailed hydrological and ecological baselines of the largely undocumented sources and watersheds of Africa's greatest river basins — Zambezi, Congo, Nile, Chad and Niger.

ACKNOWLEDGEMENTS

This work would be impossible without the collaboration of our various partners, who enable information-sharing, provide invaluable guidance, and grant permissions wherever we work. For input and collaboration, we thank the Zimbabwe Parks and Wildlife Management Authority, African Parks, Wildlife Conservation Action, and the Wild Bird Trust. Finally, to the traditional custodians who granted us permission to navigate the waters and lands of Lake Kariba.

WILD BIRD TRUST

Wildlife Conservation Action

AFRICAN PARKS

834km

Traversed by sailboat and canoe

9 people

From four African countries

123

Fixed survey sites established

19 days

18 June - 6 July 2024

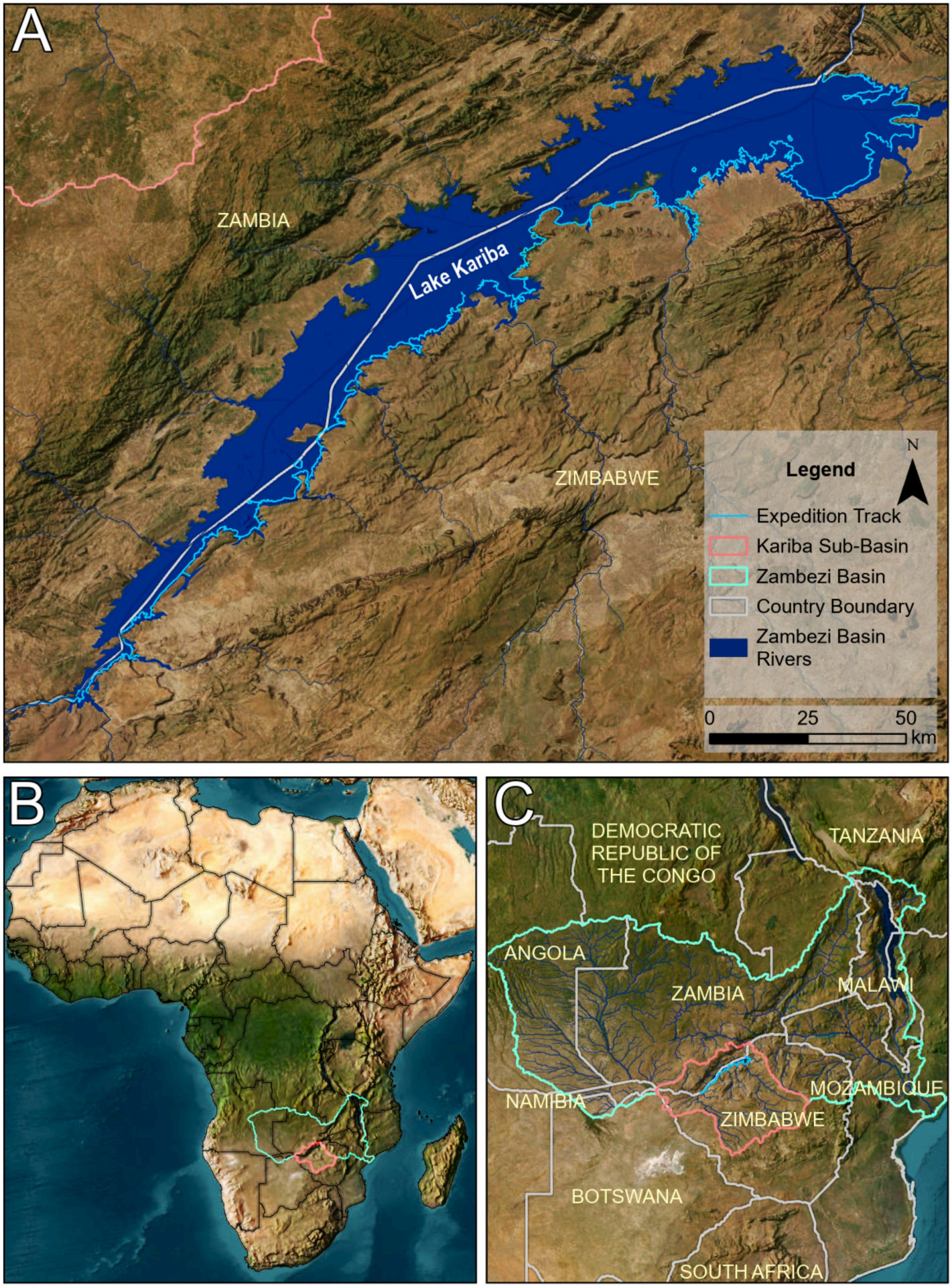
INTRODUCTION

Lake Kariba, located on the Zambezi River between Zambia and Zimbabwe, is the largest man-made reservoir by volume in the world, covering approximately 5,580 square kilometres. The lake plays a crucial role in regulating water flow along the Zambezi River basin, supporting fisheries, hydroelectric power generation, and tourism.

Since the construction of the Kariba Dam in 1959, the lake has received a relatively high level of research attention compared to elsewhere along the Zambezi River. However, its importance to the livelihoods of millions of people means that ongoing monitoring of the lake will be vital for the sustainable management of the Zambezi River.

The Wilderness Project conducted the Lake Kariba transect across 19 days in June–July 2024. The transect traversed 834 km on the Zimbabwean side of Lake Kariba from the mouth of the Zambezi River to the Kariba dam wall. Several important baseline datasets were collected along the transect to provide a picture of the lake's health.

The data collected on this expedition offer a snapshot of Lake Kariba using modern scientific techniques. This report, presenting an overview of the preliminary assessment, will be followed by a comprehensive expedition report. It is our hope that this report will support the researchers, river authorities, local communities and NGOs that share in the wonder of this unique river.



A - The 834 km track traversed by the expedition team along the south of Lake Kariba.
B - Located in the southern Africa, Lake Kariba is the largest man-made reservoir in the world
C - Situated 1 800 km upstream of the Zambezi River outflow in the Indian Ocean, Lake Kariba is critical for regional water, food and power security.

Collecting an eDNA sample

FIXED SURVEY SITES

Fixed survey locations allow researchers to consistently monitor lakes and their tributaries over the long term. These sites are established at set intervals along the transect, thereby allowing us to compare different sections of the lake. By regularly conducting drone flights, eDNA assessments, macroinvertebrate surveys, and water quality tests at these sites, we can detect patterns that only emerge through systematic survey methods. This methodology provides stakeholders like local communities, lake authorities and NGOs with a structured way of understanding the variation in biodiversity, water quality and human activity around the lake.

A fixed survey site at Island 155 in Lake Kariba.

OVERVIEW OF DATA COLLECTED

123 sites

110
aerial drone surveys, water quality measurements and pathogen samples

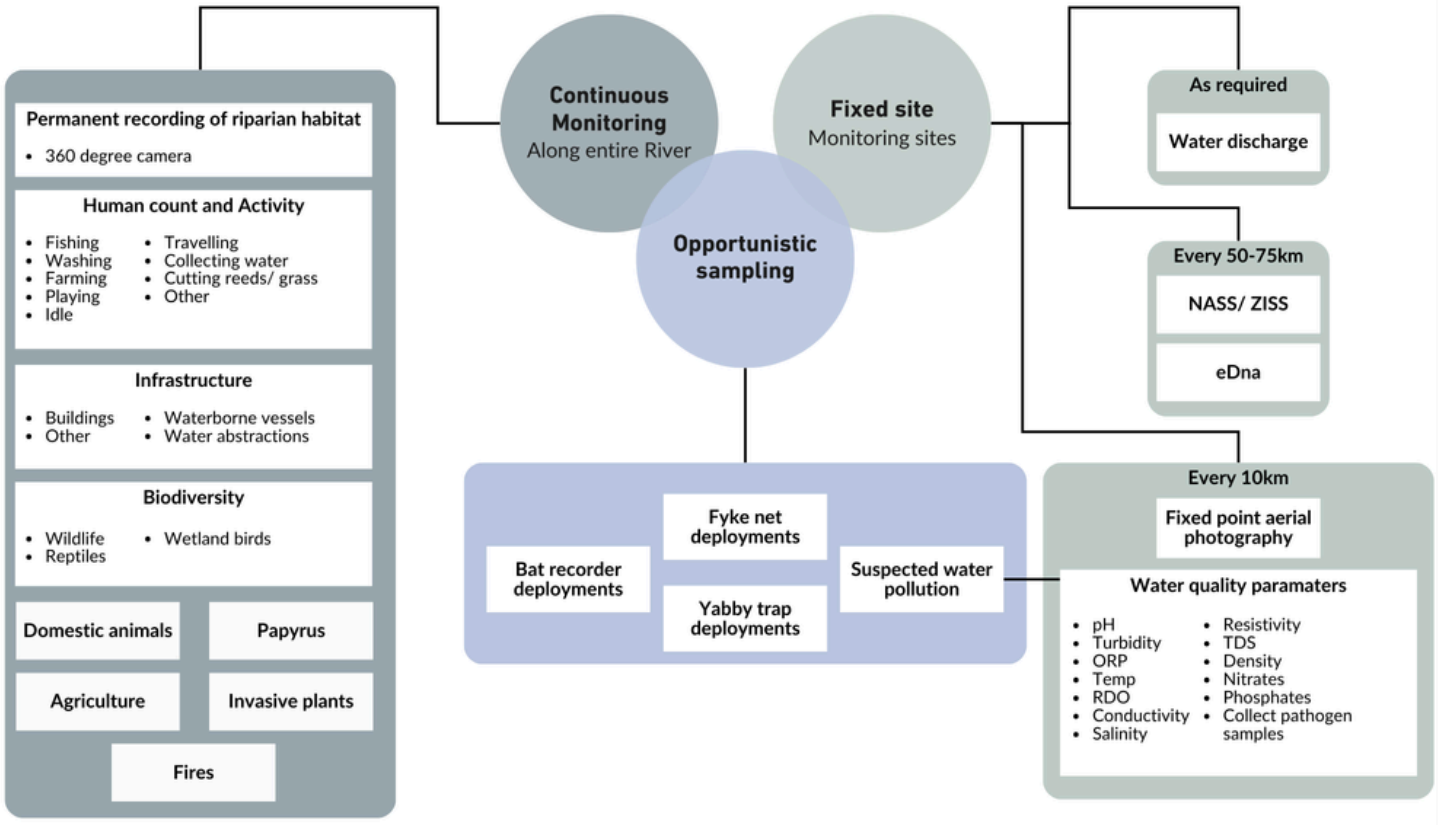
21
eDNA samples

12
benthic macroinvertebrate assessments

45 GB
bat-call recordings

5
islands surveyed

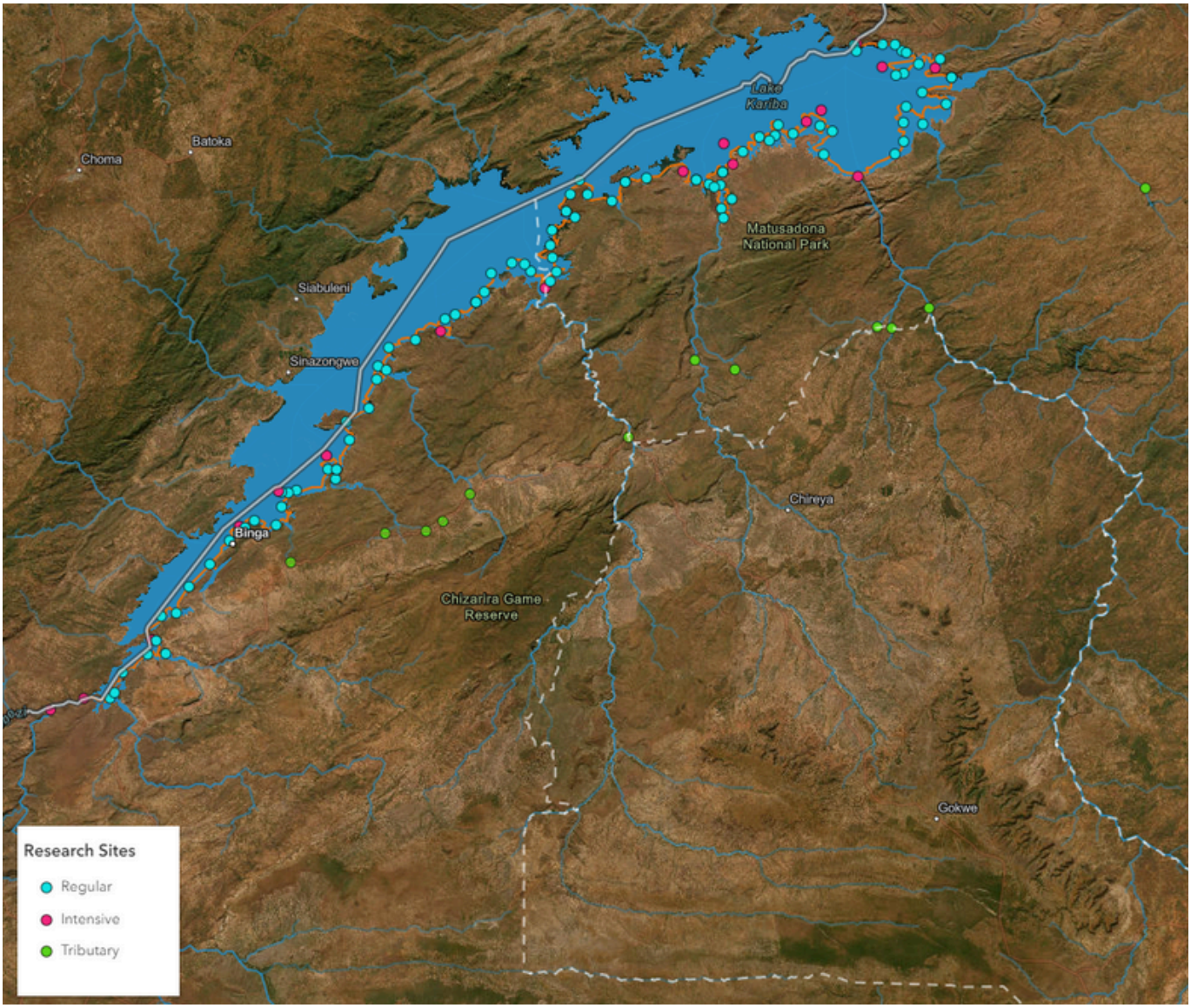
8
tributaries surveyed



Summary of data collected on the lake.

CONTINUOUS MONITORING RESULTS

Human Impact						Biodiversity	
People/ km	Fishers/ km	Fishing Gear/km	Vessels/ km	Livestock/ km	Cropland (% of transect)	Wetland birds/ km	Wildlife/ km
3.00	0.47	1.36	1.60	2.51	0.6%	34.97	11.78



Water quality analysis and drone flights were conducted at fixed survey sites every 10 km along the lake shore and at tributaries. At larger intervals - every 50-75 km - eDNA and benthic macroinvertebrates were collected.

Water Quality

For the parameters measured in the field, Lake Kariba's water quality broadly aligns with the World Health Organization (WHO) guidelines for potable water[1]. Exceedances of the WHO values were recorded for pH and nitrate at several points, and communities in these areas should treat their water prior to consumption. Spatial variability appears in all measured water quality parameters along the transect, likely due to: i) anthropogenic activities near and in the lake, such as aquaculture effluent, ii) modifications to lake water quality from tributaries flowing into it, and iii) daily weather fluctuations that influence the lake's physicochemical properties (e.g., water temperature).

The Deka tributary shows potential point-source pollution, likely originating from upstream mining activities. Water quality tests of the tributary, conducted above and below a mine, reveal a sharp increase in water acidity (pH of 3.6) and elevated concentrations of dissolved ions. Ongoing water quality monitoring initiatives in the lake should include a detailed assessment of the Deka's water quality.

The areas around crocodile farm effluent pipes exhibit high levels of dissolved ions, indicating possible contaminants that pose risks to the ecosystem and human health. This concern is heightened by the high density of fishers near the pipes. Further water quality testing for major ions and antibiotics around these pipes is recommended for a more comprehensive assessment.

Depth measurements reveal that water quality parameters stay consistent above 10m and only change meaningfully below 10 meters. This supports other findings that warmer climates have decreased the depth of the epilimnion[2] (the upper layer of water in a stratified lake) from 20 m to 10 m. This has resulted in a more stable thermocline. A more stable thermocline traps greater amounts of nutrients in the deep, cold bottom waters and reduces nutrient availability within the epilimnion. This nutrient limitation may impact aquatic life and overall water quality in the upper layers of the lake. Conducting repeated surveys will help track changes in both surface and deeper water quality over time.

1.WHO. 2008. Guidelines for drinking-water quality. Volume 1.Geneva.
2. Ndebele-Murisa, M.R. 2011. An analysis of primary and secondary production in Lake Kariba in a changing climate. (May):181.

People and the Lake

Fishermen on Lake Kariba

People are present along most stretches of Lake Kariba, with activity concentrated around the towns of Binga, Chibuyu, Chalala, and Kariba. Satellite analysis shows that the Zimbabwean side of the lake has half the number of buildings (5.10 buildings per km^2) compared to the Zambian side (10.82 buildings per km^2). Fishing serves as the primary livelihood on Lake Kariba, encompassing both the Kapenta industry and artisanal fishing.

Fishing activity on Lake Kariba remains high, except within designated National Parks and Safari areas. Kapenta fishing dominates the industry, with 342 Kapenta boats counted during the transect. However, Kapenta catch volumes have declined from a peak of 20,000 tonnes in 1990 to roughly 6,000 tonnes in 2020 due to overfishing, climate change, and reduced lake levels.[3] Additionally, 396 individuals were observed engaging in artisanal inshore fishing, mainly using gill nets. Numerous illegal fishing camps and boats were also noted along the transect. ZimParks conducts regular patrols along the lake, playing a key role in addressing illegal fishing by removing gillnets and actively curbing this issue. Increased and continued support of ZimParks is recommended to increase their capacity to manage illegal fishing on Lake Kariba.

3.Lake Kariba Fisheries (2021) Kapenta Research, Lake Kariba Fisheries.

Preliminary Recommendations

- Conduct ongoing water quality monitoring at several fixed survey sites along the Lake Kariba transect, including the Deka Tributary and aquaculture farm effluent pipes. Include depth measurements to track changes in the thermocline, as these can impact nutrient availability and overall water quality.
- Prioritize the conservation of wetland habitats along the lake, given their support of a high diversity of bird species. Designating protected areas or enforcing existing regulations will help preserve these crucial shoreline habitats.
- Conduct a detailed fisheries assessment of Lake Kariba to reassess the sustainability of fishing techniques and fishing pressure within the system.
- Develop and implement targeted control programs for the red claw crayfish. This includes promoting overexploitation of the crayfish as an alternative protein source, thereby reducing fishing pressure on native fish populations. This approach, as suggested by the University of Zimbabwe, could help control the crayfish while supporting sustainable protein sources for local communities.

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